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Automatic forced draught burners for liquid fuels

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Automatic forced draught burners for liquid fuels

Brûleurs automatique à air soufflé pour cobustibles liquide

Automatische Brenner mit Gebläse für flüssige Brennstoffe

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 47.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (prEN 267:2005) has been prepared by Technical Committee CEN/TC 47 “Atomizing oil burners and their components - Function - Safety - Testing”, the secretariat of which is held by DIN.

This document is currently submitted to the parallel Enquiry.

This document will supersede EN 267:1999.

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 EU Directive(s).

Introduction

This European Standard is primarily intended for automatic forced draught oil burners having a combustion air fan, operated with liquid fuels, and intended to be marketed as a complete assembly.

Forced draught oil burners according to this standard are often used in industrial applications. The safety principles are the same as for forced draught oil burners used for household/commercial applications. Industrial forced draught OIL burners however must operate safely in their industrial environment and the risks involved may differ from those for household applications. These industrial forced draught oil burners can be characterised by the ability to withstand industrial environmental influences, like moisture, high temperature, electrical and magnetic phenomena, vibrations, etc.

Special requirements for forced draught burners for industrial premises will be given as a note with the addition "Industrial application".

Further information and application limitations for forced draught burners, which are used for industrial application, are given in informative annex H.

1 Scope

This European Standard specifies the test requirements for laboratory testing, the terminology, the general requirements for the construction and operation of automatic forced draught oil burners supplied with:

— a fuel having a viscosity at the burner inlet of 1,6 mm²/s (cSt) up to 6 mm²/s (cSt) at 20 °C, and

— higher boiling petroleum based first raffinates. To achieve the viscosity required for proper atomisation preheating is necessary.

The standard is applicable to:

— single burners with a single combustion chamber, although such burners are fitted to a single appliance, in which case the requirements of the relevant appliance standard shall additionally apply;

— single-fuel and dual-fuel burners when operating on oil only;

— the oil function of dual-fuel burners designed to operate independently on gaseous or liquid fuels. In which case the requirements of EN 676 will also apply in respect of the gaseous fuel function.

2 Normative references

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

EN 230, *Monobloc oil burners - Safety, control and regulation devices and safety times.*

EN 264, *Safety shut-off devices for combustion plants using liquid fuels; safety requirements and testing.*

EN 676, *Automatic forced draught burners for gaseous fuels.*

EN 1044, *Brazing - Filler metals.*

EN 1057, *Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications.*

EN 1092-1, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges.*

EN 1092-2, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges.*

EN 1092-3, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories PN designated - Part 3: Copper alloy flanges.*

EN 1254-1, *Copper and copper alloys - Plumbing fittings - Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes.*

EN 1254-4, *Copper and copper alloys - Plumbing fittings - Part 4: Fittings combining other end connections with capillary or compression ends.*

EN 12067-2, *Gas/air ratio controls for gas burners and gas burning appliances - Part 2: Electronic types.*

EN 50156-1, *Electrical equipment for furnaces and ancillary equipment - Part 1: Requirements for application design and installation.*

EN 60204-1, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997).*

EN 60335-1, *Household and similar electrical appliances - Safety - Part 1: General requirements (IEC 60335-1:2001, modified).*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989).*

EN 60730-1, *Automatic electrical controls for household and similar use - Part 1: General requirements (IEC 60730-1:1999, modified).*

EN 60947-5-1, *Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices (IEC 60947-5-1:2003).*

EN ISO/IEC 17025, *General requirements for the competence of esting and calibration laboratories (ISO/IEC 17025:1999).*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation.*

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

ISO 1129, *Steel tubes for boilers, super heaters and heat exchangers; Dimensions, tolerances and conventional masses per unit length.*

ISO 3183-1, *Steel pipes for pipelines for combustible fluids — Technical delivery conditions — Part 1: Pipes of requirement class A.*

ISO 3183-2, *Steel pipes for pipelines for combustible fluids — Technical delivery conditions- Part 2: Pipes of requirement class B.*

ISO 6806, *Rubber hoses and hose assemblies for use in oil burners – Specification.*

ISO 9329-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steels with specified room temperature properties.*

ISO 9330, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steel tubes with specified room temperature properties.*

3 Terms and definitions

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

3.1 General definitions

3.1.1
oil burner
means classified according to:

— type of atomisation;

— method of control;

— means of ignition.

3.1.2
forced draught burner
burner in which the total air for combustion is supplied by means of a fan

3.1.2.1
automatic forced draught burner
oil burner that is fitted with an automatic ignition, flame monitoring and burner control devices. Ignition, flame monitoring and the on/off switching of the burner occur automatically. The heat input of the burner can be adjusted during operation either automatically or manually.

