INTERNATIONAL STANDARD

ISO 22968

First edition
2010-11-01

Forced draught oil burners

Brûleurs à air soufflé pour combustibles liquides

Reference number
ISO 22968:2010(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 22968 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 oil burners having a combustion air fan, operated with liquid fuels and intended to be marketed as a complete assembly.

Many burners are designed to operate using a wide range of fuel oils 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 oil burners

1 Scope

This International Standard specifies the terminology, test procedures and 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 mm^2/s (cSt) to 6 mm^2/s (cSt) at 20 °C or higher, boiling petroleum in accordance with ISO 8217-based first raffinates, and the provision of related control and safety devices.

It is applicable to the following:

a) automatic oil burners (hereinafter called “burners”) fitted with a combustion air fan and equipped as described in Clause 5, intended for use in appliances of different types and operated with fuel oils;

b) 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;

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

d) the oil function of dual-fuel burners designed to operate simultaneously on gaseous and liquid fuels, which, for the former, the requirements of ISO 22967 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 6806, *Rubber hoses and hose assemblies for use in oil burners — Specification*

ISO 7005 (all parts), *Pipe flanges*

ISO 8217, *Petroleum products — Fuels (class F) — Specifications of marine fuels*

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/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 22967, *Forced draught gas burners*

ISO 23550, *Safety and control devices for gas burners and gas-burning appliances — General requirements*

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*

ISO 23553-1, *Safety and control devices for oil burners and oil-burning appliances — Particular requirements — Part 1: Shut-off devices for oil burners*

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

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*

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

3.1.5
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

3.1.6
heat-transfer medium
gaseous or liquid substance for the transport of heat energy from the appliance

3.1.7
appliance
heat generator into which the burner fires having a combustion chamber and heat exchanger used to indirectly transmit the heat input from the burner combustion gases to the heat-transfer medium

3.2 Fuel mass flow rate and performance

3.2.1
mass flow rate
q_m
mass of oil consumed by the burner in unit time during continuous operation

NOTE It is expressed in kilograms per hour (kg/h) or grams per hour (g/h).

3.2.2
maximum mass flow rate
mass of fuel consumed during one hour at the highest mass flow rate stated by the manufacturer

NOTE It is expressed in kilograms per hour (kg/h).

3.2.3
minimum mass flow rate
mass of fuel consumed during one hour at the lowest mass flow rate stated by the manufacturer

NOTE It is expressed in kilograms per hour (kg/h).

3.2.4
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 fuel oil, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions

NOTE 1 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.

NOTE 2 It is expressed in megajoules per kilogram (MJ/kg).

NOTE 3 See ISO 14532.

3.2.5
heat input
Q_F
amount of heat as a function of time released by the burner at a given mass flow rate

NOTE It is expressed in kilowatts (kW) and calculated as the oil flow rate x lower calorific value (q_{Vo} H_i) of the fuel.

3.2.6
maximum heat input
Q_{Fmax}
maximum heat input of the burner as stated by the manufacturer

NOTE It is expressed in kilowatts (kW).

3.2.7
minimum heat input
Q_{Fmin}
minimum heat input of the burner as stated by the manufacturer

NOTE It is expressed in kilowatts (kW).

3.2.8
start heat input
Q_s
maximum heat input at the start of ignition as a percentage of heat input (Q_F)

3.2.9
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.

3.2.10
heat load rate
ratio between heat input (Q_F) and volume or cross-sectional area of the combustion chamber

NOTE It may be expressed in kilowatt hours per cubic metre (kWh/m^3) or per square metre (kWh/m^2).

3.2.11
turndown rate
ratio between maximum heat input (Q_{Fmax}) and minimum heat input (Q_{Fmin})

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 takes 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
content of unburnt hydrocarbons
ratio of the volume of unburnt hydrocarbons to the total volume of dry gaseous products in which they are present

NOTE It is expressed in millilitres per cubic metre (ml/m^3), calculated as C_3H_8.

3.4.6
smoke number
sample reference whose shade is closest to that of the test mark

NOTE See Annex A.

