
INTERNATIONAL STANDARD



5063

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Atomizing oil burners of the monobloc type — Testing

Brûleurs à combustible liquide à pulvérisation de type monobloc — Essais

First edition — 1978-11-15

UDC 662.941.2

Ref. No. ISO 5063-1978 (E)

Descriptors : pulverization burners, liquid fuels, tests, performance tests, exhaust gases, determination of content, definitions.



Documents

Document Sharing Hub

Price based on 17 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5063 was developed by Technical Committee ISO/TC 109, *Oil burners and associated equipment*, and was circulated to the member bodies in May 1977.

It has been approved by the member bodies of the following countries :

Belgium	Germany, F.R.	Spain
Czechoslovakia	Italy	Turkey
Egypt, Arab Rep. of	Mexico	United Kingdom
France	South Africa, Rep. of	Yugoslavia

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Canada
Denmark
Switzerland

Atomizing oil burners of the monobloc type – Testing

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies testing procedures in the laboratory for atomizing oil burners of the monobloc type.¹⁾

In general, the tests are made in the combustion chambers defined in 6.3. However, in certain specific cases, they may be made in an appliance in use, in the particular case of tests on site.

These testing procedures do not apply to burners forming part of an assembly boiler/heat-exchanger constituting a packaged boiler, because in this case the whole assembly would be the subject of tests.

1.2 This International Standard applies to atomizing oil burners of the monobloc type as such, generally intended for space-heating appliances and hence releasing energy in combustion chambers at comparatively low temperatures.

A burner of the monobloc type is an assembly of components allowing the supply and atomization of the fuel, the monitoring of the flame, and the adjustment of operation. The components of the assembly are fixed one to another or assembled on the same frame or in the same housing. These components include a fuel pump, an atomizing device, a combustion air fan, an ignition device, a flame monitoring device and a burner motor. The assembly is catalogued in this way by the manufacturer.

This International Standard does not apply to burners with natural draught since these are generally an integral part of a heat generator.

2 REFERENCE

ISO 3544, *Atomizing oil burners of the monobloc type – Safety times and safety, control and monitoring devices.*

3 CLASSIFICATION

Atomizing oil burners are classified according to :

- the atomizing process;

- the type of control,
- the type of ignition procedure;
- the means of supplying combustion air;
- the level of combustion rate.

3.1 Atomizing processes

The main atomizing processes include the following :

3.1.1 Mechanical atomization by pressurized liquid fuel

Atomization obtained by release of previously pressurized fuel through a nozzle to form a film which then breaks up into droplets.

3.1.2 Blast atomization

Atomization obtained by the impact of the stream of fuel with a stream of air, steam or other fluid. Burners using this atomizing process also include, in particular :

- burners in which the fuel is pre-mixed with the atomizing fluid;
- burners in which atomization is obtained by the fuel impacting a stream of air, steam or other fluid at the exit from a rotary member.

3.2 Types of fuel-metering control

The burners covered by this International Standard incorporate one of the following types of metering controls.

3.2.1 Automatic control

A type of control in which the fuel metering is automatically varied by appliances put into operation by components sensing the temperature or pressure variations of the controlled medium.

1) An International Standard referring to on-site testing for appliances in use may be prepared later.

3.2.2 *Semi-automatic control*

A type of control in which the fuel metering is varied as in the automatic control type and for which ignition is always manual. Shut-off may be carried out manually.

3.2.3 These semi-automatic or automatic controls may be of the following types :

3.2.3.1 "ON-OFF" CONTROL

A type of control in which the burner is alternately completely shut off (the ignition device itself, however, may be designed to remain "on") or operates at a constant fuel rate.

3.2.3.2 "HIGH-LOW" CONTROL

A type of control permitting only two rates of flow.

3.2.3.3 "STEPPED" CONTROL

A type of control in which the fuel-metering components may dwell at a number of positions between those providing the highest and the lowest fuel rate.

3.2.3.4 "CONTINUOUSLY ADJUSTABLE" CONTROL

A type of control in which the fuel-metering components may dwell in any position between those providing the highest and the lowest rate of flow, the flow rate of the combustion air remaining, for these different positions, more or less proportional to the corresponding flow rate of the fuel.

3.3 Type of ignition procedure

The burners covered by this International Standard may be equipped with one of the following types of ignition system :

3.3.1 *Automatic ignition performed electrically*

A system in which the ignition necessarily involves the sole use of electrical energy. The following two systems are distinguished :

3.3.1.1 PROVEN SPARK IGNITION

A system which admits no fuel flow unless the presence of the spark is proved.

3.3.1.2 UNPROVED SPARK IGNITION

A system in which the admission of the fuel is not prevented by the absence of the spark.

