SLOVENSKI STANDARD
SIST EN 267:2000

01-junij-2000

Ventilatorski oljni gorilniki - Definicije, zahteve, preskuġanje, oznaļevanje

Forced draught oil burners - Definitions, requirements, testing, marking

Ölzerstäubungsbrenner vom Typ Monoblock - Prüfungen

Bruleurs a fioul a pulvérisation de type monobloc - Essais

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English version

Forced draught oil burners - Definitions, requirements, testing, marking

Brûleurs à fioul à air soufflé - Définitions, spécifications, essais, marquage

Ölbrenner mit Gebläse - Begriffe, Anforderungen, Prüfung, Kennzeichnung

This European Standard was approved by CEN on 7 June 1999.

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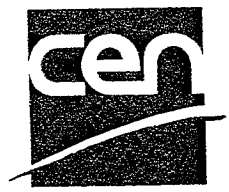

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This European Standard 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 European Standard supersedes EN 267:1991 and EN 267:1991/A1:1996.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2000, and conflicting national standards shall be withdrawn at the latest by March 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom

NOTE: This European Standard had also been proposed for inclusion in the mandate under the EU Directive 98/37/EC (Machinery Directive). As the mandate has been given after the Standard had been accepted by the Technical Committee for submission to formal vote and in order not to further delay its publication, it will be reviewed within the context of the Directive 98/37/EC directly after the publication.

1 Scope

This European Standard specifies the test requirements and methods for laboratory testing of 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.

This standard also applies to the oil function of dual fuel burners designed to operate on liquid and gaseous fuels in which case the requirements of EN 676 will also apply in respect of the gaseous fuel function.

This standard does not apply to burners intended for use in industrial processes although some aspects of the standard may be relevant.

2 Normative references

This standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to 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 60204-1
Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1 : 1997)

EN 60335-1
Safety of household and similar electrical appliances - Part 1: General requirements (IEC 60335-1 : 1991, modified)

EN 50165
Electrical equipment of non-electric appliances for household and similar purposes – Safety requirements

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

EN 60947-5-1
Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Eletromechanical control circuit devices (IEC 60947-5-1 : 1997)

EN ISO 6806
Rubber hoses and hose assemblies for use in oil burners – Specification (ISO 6806 : 1992)

3 Definitions

For the purposes of this standard the following definitions apply:

3.1 Oil burner

3.1.1 fully automatic oil burner: an oil burner, equipped with automatic ignition, flame supervision, control and regulating devices. Ignition, flame supervision and the on-off switch of the burner are achieved without the intervention of operating personnel.

3.1.2 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 restart after switching off the burner.

3.1.3 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 atomizing, air mixing and recirculating sections, where appropriate internal oil pre-heating devices including oil pressure pump in the case of oil pressure atomizers, combustion air fan (in the case of duobloc-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.

3.1.4 multi-fuel burner: a multi-fuel burner is a burner that is capable of burning different fuels simultaneously or as an alternative to liquid fuel.

3.2 Fuel throughput and performance

3.2.1 throughput: constant mass of fuel $\dot{m}$ consumed during one hour.
Unit: kg/h

3.2.1.1 maximum throughput: mass of fuel $\dot{m}$ consumed during one hour at the highest throughput stated by the manufacturer.
Unit: kg/h

3.2.1.2 minimum throughput: mass of fuel $\dot{m}$ 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_{Fmax}: 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)

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

3.3 test rig: the test rig is the combustion chamber nominated by the manufacturer.

In the case that 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: Millibar (mbar)

3.4.2 lenght l_1 of the combustion chamber: distance between the face of the nozzle or the fuel outlet and the rear wall of the test flame tube or combustion chamber.
Unit: Millimeter (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 nitrous oxide: quantity of nitrous 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 unburnt hydrocarbons: quantity of unburnt hydrocarbons in the dry gaseous combustion products, measured as volumetric ppm, calculated as C_3H_8.

3.5.6 smoke number: see annex A.

3.6 air figure λ: the air figure λ is the ratio between the effectively introduced quantity of air and the theoretically required quantity of air.

3.7 Oil burner shut-down

3.7.1 controlled shut-off: the 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.

3.7.2 safety lock-out: operation initiated by the action of a flame detector, as a result of abnormal operating conditions described in 5.3.2.

3.7.3 safety shut-down: the 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.

3.7.4 safety shut-off device: a safety shut-off device is a device that automatically cuts off the fuel supply.

