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Atomizing oil burners of the monobloc type — Testing

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FOREWORD

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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

Printed in 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 INGITION

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

3.3.2 *Automatic ingition 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 be 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 kilowatts[1] 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 inition 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 range[1] of maximum fuel rates given by the manufacturer.

— **"high-low" or gradual :** The ranges[1] 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 CO_2 content : The ratio of the volume of carbon dioxide (CO_2) contained in the dry gaseous products of combustion to the total volume of the products, expressed as a percentage.

4.4.2 O_2 content : The ratio of the volume of the oxygen (O_2) 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:

$\leqslant 3$ for liquid fuels of classes II and III;

$\leqslant 4$ 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/mm^2 = 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 it 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 ± 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 tests[2)].

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.

Each combustion chamber is defined by its internal diameter (0,280 m — 0,400 m — 0,500 m — 0,600 m — 0,800 m) and by its depth; the ratio depth/diameter shall be not greater than 5.

The depth is adjustable by means of a movable wall which can be displaced longitudinally in the combustion chamber. This movable wall is fitted with a baffle which allows a variable pressure drop to be provided at the outlet of the combustion chamber. This device permits the adjustment of the pressure in the combustion chamber.

All the walls, except the front, are cooled.

A heat exchanger permits cooling of the products of combustion before they enter the metering section shown in figure 3 without direct contact between the gases and the cooling fluid.

The combustion chamber is equipped with gas-tight observation ports to allow visual inspection of the flame. It shall be possible to measure the pressure in the combustion chamber.

6.4 Test apparatus

6.4.1 *Determination of* CO_2 *or* O_2 *and CO content of the flue gases*

The CO_2 or O_2 content in the flue gases, required for the calculation of the excess air, shall be determined by means of an Orsat apparatus or its equivalent. The CO content is to be recorded at the outlet of the combustion chamber by means of a fully automated or manual detector. If there is any contestation or doubt, the most accurate method is the only one to be taken into consideration.

6.4.2 *Determination of the smoke number*

The test apparatus is described in the annex.

6,5 Quantities to be measured — Accuracy of measurements

— Combustion air temperature : read near the air inlet to the burner to ± 1 °C. The thermosensitive element shall be protected from radiation.

— Effective pressure or vacuum in the combustion chamber :

— in operation : measured at the front;

— during start-up : measured either at the front or at the midpoint between the front and the movable wall.

— Depth of the combustion chamber : to ± 1 %.

— Fuel feed pressure : to ± 2 %.

— Fuel temperature : to ± 1 °C.

— Fuel consumed : to be determined by a mass-unit or volumetric method to ± 1 %.

— Gaseous products of combustion : The CO_2 and O_2 content of the dry combustion gases shall be measured and recorded in percentage with instruments providing an accuracy of ± 0,2 in absolute value.

The CO content shall be determined by micro-determination, and it should be possible to detect a content of 5 parts in 100 000 with an accuracy of ± 2 parts in 100 000.

— Temperature of gaseous products of combustion : to ± 5 °C. It shall be possible to detect a change in temperature of ± 1 °C.

— Fuel sampling for analysis purposes : The sampling is intended to check the conformity of the fuel to the specifications given in 6.7.1.

— Time : to ± 1 %.

6.6 Testing schedule

Before installation on the test chamber chosen, the identification of the burner and the checking of its compliance with the relevant constructional characteristics shall be carried out.

6.6.1 *Choice of the test combustion chamber*

Burners are generally intended to operate in heat generators having combustion chambers having differing characteristics. In view of this, the manufacturer of the burner must seek a flame type capable of being adapted to the generator to be fired. For this reason, various geometries of the test combustion chamber for a specific burner fuel rate per hour are proposed in this International Standard.

Figures 4, 5 and 6 give the relationship between the depths and diameters of test combustion chambers and the burner fuel rate per hour.

For the burner under test, the manufacturer shall indicate to the testing agency :

— whether figure 4, 5 or 6 shall be used;

— the diameter and the depth of the combustion chamber to be chosen when figure 5 or 6 is used.

The report established by the testing agency shall indicate the diameter and the depth of the combustion chamber used for each burner fuel rate.

6.6.2 *Tests to be carried out*

Depending on the type of control system of the burner, the tests specified in 6.6.2.1, 6.6.2.2 and 6.6.2.3 shall be carried out for each combustion head.

