INTERNATIONAL STANDARD

ISO 22967

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Forced draught gas burners

Brûleurs à air soufflé pour combustibles gazeux

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 22967 was prepared by Technical Committee ISO/TC 109, *Oil and gas burners*.

Introduction

This International Standard is primarily intended for application to automatic forced draught gas burners having a combustion air fan, operated with gaseous fuels and intended to be marketed as a complete assembly.

Many burners are designed to operate on a wide range of fuel gases with little or no modification other than adjustment of the air supply.

When applying the requirements specific to a country or region, which are given in the various annexes, it is essential that a level of safety be ensured that is at least equivalent to that provided for by the requirements of the main body of this International Standard.

Forced draught gas burners

1 Scope

This International Standard specifies the terminology, test procedures and general requirements for the construction and operation of automatic forced draught gas burners, and the provision of related control and safety devices.

It is applicable to the following:

a) automatic gas burners (hereinafter called “burners”) fitted with a combustion air fan that are equipped as described in Clause 4, intended for use in appliances of different types and operated with fuel gases;

b) total pre-mixed burners and nozzle mixed burners;

c) single burners with a single combustion chamber, for which, where such burners are fitted to a single appliance, the requirements of the relevant appliance standard also apply;

d) single-fuel and dual-fuel burners when operating only on gas;

e) the gas function of dual-fuel burners designed to operate simultaneously on gaseous and liquid fuels, which, for the latter, the requirements of ISO 22968 also apply.

It is not applicable to burners used in direct fired processes either with defined combustion chamber applications or where the combustion chamber wall surface temperature is greater than 750 °C or the heat-transfer medium temperature is greater than 500 °C.

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.

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

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1129, *Steel tubes for boilers, superheaters and heat exchangers — Dimensions, tolerances and conventional masses per unit length*

ISO 3183, *Petroleum and natural gas industries — Steel pipe for pipeline transportation systems*

ISO 7005 (all parts), *Pipe flanges*

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

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

ISO 22968, *Forced draught oil burners*

ISO 23551-1, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 1: Automatic valves*

ISO 23551-2, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 2: Pressure regulators*

ISO 23551-3, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 3: Gas/air ratio controls, pneumatic type*

ISO 23551-4, *Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 4: Valve-proving systems for automatic shut-off valves*

ISO 23552-1, *Safety and control devices for gas and/or oil burners and gas and/or oil appliances — Particular requirements — Part 1: Fuel/air ratio controls, electronic type*

IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60335-1:2001, *Household and similar electrical appliances — Safety — Part 1: General requirements*, as amended 2004 and 2006

IEC 60335-2-102:2004, *Household and similar electrical appliances — Safety — Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections*

IEC 60529, *Degrees of protection provided by enclosures (IP code)*

IEC 60730-2-5:2004, *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*

IEC 60730-2-6, *Automatic electrical controls for household and similar use — Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

IEC 60947-5-1, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

IEC 61810-1, *Electromechanical elementary relays — Part 1: General requirements*

IEC 60747-5-2, *Discrete semiconductor devices and integrated circuits — Part 5-2: Optoelectronic devices — Essential ratings and characteristics*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General

3.1.1
forced draught burner
burner in which the total air for combustion is supplied by means of a fan

3.1.2
automatic forced draught burner
burner that is fitted with an automatic ignition, flame monitoring and burner control devices where the ignition, flame monitoring and the on/off switching of the burner occur automatically

NOTE The heat input of the burner can be adjusted during operation either automatically or manually.

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
total pre-mixed burner
burner in which part or all of the air for complete combustion of the gas is mixed with the gas upstream of the mixture outlet ports

3.1.5
nozzle mixed burner
burner in which part or all of the air required for combustion of the gas is mixed with the gas at, or downstream of, the air and gas ports

3.1.6
integrated ignition burner
burner with direct main ignition burner at reduced rate with bypass start gas supply

3.1.7
start gas rate
gas rate ignited by the ignition device during the start-up of the burner

3.1.8
combustion chamber
part of the appliance in which the combustion takes place

3.1.9
burner head
device for mixing fuel and air comprising, for example, a stabilizing disc and nozzle, that keeps the flame in its safe position during operation of the burner

3.1.10
heat-transfer medium
gaseous or liquid substance for the transport of heat energy from the appliance

3.1.11
appliance
heat generator into which the burner fires having a combustion chamber and heat exchanger are used to indirectly transmit the heat input from the burner combustion gases to the heat-transfer medium

3.2 Combustible gases

3.2.1
reference conditions
conditions corresponding to a temperature of 15 °C and a pressure of 0,101 325 MPa, unless otherwise specified

NOTE Based on standard reference conditions specified in ISO 13443.