3.7.5 lock-out: shut-down condition of the burner control unit such that re-start cannot be achieved without manual intervention.

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

3.7.7 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.

3.7.8 pressure switch: the pressure switch 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.

3.8 Safety times and operating sequences

3.8.1 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)

3.8.1.1 pre-ignition time: period between the start of the ignition cycle and the release of the fuel.
Unit: Seconds (s)

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

3.8.1.3 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)

3.8.2 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)

3.8.2.1 ignition safety time: time 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)

3.8.2.2 safety time during operation: time 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)

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

3.8.3.1 pre-purge time: period immediately proceeding the release of fuel.
Unit: Seconds (s)

3.8.3.2 post-purge time: period immediately following the cutting-off of the fuel supply.
Unit: Seconds (s)

3.8.4 flame simulation: signal indicating the existence of a flame when no flame is present.

3.8.5 operational state: state commencing with the presence of flame after the permissible ignition safety time has expired; i.e. the end of the starting process. Starting can, however, not be considered 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.

3.8.6 intermittent operation: state of operation the duration of which does not exceed 24 h.

3.8.7 continuous operation: state of operation the duration of which exceeds 24 h.

3.9 working field: the working field represents the admissible range of application of the burner (pressure in the combustion chamber as a function of fuel flow) (see figure 4, hatched area).

3.10 testing field: the testing field represents the test range of the burner during the tests (pressure in the combustion chamber as a function of fuel flow, see figure 4).

4 Classification of oil burners

Oil burners are classified as follows according to:

- type of atomization;
- method of control;
- means of ignition.

4.1 Types of atomization

The following different types of atomization are noted:

4.1.1 Mechanical atomization by pressurization of the combustion liquid

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

4.1.2 Atomization by auxiliary fluid

Atomization 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 atomizing fluid;
- rotary cup burners in which atomization 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 respects with the requirements and test conditions of the European Standard.

4.2 Methods of control of oil burners

Automatic or semi-automatic oil burners may be controlled as follows:

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 may be utilised. Oil burners with only two firing rates are 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

System in which the ignition of the fuel is brought about by means of electrical energy.

4.3.1.1 Ignition by controlled spark

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

4.3.1.2 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

System in which the fuel is ignited by an ignition burner using liquid or gaseous fuels. 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.

4.3.2.1 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.

4.3.2.2 Ignition by non-controlled ignition burner

System in which the main fuel supply may be released when the ignition burner flame is not controlled.

5 Requirements

5.1 Construction and operation

5.1.1 General design

5.1.1.1 Materials

The quality of materials, form and dimensioning of the components shall ensure that the oil burners are capable of operating safely and for suitable periods when they are installed correctly under the operating, maintenance and adjustment conditions specified by the manufacturer and the related mechanical, chemical and thermal stresses.

The manufacturer has to ensure that the materials meet all the chemical, mechanical and thermal requirements.

The construction of the burners shall be such that no instability, distortion or breakage likely to impair its safety can occur.

Levers and similar devices which are operated by the installer or user shall be appropriately identified.

Under normal conditions of use, maintenance and adjustment, they shall not show any changes that could affect their normal functioning.

Housings not made of corrosion-resistant material shall be suitably protected with an effective anti-corrosion coating.

Asbestos or asbestos-containing materials shall not be used.

5.1.1.2 Design

The construction and design of the oil burners shall be such that the fuel oil to be used according to the scope burns safely for the specified input (input range) and pressure range specified by the manufacturer and the requirements given in clause 6 are met.

Oil burners that can only operate by means of permanent ignition are not permitted.

5.1.1.3 Mounting

The oil burners shall be designed so that they can be easily attached to the heat generator.

The oil burner components shall be arranged and secured in such a manner that the correct operating position and above all the correct position of the burner orifices does not change during operation. The correct position shall be maintained if the components are dismantled and reassembled.

Parts of the burner that are set or adjusted at the stage of manufacture and which shall not be manipulated by the user or installer shall be sealed.

5.1.1.4 Accessibility for maintenance and use

Components requiring regular maintenance shall be so arranged or so designed that they are easily detachable. Furthermore, they shall be designed or marked in such a way that if the manufacturer's instructions are followed they cannot be replaced incorrectly.

Constructional parts accessible during use and maintenance shall be free from sharp edges and corners that might cause damage or personal injury during use or maintenance.