3.3.2 *Automatic ignition provided by liquid or gaseous fuel*

A system in which the fuel is ignited by a small liquid or gaseous fuel burner known as a pilot burner and which may be operated continuously or discontinuously.

In the former instance, the pilot burner may be operated manually prior to operating the burner for the first time.

If operated discontinuously, the pilot burner is put in service automatically by a special device which is usually electrical, and the following two systems may be distinguished :

3.3.2.1 IGNITION BY PROVED PILOT BURNER

A system which admits no main fuel flow unless the presence of flame on the pilot burner is proved.

3.3.2.2 IGNITION BY UNPROVED PILOT BURNER

A system in which admission of the main fuel is not prevented by the absence of a flame on the pilot burner.

3.4 Means of supplying combustion air provided by mechanical means

In this instance, the combustion air is supplied to the combustion chamber by either a forced or induced draft system or by both systems.

3.5 Level of combustion rate

The combustion rate is the ratio of heat input rate given to the burner, expressed in kilowatts¹⁾ to the volume of the combustion chamber, expressed in cubic metres.

4 DEFINITIONS

4.1 atomizing oil burner : A burner for liquid fuel, in which ignition of the fuel is preceded by a preparatory phase in which division of the fuel into small droplets occurs, in order to facilitate mixing with combustion air.

4.1.1 automatic oil burner : An oil burner equipped with automatic working flame monitoring, control and regulating devices, so that the initiation of the flame, the flame monitoring as well as the start and the shut-off of the oil burner and, possibly, the regulation of the amounts of the fuel and the combustion air take place without intervention of operating personnel.

4.1.2 semi-automatic oil burner : An oil burner equipped with automatic ignition, flame monitoring control and regulating devices, and, possibly, automatic devices for regulating the amount of fuel and combustion air on which each ignition for putting the burner into service is carried out manually.

1) 1 Mcal_{IT}/h = 1,163 kW

The oil burner is monitored and switched off by flame detectors (and, when available, from limiting devices) during starting and during operation. The burner output (oil throughput) may be automatically or manually regulated during operation.

The switching off of the burner may be achieved manually; in this case the re-ignition, which constitutes a new start, is manual.

4.2 Operating characteristics

4.2.1 fuel rate per hour : The amount of fuel consumed in 1 h by the burner at a constant rate.

4.2.1.1 maximum fuel rate per hour : The amount of fuel actually consumed in 1 h by the burner at the maximum rate indicated by the manufacturer.

4.2.1.2 minimum fuel rate per hour : The amount of fuel actually consumed in 1 h by the burner at the minimum rate indicated by the manufacturer.

4.2.1.3 mean fuel rate per hour : The amount of fuel actually consumed in 1 h by the burner at the mean rate, i.e. the halved value of the summed maximum and minimum rates.

4.2.1.4 intermediate fuel rate per hour (only for burners with stepped control of continuously adjustable control) : The amount of fuel actually consumed in 1 h by the burner at a rate corresponding to the maximum rate less one-third of the difference between the maximum and minimum rates of the burners.

Fuel rates are expressed in kilograms per hour (kg/h).

4.2.1.5 nominal ranges of rate per hour :

- “on-off” control : The range¹⁾ of maximum fuel rates given by the manufacturer.
- “high-low” or gradual : The ranges¹⁾ of maximum and minimum fuel rates given by manufacturer.

4.2.2 heat input rate : The amount of heat, in relation to time, which is liberated by the burner at a given heat input rate (fuel rate per hour × net calorific value of the fuel).

4.2.2.1 maximum nominal heat input rate : The maximum heat input rate indicated by the manufacturer.

4.2.2.2 minimum nominal heat input rate : The minimum heat input rate indicated by the manufacturer.

Heat input rates are expressed in watts (W).

4.3 Combustion chamber

4.3.1 pressure or vacuum in combustion chamber : The effective pressure or vacuum in the combustion chamber.

Pressures or vacua are expressed in pascals (Pa) or in millibars (mbar).²⁾

4.3.2 depth of the combustion chamber : The distance between the end of the nozzle and the movable wall of the combustion chamber (see 6.3).

4.4 Contents of gaseous combustion products

4.4.1 CO₂ content : The ratio of the volume of carbon dioxide (CO₂) contained in the dry gaseous products of combustion to the total volume of the products, expressed as a percentage.

4.4.2 O₂ content : The ratio of the volume of the oxygen (O₂) contained in the dry gaseous products of combustion to the total volume of the products, expressed as a percentage.

4.4.3 CO content : The ratio of the volume of the carbon monoxide (CO) contained in the dry gaseous products of combustion to the total volume of the products, expressed as a percentage.