3.2.2
calorific value
quantity of heat produced by the combustion, at a constant pressure equal to 0,101 325 MPa, 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

NOTE A distinction is made between

a) the superior calorific value (H_S) in which the water produced by combustion is assumed to be condensed, and

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

The units used for calorific value are either

c) megajoules per cubic metre (MJ/m^3) of dry gas at the reference conditions, or

d) megajoules per kilogram (MJ/kg) of dry gas.

See ISO 14532.

3.2.3
relative density
d
⟨fuel gas⟩ ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

NOTE Adapted from ISO 80000-4:2006, 4-3.

3.2.4
Wobbe index
ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

NOTE 1 The Wobbe index is said to be superior (W_S) or inferior (W_i) depending on whether the calorific value used is superior or inferior.

NOTE 2 The units used for the Wobbe index are either

a) megajoules per cubic metre (MJ/m^3) of dry gas at the reference conditions, or

b) megajoules per kilogram (MJ/kg) of dry gas.

NOTE 3 Adapted from ISO 14532:2005, definition 2.6.4.4.

3.2.5
gas pressure
static pressure of the moving gas, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas

NOTE Gas pressure is expressed in pascals or units thereof (Pa, kPa, MPa).

3.2.6
line-conveyed gas
gaseous fuels available by line-conveyed supply on site on which burners operate under nominal conditions when supplied at the corresponding normal pressure

3.2.7
normal pressure
pressure under which burners operate in nominal conditions when supplied with the corresponding line-conveyed gas

3.2.8
limit pressures
pressures representative of the extreme variations in the burner supply conditions

NOTE The test pressures are given in Table 4.

3.2.9
supply pressure
pressure measured immediately upstream of all gas line components but downstream of the manually operated shut-off valve

3.2.10
adjustment pressure
pressure measured immediately downstream of the pressure regulator

3.2.11
burner head pressure
pressure measured immediately before the burner head

3.3 Test rig and combustion chamber

3.3.1
combustion chamber pressure
p_F
effective positive pressure or negative pressure relative to the atmospheric pressure prevailing in the combustion chamber

NOTE Combustion chamber pressure is measured in kilopascals (kPa).

3.3.2
length of the combustion chamber
l_1
distance between the face of the nozzle or the fuel outlet and the rear wall of the test flame tube or combustion chamber or any lateral contraction

NOTE The length of the combustion chamber is measured in metres (m).

3.3.3
diameter of the combustion chamber
d_1
inner diameter of the combustion chamber around the flame tube of the burner

NOTE The diameter of the combustion chamber is measured in metres (m).

3.3.4
burner flame tube
device which hosts the mixing device and the root of the flame

3.3.5
test flame tube
cylindrical part of the test rig where the combustion take place

3.4 Composition of the gaseous combustion products

3.4.1
content of carbon dioxide
CO_2
ratio of the volume of carbon dioxide to the total volume of dry gaseous products in which it is present

NOTE The carbon dioxide content is expressed as a percentage volume fraction.

3.4.2
content of oxygen
O_2
ratio of the volume of oxygen to the total volume of dry gaseous products in which it is present

NOTE The oxygen content is expressed as a percentage volume fraction.

3.4.3
content of carbon monoxide
CO
ratio of the volume of carbon monoxide to the total volume of dry gaseous products in which it is present

NOTE The carbon monoxide content is expressed as a volume fraction, in units of millilitres per cubic metre (ml/m^3) for measuring purposes and in milligrams per kilowatt hour (mg/kWh) related to inferior calorific value (H_i) for calculation purposes and declaring values.

3.4.4
content of nitrogen oxides
NO_x
ratio of the combined volume of nitrogen oxides to the total volume of dry gaseous products in which they are present

NOTE The nitrogen oxides content is expressed as a volume fraction, in units of millilitres per cubic metre (ml/m^3) for measuring purposes and in milligrams per kilowatt hour (mg/kWh) related to inferior calorific value (H_i) for calculation purposes and declaring values.