Burners that can be withdrawn or swivelled out of position without the use of tools shall be interlocked (e.g. by means of limit switches) in such a way that they cannot be operated in the withdrawn or swivelled position.

The interlock device shall be fail safe in design and, if it is a limit switch, shall comply with EN 60204-1 and EN 60947-5-1, depending on the design.

5.1.2 Equipment

5.1.2.1 Motors and fans

Motors and fans shall be so protected by suitable guards, shields or screens of adequate size, strength and durability that they are not liable to be touched accidentally. The degree of protection shall be at least IP 20, according to EN 60529. Removal of such guards, shields or screens shall only be possible with the use of tools.

Belt drives, where used, shall be so designed or positioned as to afford protection to the operator.

The correct belt tension is important. This can be achieved either by automatic means or manually. In the latter case access shall only be possible by the use of tools.

5.1.2.2 Electric safety

For the electrical safety of the burner and the connected devices that have not been prototype tested EN 50165 and the following requirements of EN 60335-1 apply:

a) – nominal value;

b) – protection against electric shock;
– insulation resistance and electric strength;
– internal wiring;
– supply connection and external wiring;
– connection terminals for external conductors;
– earth terminal;
– creepage or track distances, clearances and distances through insulation;
– components;

c) – radio interference suppression;
– resistance to heat;
– track resistance.

In addition the documentation of the electrical connections for the individual components shall be provided by means of an electrical wiring and connection diagram.

5.1.2.3 Installation of oil burner controls

The oil burner controls shall meet the requirements of EN 230 and, in the installed condition, (e.g. in the burner housing) shall have at least IP 40 degree of protection as specified in EN 60529.

5.1.2.4 Ignition devices

The ignition device shall ensure safe ignition of the ignition and/or main burner under the specified conditions of operation device.

5.1.2.5 Rubber hoses and hose assemblies

Rubber hoses and hose assemblies for use in oil burners according to EN ISO 6806 for fuel oil according to the definition of the scope at the burner are permitted, if they have a corrosion-proof metal braiding.

5.1.2.6 Safety shut-off devices and oil pressure switches

5.1.2.6.1 Safety shut-off devices shall be type-tested in accordance with EN 264.

5.1.2.6.2 Burners with a flow rate ≤ 100 kg/h

The safety shut-off devices for burners with a flow rate ≤ 100 kg/h shall be provided between pump and nozzle corresponding to the burner system as shown in figures F.1 to F.4. It is permissible that the safety shut-off device be integrated with the oil-pump.

a) One-stage burners shall be provided with one safety shut-off device in accordance with EN 264;

b) two-stage or multi-stage burners shall be fitted with one safety shut-off device for each nozzle (see figure F.2);

c) burners with spill back nozzle shall be fitted with a safety shut-off device complying with EN 264 in the feed line and in the return line.The nozzle shut-off valve may be fitted in lieu of one each of the safety shut-off devices in the feed line and in the return line, on conditions that nozzle shut-off valve is tested and approved as a safety shut-off device in accordance with EN 264. For atomizing oilburning with spill back nozzle and an oil throughput > 30 kg/h a pressure monitor in the return line shall be provided. The pressure monitor has to monitor the pressure in the return line (see figures F.3 and F.4).

5.1.2.6.3 Burners with a flow rate > 100 kg/h

Two series-connected safety shut-off devices shall be provided in the flow of oil burners with a flow rate > 100 kg/h. One of the devices shall be of the fast closing type. The second device may also be used as a final controlling element for the combustion chamber input and the closing time shall not exceed 5 seconds.

In the case of burners with a return nozzle, two safety shut-off devices shall be provided in the return line and one pressure monitoring device between the power regulator and the shut-off device (see figures F.6 and F.7). A nozzle shut-off valve may replace a safety shut-off device in each line, one in the flow and one in the return line, provided it has been tested and certified as a safety shut-off device in accordance with EN 264. The safety shut-off devices shall be interlocked so that when the flow is open the return is not closed (does not apply to the full-load stage in the case of step-regulated return burners). This can be done, for example, by

– a mechanical connection between the safety shut-off devices in the flow and return by means of an actuator

or

– electric or pneumatic interlocking of the safety shut-off devices in the flow and return.

It shall be ensured that no excessive pressure builds up between the two shut-off devices.

5.1.3 Operating requirements

5.1.3.1 Shut-down

If an on/off control, switch or limiter operates, the fuel oil supply shall be automatically cut off immediately.