Mean fuel rate or intermediate fuel rate tests shall be carried out only when the ratio of maximum fuel rate, q_{max}, to minimum fuel rate, q_{min}, corresponding to the combustion head, is greater than 2,5.

6.6.2.1 "ON-OFF" CONTROLLED BURNERS

As appropriate to the intended application of the burner, the tests listed in table 1 shall be carried out for each combustion head.

6.6.2.2 "HIGH-LOW" CONTROLLED BURNER

Each series of tests shall commence with the "high" fuel rate. The vacuum or pressure in the combustion chamber shall be adjusted for the "high" fuel rate by means of the baffle. The position of the baffle shall not be changed during verification of the operation of the burner at the "low" fuel rate.

According to the intended purpose of the burner, the tests listed in table 2 shall be carried out for each combustion head.

6.6.2.3 STEP CONTROL BURNER OR CONTINUOUSLY ADJUSTABLE CONTROL BURNER

Each series of tests shall commence with the "high" fuel rate. The vacuum or pressure in the combustion chamber shall be adjusted to the "high" fuel rate by means of the baffle. The position of the baffle shall not be changed during verification of the burner at the "intermediate" and "low" fuel rates.

These burners shall be submitted to similar tests to those given for "high-low" controlled burners. It is necessary, however, to carry out tests at the "intermediate" fuel rates corresponding to the maximum, minimum and mean fuel rates, these tests at the "intermediate" fuel rates being carried out in the test conditions at the "low" fuel rates.

6.6.3 *After completion of operating tests*

All burners shall be examined when cold. Neither materials nor components shall show any distortion, damage or maladjustment.

6.6.4 *Presentation of the results — Report*

The choice of the combustion chamber (6.6.1) and the tests carried out (6.6.2) shall be indicated in a table which shall also indicate the pressure in the combustion chamber, the composition of the gaseous products of combustion (4.4) and the depression behind the movable wall or, in the case of tests on appliances in use, downstream of the flue of the appliance.

A synthesis of the results given in the above-mentioned table shall be presented in the form of a diagram indicating the zone of correct operation of the burner (see figure 7 for an example).

TABLE 1

Fuel rate \ Pressure in the combustion chamber	Burner intended for generators operating					
	below atmospheric pressure		above atmospheric pressure		above or below atmospheric pressure	
Maximum	2 tests		2 tests		2 tests	
	± 0*	1,1 times the depression indicated by the manufacturer	± 0	1,1 times the pressure indicated by the manufacturer	1,1 times the depression indicated by the manufacturer	1,1 times the pressure indicated by the manufacturer
Minimum	2 tests		2 tests		2 tests	
	± 0	1,1 times the depression indicated by the manufacturer	± 0	1,1 times the pressure indicated by the manufacturer	1,1 times the depression indicated by the manufacturer	1,1 times the pressure indicated by the manufacturer
Mean $\left(\text{if } \frac{q_{max}}{q_{min}} > 2{,}5\right)$	2 tests		2 tests		2 tests	
	± 0	1,1 times the depression indicated by the manufacturer	± 0	1,1 times the pressure indicated by the manufacturer	1,1 times the depression indicated by the manufacturer	1,1 times the pressure indicated by the manufacturer

* ± 0 means pressure or vacuum zero.

TABLE 2

Fuel rate \ Pressure in the combustion chamber		Burner intended for generators operating : below atmospheric pressure		above atmospheric pressure		above or below atmospheric pressure	
Maximum		4 tests		4 tests		4 tests	
	"High"	± 0	1,1 times the depression indicated by the manufacturer	± 0	1,1 times the pressure indicated by the manufacturer	1,1 times the depression indicated by the manufacturer	1,1 times the pressure indicated by the manufacturer
	"Low"	Depression resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Pressure resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Pressure resulting from adjustment to the "high" rate
Minimum		4 tests		4 tests		4 tests	
	"High"	± 0	1,1 times the depression indicated by the manufacturer	± 0	1,1 times the pressure indicated by the manufacturer	1,1 times the depression indicated by the manufacturer	1,1 times the pressure indicated by the manufacturer
	"Low"	Depression resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Pressure resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Pressure resulting from adjustment to the "high" rate
Mean $\left(\text{if } \frac{q_{max}}{q_{min}} > 2,5\right)$		4 tests		4 tests		4 tests	
	"High"	± 0	1,1 times the depression indicated by the manufacturer	± 0	1,1 times the pressure indicated by the manufacturer	1,1 times the depression indicated by the manufacturer	1,1 times the pressure indicated by the manufacturer
	"Low"	Depression resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Pressure resulting from adjustment to the "high" rate	Depression resulting from adjustment to the "high" rate	Pressure resulting from adjustment to the "high" rate