3.1.2.2
semi-automatic oil burner:
an oil burner, that differs from the fully automatic burner only in that start-up of the burner is initiated manually by the operating personnel and there is no automatic re-start after switching off the burner

3.1.3
dual-fuel burner
burner in which both gaseous and liquid fuels can be burnt either simultaneously or in succession.

3.1.4
burners as a structural unit
burners as a structural unit are individually operating burners and comprise all the devices necessary for operation such as oil atomising, air mixing and recirculating sections, where appropriate internal oil pre-heating devices including oil pressure pump in the case of oil pressure atomisers, combustion air fan (in the case of duo bloc-burners also the combustion air fan delivered separately) and flame supervision devices, ignition device and the necessary valves for control and safety shut-down of the burner

3.1.5
multi-fuel burner
burner that is capable of burning different fuels simultaneously or as an alternative to liquid fuel

3.1.6
industrial applications
industrial applications means:

- the extraction,
- growth,
- refining,
- processing,
- production,
- manufacture or
- preparation

of materials, plants, livestock, animal products, food or artefacts.

3.2 Fuel throughput and performance

3.2.1
throughput
constant mass of fuel consumed during one hour [Unit: kg/h]

3.2.1.1
maximum throughput
mass of fuel consumed during one hour at the highest throughput stated by the manufacturer [Unit: kg/h]

3.2.1.2
minimum throughput
mass of fuel consumed during one hour at the lowest throughput indicated by the manufacturer [Unit: kg/h]

3.2.2
heat input Q_F
amount of heat as a function of time released by the burner at a given throughput (oil flow rate x lower calorific value H_i of the fuel) [Unit: Kilowatt (kW)]

3.2.2.1
maximum heat input Q_{max}
maximum heat input of the burner as indicated by the manufacturer [Unit: Kilowatt (kW)]

3.2.2.2
minimum heat input Q_{Fmin}
minimum heat input of the burner as indicated by the manufacturer [Unit: Kilowatt (kW)]

3.3 3.2.3

starting input Q_s
input of the burner during start-up position as a function of the maximum heat input [Unit: Per cent (%)]

3.3.1
test rig
combustion chamber nominated by the manufacturer. In the case where the manufacturer has not nominated a combustion chamber, the test is carried out on test rigs with the flame tubes according to 6.3.

3.4 Combustion chamber, flame tubes

3.4.1
combustion chamber pressure p_F
effective positive pressure or negative pressure relative to the atmospheric pressure prevailing in the combustion chamber [Unit: kilopascal (kPa)]

3.4.2
length of the combustion chamber *l*
distance between the face of the nozzle or the fuel outlet and the rear wall of the test flame tube or combustion chamber [Unit: Millimetre (mm)]

3.5 Composition of the gaseous combustion products

3.5.1
CO_2 content
quantity of carbon dioxide (CO_2) in the dry gaseous products expressed as a proportion of the total volume, in %

3.5.2
O_2 content
quantity of oxygen (O_2) contained in the dry gaseous products, expressed as a proportion of the total volume, in %

3.5.3
CO content
quantity of carbon monoxide (CO) in the dry gaseous combustion products, measured as volumetric ppm indicated as mg/kWh

3.5.4
content of nitrogen oxide
quantity of nitrogen oxide (NO and NO_2) in the dry gaseous combustion products, measured as volumetric ppm, calculated as NO_2 , expressed in mg/kWh

3.5.5
content of unburned hydrocarbons
quantity of unburned hydrocarbons in the dry gaseous combustion products, measured as volumetric ppm, calculated as C_3H_8

3.5.6
smoke number
sample reference, the shade of which is closest to that of the test mark [see annex A]

3.5.7
air figure λ
ratio between the effectively introduced quantity of air and the theoretically required quantity of air

3.6 Adjusting, control and safety devices

3.6.1
flame detector device
device by which the presence of a flame is detected and signalled.

It can consist of a flame sensor, an amplifier and an element 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.

3.6.2
automatic burner control system
automatic burner control system comprises 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.

3.6.3
programming unit
programming unit 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 non-volatile lock-out. The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

3.6.4
safe start check
procedure employing a protection circuit or circuits, to establish whether or not a fault in a safety system or a flame simulating condition exists prior to start-up

3.6.5
controlled shut-down
process by which the power to the fuel shut-off valve(s) is immediately removed before any other action takes place, e. g. as a result of the action of a controlling function.

3.6.6
non-volatile lock-out
safety shut-down condition of the system, such that a re-start can only be accomplished by a manual reset of the system and by no other means

3.6.8
safety shut-down
process which is effected immediately following the response of a safety limiter or the detection of a fault in the automatic burner control system and which puts the burner out of operation by immediately removing the power to the fuel shut-off valve(s) and the ignition device

NOTE Safety shut-down can also occur as a result of an interruption/decrease of the power supply.