3.4.5
excess air ratio
λ
ratio between the effectively introduced quantity of air and the theoretically required quantity of air

3.5 Burner operation

3.5.1 Gas rate

3.5.1.1
volume flow rate
q_V
volume of gas consumed by the burner in unit time during continuous operation

NOTE The units used for volume flow rate are either

a) cubic metres per hour (m^3/h),

b) litres per minute (l/min),

c) cubic decimetres per hour (dm^3/h), or

d) cubic decimetres per second (dm^3/s).

3.5.1.2
nominal volume flow rate
volume flow rate stated by the manufacturer, expressed in cubic metres per hour (m^3/h) at reference conditions

3.5.1.3
maximum flow rate
highest flow rate stated by the manufacturer, expressed in cubic metres per hour (m^3/h) at reference conditions

3.5.1.4
minimum flow rate
lowest flow rate stated by the manufacturer, expressed in cubic metres per hour (m^3/h) at reference conditions

3.5.1.5
mass flow rate
q_m
mass of gas consumed by the burner in unit time during continuous operation

NOTE The units used for mass flow rate are

a) kilograms per hour (kg/h), or

b) grams per hour (g/h).

3.5.1.6
nominal mass flow rate
mass flow rate stated by the manufacturer

3.5.1.7
heat input
Q_F
amount of heat expressed as a function of time released by the burner at a given throughput

NOTE Heat input is expressed in kilowatts (kW) and is calculated as gas flow rate x inferior calorific value ($q_{Vg}H_i$) of the fuel.

3.5.1.8
nominal heat input
Q_{FN}
value of the heat input declared by the manufacturer

NOTE 1 It is expressed in kilowatts (kW).

NOTE 2 Fixed heat input or range-rated burners have a single nominal heat input. Range-rated burners can be adjusted between the maximum nominal heat input and the minimum nominal heat input declared by the manufacturer.

3.5.1.9
minimum heat input
Q_{Fmin}
lowest heat input specified by the manufacturer at which the burner can operate in accordance with the operational requirements

NOTE It is expressed in kilowatts (kW).

3.5.1.10
maximum heat input
Q_{Fmax}
highest heat input specified by the manufacturer at which the burner can operate in accordance with the operational requirements

NOTE It is expressed in kilowatts (kW).

3.5.1.11
start heat input
Q_S
maximum heat input at the start of ignition as a percentage of the heat input, Q_F

3.5.2 Running conditions

3.5.2.1
burners for permanent operation
burners that are designed to remain in the running condition for more than 24 h without interruption

3.5.2.2
burners for intermittent operation
burners that are designed to remain in the running condition for less than 24 h

3.6 Gas line components

3.6.1
gas line
part of the burner made up of the valves, controls and safety devices, in which gas is conveyed between the inlet connection and the burner head

3.6.2
range-rating device
component on the burner intended to be used for adjusting the heat input, within a range of heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation

NOTE This adjustment may be progressive or in discrete steps.

3.6.3
automatic shut-off valve
valve which opens when energized and closes automatically when de-energized

3.6.4
filter
strainer
device that enables foreign elements, which might otherwise cause failures in the system, to be collected

3.7 Adjustment, control and safety devices

3.7.1
pressure regulator
device which maintains the downstream pressure constant to within fixed limits independent of variations, within a given range, of the upstream pressure

3.7.2
adjustable pressure regulator
pressure regulator fitted with a means of adjusting the loading on the diaphragm and thus the downstream pressure

3.7.3
gas pressure protection device
device that compares the actual value of the 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

3.7.4
flame detector device
device by which the presence of a flame is detected and signalled

NOTE 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.

3.7.5
automatic burner control system
system comprising at least a programming unit and all the elements of a flame detector device

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

3.7.6
programming unit
unit that 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

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

3.7.7
safe start check
procedure employing a protection circuit or circuits to establish whether or not a fault in a safety system or flame simulating condition exists prior to start-up

3.7.8
controlled shut-down
process by which the power to the gas shut-off valve(s) is immediately removed before any other action takes place (e.g. as a result of activating a controlling function)

3.7.9
safety shut-down
process that 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.

3.7.10
non-volatile lock-out
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

3.7.11
start signal
signal (e.g. from a thermostat) which releases the system from its start position and commences the predetermined programme

3.7.12
recycling
process by which, after a safety shut-down, a full start-up sequence is automatically repeated