6.7 Testing requirements

6.7.1 *Allowable fuel*

The test shall be carried out under the specified operating conditions, with the fuel specified by the burner manufacturer and belonging to one of the classes indicated below, for each of which the viscosity at test shall be brought to :

- Class 0 : Viscosity between 1,3 and 1,6 mm^2/s*
- Class I : Viscosity between 3,5 and 4,5 mm^2/s
- Class II : Viscosity between 11 and 13 mm^2/s
- Class III : Viscosity between 30 and 34 mm^2/s
- Class IV : Viscosity between 115 and 125 mm^2/s

These conditions shall be fulfilled at the inlet of the burner, i.e. before any auxiliary equipment supplied by the manufacturer. For this purpose, the test laboratory shall be equipped with the necessary fuel heating or cooling devices.

NOTE — The designation of the class (class 0 to IV) of the fuel to be supplied to the burner should be marked on the name plate as well as in the operating manual accompanying the apparatus.

In addition, the manufacturer should specify, in the relevant commercial and technical documentation, the class or classes of fuel suitable for the burner.

For each change of class of fuel to one having the next greater viscosity, all the tests specified in this International Standard shall be carried out on the burner in question.

A change of class of fuel to one having the next lesser viscosity in the range of the classes IV to II does not necessitate a repetition of the tests. It is, however, necessary to verify that combustion remains satisfactory after a change of class of the fuel; this is especially because of the difference in calorific value between fuels.

6.7.2 *Definition of steady conditions*

Steady conditions shall be considered as having been established if, after two checks spearated by an interval of 15 min, it can be stated that :

- the fuel flow rate per hour does not vary by more than 2 %;
- the temperature of the flue gases does not vary by more than 5 °C;
- the flue gas CO_2 content does not vary by more than 0,2 %.

6.7.3 *Test proper*

The test properly so-called shall commence once steady conditions have been established and shall be continued as long as is necessary for the various values being checked to be measured, with the required accuracy.

The results shall be in conformity with the requirements of clause 5. In addition, it shall be ensured that the following test conditions are fulfilled at the end of the period of establishment of steady conditions and during the test proper :

- the temperature of the cooling fluid shall be within the range 50 to 90 °C;
- the temperature of the flue gases measured in the metering section shall be within the range 160 to 350 °C;
- the temperature of the combustion air and the ambient temperature shall be between 15 to 25 °C; every precaution should be taken to ensure that there is no ingress of outside air to the burners.

As far as possible, the air supply to the test area shall be by means of a duct situated approximately 2 m above the test installations. If the air is induced at low level, the burner test mouldings shall be protected by screens.

After each test, starting and ignition of the burner shall occur normally and in accordance with the safety conditions laid down in ISO 3544.

6.7.4 *Determination of the smoke number*

The measurement method is given in the annex.

6.7.5 *Checking the burner at 85 % of normal voltage of electric power supply*

The tests proper specified in 6.7.3 shall be carried out under an electrical supply voltage equal to 100 % of the normal voltage.

At the end of these tests, with the burner operating at its maximum nominal heat input rate, with all the electrical equipment and accessories in operation, in particular the heater, and without changing the air intake adjustment (if fitted), the voltage shall be reduced to 85 % of its nominal value.

The burner shall be stopped for at least 5 min, and shall then be put into operation at 85 % of the nominal voltage.

Starting-up and ignition of the burner shall be carried out normally.

7 MARKING

When the burner is tested in a test combustion chamber, the operating instructions for the burner shall give, in the form of a graph or table (see figure 7), at least the following indications :

- the test chamber diameters and depths used;
- CO_2 content;

* 1 mm^2/s = 1 cSt

— the pressure in the test chamber (value indicated by the manufacturer) corresponding to the various fuel rates for the various combustion heads.

The values to be used are those noted in the table mentioned in 6.6.4.

In addition, the operating instructions shall indicate the class or classes of the fuel to be used with the burner.

If the burner is tested only on an appliance in use, the operating instructions shall specify at least :

— the geometry of the furnace of the appliance used;

— the CO_2 content;

— the pressure in the furnace.