4.5 excess air in dry flue gases : The amount of air introduced over and above that needed for perfect combustion (i.e. that strictly needed to ensure complete combustion of the fuel). The excess air refers to that within the combustion chamber and is expressed as a percentage of the volume of theoretical air.

4.6 smoke number : A number permitting the evaluation of the degree of smoke by means of a conventional shade scale (Bacharach scale — see annex).

5 OPERATING CHARACTERISTICS

5.1 Permitted values of the smoke number

The smoke number shall be recorded for each heat input rate, and shall be in accordance with the following values on the grey scale (see the annex) when the tests are carried out in the combustion chambers defined in 6.3 :

- < for liquid fuels of class I:
 - ≤ 3 for liquid fuels of classes II and III;
 - ≤ 4 for liquid fuels of class IV.
- (the limit for class IV is adopted provisionally until a more suitable quantitative method is available).

1) Within a range, the different values of fuel rates are obtained by various means such as by changing the nozzle or by varying the pressure, etc.

2) 1 mbar = 100 N/mm² = 0,1 kPa

The classes of liquid fuels are specified in 6.7.1.

When the tests are carried out on an appliance in use, these values may be reduced by one point.

No significant yellow staining on the back of the test paper, indicating the presence of unburnt liquid, shall be allowed; a yellow tint is, however, permitted.

5.2 Maximum CO content

The CO content of the flue gases shall be less than or equal to 0,1 % (V/V) for all fuel rates and all classes of fuel.

5.3 Excess air

When testing the maximum fuel rate per hour, the excess air should not be greater than the value shown on the appended curve in terms of the fuel rate (see figure 1).

5.3.1 On-off controlled burners should be tested at both mean and minimum fuel rates with excess air not greater than the value shown on the curve for the relevant fuel rate.¹⁾

5.3.2 When testing high-low-controlled burners at the minimum fuel rate per hour, the excess air shall not be greater than 60 %.

Another test should also be carried out at the mean fuel rate with excess air not greater than the value shown on the curve for the relevant fuel rate.

5.3.3 When testing stepped control burners at the minimum fuel rate per hour, the excess air shall not be greater than 70 %.

A test should also be carried out at an intermediate fuel rate with excess air 20 % greater than the value shown on figure 1.

6 TESTING

6.1 Purpose and general principle of test runs

The purpose of the tests is to ascertain the conformity of the burners to the design and operating characteristics defined in this International Standard. As a general rule, these tests are carried out in the combustion chambers defined in 6.3. However, in certain specific cases, they may be carried out on an appliance in use.

NOTE — An example of a case when tests could be carried out on an appliance in use would occur if the geometry of the appliance differed greatly from the geometry of the test combustion chamber.

The burner shall be tested with all the ancillaries needed for its operation.

The chief purpose of these tests being to ascertain the conformity of the burners to the operating requirements laid down, it is necessary to carry out a thermal test (heat balance) to verify the heat input rates claimed by the manufacturer and the conformity of the burner to the requirements of clause 5.

To this end, the fuel rates per hour as defined by the characteristics of the burner are determined and stated with a tolerance of $\pm 10\%$.

It shall be checked that there is no phenomenon of pulsation at the start-up of the burner. This is done by recording the pressure variations in the combustion chamber from the instant when admission of fuel to the burner is signalled.

The various components of the burner whose characteristics are to be tested (motors, transformers, pumps, filters, nozzles, etc.) are the subject of specific tests²⁾.

For safety reasons, fans shall be protected to prevent foreign objects coming into contact with the impeller blades.

The device for adjusting the air flow in different directions shall have a locking device.

Additionally, the performance of the equipment during the test runs shall be observed. Using the control equipment, the burner shall be operated and shut off ten times consecutively. The periods of operation and shut-down shall be of 2 min duration. In principle, these observations are made for each combination, nozzle-combustion head.

It shall be verified in particular that :

- there is no undue heating of the electric system;
- there are no leaks in the fuel circuit;
- there is no fouling of the ignition devices, nozzles, air ducts or mixers or of the flame detectors, which might endanger the reliability or the efficiency of the control systems.

Checks shall be made to ensure that the operation of the control system is consistent with the correct functioning of the burner.

6.2 Testing procedure

Testing should be performed in a test laboratory.

6.3 Test laboratory

Testing should be carried out in a test facility so equipped as to enable the test procedures described below to be carried out.

The test facility shall be equipped with combustion chambers of circular section (see example in figure 2).

1) The different values of fuel rates are obtained by various means such as by changing the nozzle or by varying the pressure, etc.

2) In preparation.