3.6.9
safety shut-off device
device that automatically cuts off the fuel supply

3.6.10
ignition-restoration
operation by which the fuel is re-ignited after the extinction of the flame during operation without the fuel supply being interrupted.

3.6.11
re-start
operation by which the starting process is repeated, after the extinction of the flame during operation. When re-start takes place, the stipulated sequences of the control programme shall be adhered to

3.6.12
pressure switch
switch which compares the actual value of a pressure with the desired value, gives a signal when the actual value exceeds or drops below the desired value and initiates the shut-off sequence.

3.6.13
ignition device
any means (flame, electrical ignition or other means) used to ignite the main burner, or the pilot burner if applicable.

3.7 Sequencing times

3.7.1
total ignition time
period during which the ignition device is in operation. Pre-ignition, actual ignition and post-ignition times make up the total ignition time [Unit: Seconds (s)]

3.7.1.1
pre-ignition time
period between the start of the ignition cycle and the release of the fuel [Unit: Seconds (s)]

3.7.1.2
ignition time
period between the release of the fuel and the first indication of the flame by the flame detector device [Unit: Seconds (s)]

3.7.1.3
post-ignition time
period between the first indication of the flame by the flame detector device and the ignition device shut-off [Unit: Seconds (s)]

3.7.2
safety time t_s
duration of the maximum permissible time during which the burner control unit allows the fuel to be released without there being a flame [Unit: Seconds (s)]

3.7.2.1
ignition safety time
period starting from the signal for release of the fuel and terminating at the moment at which the signal for interrupting the fuel supply is given [Unit: Seconds (s)]

3.7.2.2
safety time during operation
period starting at the moment the flame is extinguished and ending at the moment the signal for interrupting the fuel supply is given [Unit: Seconds (s)]

3.7.3
purge time
period during which the combustion chamber is compulsorily ventilated without any fuel being supplied [Unit: Seconds (s)]

3.7.3.1
pre-purge time
period during which purge takes place at the proven air rate prior to the energisation of the ignition device [Unit: Seconds (s)]

3.7.3.2
post-purge time
period between any shut-down and the moment the fan is switched off. [Unit: Seconds (s)]

3.7.4
flame simulation
signal indicating the existence of a flame when no flame is present

3.7.5
operational state
state commencing with the presence of flame after the permissible ignition safety time has expired; it is the end of the starting process. Starting can, however, be considered not to have taken place if the fuel release is not authorized or if it is interrupted after expiry of the safety time by the lock-out of the burner control unit.

3.7.6
intermittent operation
state of operation the duration of which does not exceed 24 h

3.7.7
continuous operation
state of operation the duration of which exceeds 24 h

3.8
working field
admissible range of application of the burner (pressure in the combustion chamber as a function of fuel flow)

3.10
testing field
test range of the burner during the tests (pressure in the combustion chamber as a function of fuel flow

4 Constructional and operational requirements

4.1 Types of atomisation

4.1.1 Mechanical atomisation by pressurisation of the combustion liquid

Atomisation of the fuel by means of an atomising nozzle, through pressure release.

4.1.2 Atomisation by auxiliary fluid

Atomisation is obtained by the fuel flow meeting a flow of air, steam, other gases or any other liquid. These types of burner include particularly:

— emulsion burners, in which there is a prior mixing of the fuel with the atomising fluid;

— rotary cup burners in which atomisation is obtained by the fuel, when leaving the edge of a rotating cup, meets a flow of air, steam, other gases or any other fluid.

Burners having other means of preparation are allowed, if they comply in all other respects with the requirements and test conditions of this Standard.

4.2 Methods of control of automatic or semi-automatic oil burners

4.2.1 On-off control (single stage burner)

Type of control where the oil burner is either in operation at constant throughput or switched off.

4.2.2 Multi-stage control (two and multi-stage burner)

Type of control where several firing stages (steps) can be utilised. Oil burners with only two firing rates are included in this category.

4.2.3 Modulating control (modulating burner)

Type of control where the throughput may be infinitely varied between the lower and upper limits.

4.3 Means of ignition

4.3.1 Automatic electric ignition

4.3.1.1 General

These are systems in which the ignition of the fuel is brought about by means of electrical energy.

4.3.1.2 Ignition by controlled spark

System in which fuel is released when the presence of the ignition spark has been proven.

4.3.1.3 Ignition by non-controlled spark

System in which fuel may be released when the ignition spark is not controlled.

4.3.2 Automatic ignition with liquid or gaseous fuels

4.3.2.1 General

These are systems in which an ignition burner, which uses liquid or gaseous fuels, ignites the main fuel. The operation of these ignition burners may be either permanent or intermittent. Permanent ignition burners may be started manually. Intermittent ignition burners are started automatically.

4.3.2.2 Ignition by controlled ignition burner

System in which the main fuel supply may only be released when the controlled flame of the ignition burner has been proven.