5.1.3.2 Protection of the oil and air supply

5.1.3.2.1 The oil supply shall not be released if the atomizing process is not ensured (e.g. failure of the atomizing medium, oil pressure too low, return pressure too high in the case of burners with return nozzle, speed too low) or the combustion air is not available. If the atomizing medium or combustion air supply fails during operation, the oil supply shall be automatically cut off immediately. In the case of oil pressure atomizers, if no spring-loaded fast closing devices are available in the oil-pump, oil pressure switches shall be used.

Where there are no oil or air supply monitoring devices or spring-loaded fast closing device in the pump, the above requirements are considered to have been met if there is a motor-fan-pump assembly in the case of a single shaft motor output or a fan-motor-oil pump assembly in the case of a double ended shaft motor output. In the latter case, there shall be a positive coupling between the motor and the fan.

5.1.3.2.2 The control circuit of the automatic safety shut-off devices shall be so designed that it does not release the oil supply during start-up and cuts off the oil supply during operation:

a) when the required atomizing pressure is not reached in the case of steam and compressed air atomizers or when the speed of the rotary cup is too low in the case of rotary atomizers (when the coupling between the atomizing cup and fan cannot be detached, monitoring of the fan air pressure is adequate);

b) when the maximum oil return pressure is exceeded (in the case of return atomizers > 30 kg/h);

c) when the combustion air fails if the fan is separate;

d) when the main switch is activated;

e) when burners (or even burner lances) are swung out or moved out in cases where this can be done without the use of tools;

f) if at combustion > 30 kg/h the combustion air fails.

Control is not required if the fuel/air ratio is mechanically fixed and the ratio cannot be altered by interference or operating effects. The fuel/air ratio device have to be prototype tested with the combustion or is to be in compliance with EN 60730-1, H.6.18.3.

As soon as the conditions listed under a) to c) no longer pertain, the burners may start up automatically with the start-up programme maintained.

With regard to clauses d) to e), a restart shall only be possible by manual intervention.

5.2 Safety devices

5.2.1 General

The following requirements are generally applicable. Deviations from the sequence specified in the standard are permitted in the case of special types of apparatus and oil burners of special design or size.

The system and oil burners are also regarded as meeting the requirements of this standard if the design is declared safe to operate by the test laboratory after testing of the whole unit or of the oil burner with the relevant equipment.

5.2.2 Ignition safety times for start-up

5.2.2.1 The safety equipment for the flame supervision system shall ensure that the safety times for ignition given in table 1 are adhered to.

Table 1: Maximum heat intput Q_{smax} and ignition safety times t_{smax}

heat input Q_F kg/h	direct main burner ignition at full rate t_{smax} in s	direct main burner ignition at reduced rate Q_s t_{smax} in s Q_{smax} in %	reduced rate Q_s by ignition burner t_{smax} in s Q_{smax} in %
≤ 30	t_{smax} = 10	t_{smax} =10	t_{smax} = 10
> 30 ≤ 100	t_{smax} = 5	t_{smax} = 5	t_{smax} = 5
> 100 ≤ 500	not permitted	≤ 100 kg/h or Q_{smax} ≤ 70 % t_{smax} = 5	≤ 100 kg/h t_{smax} = 5
> 500	not permitted	Q_{smax} ≤ 35 % t_{smax} = 5	Q_{smax} ≤ 50 % t_{smax} = 5

5.2.2.2 In the case of an ignition burner ignited by electric energy, supervision of the pilot flame is necessary if the time between opening of the fuel shut-off valve of the ignition burner and opening of the main oil valve of the main burner is more than 5 seconds.

Separate supervision of the pilot flame is not necessary up to 5 seconds pre-ignition time if the oil supply is cut off and the pilot valve closed within the safety time in the case of non-ignition of the oil flame. In this case, the ignition fuel is permitted to flow for a maximum of 10 seconds (5 seconds pre-ignition time and 5 seconds safety time).

5.2.3 Safety lock-out and restart of the oil burner

The oil supply shall be cut off automatically and safety lock-out occur not later than at the end of the safety time if

a) during the oil burner start-up, no flame has been established at the end of the safety time;

b) the flame is extinguished during operation;

1) In this case, one re-ignition attempt may be made, provided the cut-off prior to the re-ignition was not longer than one second after flame extinction.

2) For burners ≤ 30 kg/h one re-ignition attempt may be made (see EN 230).

c) a restart of the oil burner may not be possible until the burner control unit has been reset.