3.4.7
excess air ratio
λ
ratio between the effectively introduced quantity of air and the theoretically required quantity of air

3.5 Adjustment, control and safety devices

3.5.1
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.

3.5.2
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.

3.5.3
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.

3.5.4
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

3.5.5
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 activating a controlling function)

3.5.6
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.

3.5.7
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

3.5.8
safety shut-off device
device that opens and that is held open by auxiliary energy and that closes by interruption or failure of the auxiliary energy that automatically cuts off the fuel supply

3.5.9
reignition
operation by which the fuel is reignited after the extinction of the flame during operation without the fuel supply being interrupted

3.5.10
recycling
process by which, after a safety shut-down, a full start-up sequence is automatically repeated

3.5.11
pressure switch
switch that 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

3.5.12
ignition device
any means used to ignite the fuel at the ignition burner or at the main burner

EXAMPLE Flame, electrical ignition.

3.5.13
pressure monitoring device
device which monitors the actual value of a pressure and compares with the desired value, giving a signal when the actual value deviates from the desired value by a predetermined amount

3.5.14
output regulator
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 actual heat requirements of the installation

NOTE This adjustment may be progressive or in discrete steps.

3.6 Sequencing times

3.6.1
total ignition time
period during which the ignition device is in operation

NOTE 1 Pre-ignition, ignition and post-ignition times make up the total ignition time.

NOTE 2 It is expressed in seconds (s).

3.6.2
pre-ignition time
period between the start of the ignition cycle and the release of the fuel

NOTE It is expressed in seconds (s).

3.6.3
ignition time
period between the release of the fuel and the first indication of the flame by the flame detector device

NOTE It is expressed in seconds (s).

3.6.4
post-ignition time
period between the first indication of the flame by the flame detector device and the ignition device shut-off

NOTE It is expressed in seconds (s).

3.6.5
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

NOTE It is expressed in seconds (s).

3.6.6
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

NOTE It is expressed in seconds (s).

3.6.7
flame extinction safety time
period that starts with the signal that the flame has been extinguished and ends with the signal to de-energize the safety shut-off valve of the oil supply

NOTE It is expressed in seconds (s).

3.6.8
purge time
period during which the combustion chamber is compulsorily ventilated without any fuel being supplied

NOTE It is expressed in seconds (s).

3.6.9
pre-purge time
period during which purging takes place at the proven air rate prior to energizing of the safety shut-off device

NOTE It is expressed in seconds (s).

3.6.10
post-purge time
period between any shut-down and the moment the fan is switched off

NOTE It is expressed in seconds (s).

3.6.11
flame simulation
signal indicating the existence of a flame when no flame is actually present

3.6.12
operational state
state commencing with the presence of a flame after the permissible ignition safety time has expired

NOTE 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.

3.6.13
intermittent operation
state of operation whose duration does not exceed 24 h

3.6.14
continuous operation
state of operation whose duration exceeds 24 h

3.7 Diagrams

3.7.1
working diagram
admissible range of application of the burner (pressure in the combustion chamber as a function of fuel flow)

3.7.2
test diagram
test range of the burner during the tests (pressure in the combustion chamber as a function of fuel flow)

4 Classification of oil burners

4.1 General

Oil burners are classified according to their

— type of atomization,

— method of control, and

— means of ignition.

4.2 Types of atomization

4.2.1 Mechanical atomization by pressurization of the combustion liquid

Atomization of the fuel is obtained by means of an atomizing nozzle, through pressure release.

4.2.2 Atomization by auxiliary fluid

Atomization is obtained by the fuel flow meeting a flow of air, steam, other gas or any other fluid.

This type of burner particularly includes

— emulsion burners, in which there is prior mixing of the fuel with the atomizing fluid, and

— rotary cup burners, in which atomization of the fuel is obtained when the fuel leaves the edge of a rotating cup and meets an auxiliary fluid.

Burners having other means of atomization are allowed if they comply with all other requirements and test conditions of this International Standard.

4.3 Automatic oil burner control methods

4.3.1 On-off control (single-stage burner)

This controls whether the oil burner is either in operation at constant mass flow rate or is switched off.