SLOVENSKI STANDARD

SIST EN 303-7:2007

01-februar-2007

Kotli za gretje - 7. del: Plinski kotli za centralno gretje z ventilatorskimi gorilniki z imensko grelno moļ jo do vkljuļ no 1000 kW

Heating boilers - Part 7: Gas-fired central heating boilers equipped with a forced draught burner of nominal heat output not exceeding 1 000 kW

Heizkessel - Teil 7 : Zentralheizkessel für gasförmige Brennstoffe mit einer Gebläsebrenner mit einer Nennwärmeleistung kleiner als oder gleich 1 000 kW

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Chaudiere de chauffage - Partie 7 : Chaudieres de chauffage central équipées d'un bruleur a air soufflé utilisant les combustibles gazeux de puissance utile inférieure ou égale a 1 000 kW

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 303-7

October 2006

ICS 91.140.10

English Version

Heating boilers - Part 7: Gas-fired central heating boilers equipped with a forced draught burner of nominal heat output not exceeding 1 000 kW

Chaudière de chauffage - Partie 7 : Chaudières de chauffage central équipées d'un brûleur à air soufflé utilisant les combustibles gazeux de puissance utile inférieure ou égale à 1 000 kW

Heizkessel - Teil 7 : Zentralheizkessel für gasförmige Brennstoffe mit einer Gebläsebrenner mit einer Nennwärmeleistung kleiner als oder gleich 1 000 kW

This European Standard was approved by CEN on 14 December 2005.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 303-7:2006) has been prepared by Technical Committee CEN/TC 109 “Central heating boilers using gaseous fuels”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by April 2007, and conflicting national standards shall be withdrawn at the latest by April 2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

WARNING Other requirements and other EU Directives may be applicable to the products falling within the scope of this European Standard.

NOTE When constructional requirements for low temperature boilers will have been introduced in EN 303-1, they will replace those of this European Standard by amendment.

Annexes A, B, C, D, G and ZA are informative. Annexes E and F are normative.

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1 Scope

This European Standard specifies the requirements and test methods for the construction, the safety and the rational energy usage for gas-fired standard and low temperature central heating boilers equipped with a forced draught burner.

These boilers comprise a boiler body and a forced draught gas burner brought together at the producer's assembly facility, the whole being designed and marketed as a complete boiler.

This standard does not apply to the case of the assembly of a boiler body and a forced draught gas burner designed and marketed separately. In this case, EN 303-3 applies.

This European Standard applies to type B_{23} boilers with a nominal heat output not exceeding 1000 kW with a water temperature at normal operation not exceeding 105 °C and with a maximum water-side operating pressure not exceeding 8 bar.

This European Standard does not contain all the necessary requirements for:

— condensing boilers and combination boilers;

— boilers intended to be installed in the open;

— boilers permanently fitted with more than one flue outlet;

— boilers intended to be connected to a common flue having mechanical extraction;

— boilers equipped with several combustion chambers.

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This European Standard does not apply to living-space dedicated boilers (see 3.6).

This European Standard only covers type testing.

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.

EN 303-1:1999, *Heating boilers — Part 1: Heating boilers with forced draught burners — Terminology, general requirements, testing and marking*

EN 437, *Test gases — Test pressures — Appliance categories*

EN 676, *Automatic forced draught burners for gaseous fuels*

EN 60335-1:2002, *Household and similar electrical appliances - Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

EN ISO 3166-1, *Codes for the representation of name of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:1997)*

CEN/TR 1749, *European scheme for the classification of gas appliances according to the method of evacuation of the combustion products (types)*

3 Terms and definitions

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

3.1 Gas rates

3.1.1
volumetric rate ***V*** **(under test conditions);** V_r **(under reference conditions)**
volume of gas consumed by the boiler in unit time during continuous operation

NOTE Volumetric rate is expressed in cubic metres per hour (m^3/h).

3.1.2
mass rate ***M*** **(under test conditions);** M_r **(under reference conditions)**
mass of gas consumed by the boiler in unit time during continuous operation

NOTE Mass rate is expressed in kilograms per hour (kg/h), or on occasions in grams per hour (g/h).

3.2
heat input ***Q***
product of the volumetric rate or the mass rate, and the net calorific value of the gas, under the same reference conditions

NOTE Heat inputs are expressed in kilowatts (kW).

3.2.1
nominal heat input[1)] Q_n
heat input stated by the manufacturer

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3.3 Outputs

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3.3.1
useful output ***P***
quantity of heat transmitted to the heat carrier in unit time

NOTE Outputs are expressed in kilowatts (kW)

3.3.2
nominal output P_n
useful output stated by the manufacturer

3.4
useful efficiency η_u
ratio of the useful output to the heat input

NOTE the useful efficiency is expressed in percent (%).

3.5
nominal voltage
voltage or range of voltages stated by the manufacturer, at which the boiler can operate normally

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[1)] Boilers fitted with a range-rating device operate at a nominal heat input between the maximum and minimum adjustable heat inputs. Modulating boilers operate between the nominal heat input and the minimum controlled heat input. The maximum heat input corresponds to the nominal output of the boiler in accordance with EN 303-1.

3.6
boiler to be installed in the living space
boiler with an effective rated output of less than 37 kW, designed to provide heat to the part of the living space in which it is installed by means of the emission of heat from the casing having an open expansion chamber, supplying hot water using gravity circulation

3.7
boiler
appliance comprising a boiler body and a forced draught burner, designed and brought together at the producer's assembly facility and marketed as a complete boiler

3.8
gases and categories
gases are classified into families, groups and ranges in accordance with EN 437

Boilers are classified into categories in accordance with EN 437.

3.9 Classification in accordance with the mode of evacuation of the combustion products (CEN/TR 1749)

3.9.1
type B
appliance intended to be connected to a flue that evacuates the products of combustion to the outside of the room containing the appliance. The combustion air is drawn directly from the room

3.9.2
type B_2
type B appliance without draught diverter

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3.9.3
type B_{23}
type B_2 appliance incorporating a fan upstream of the combustion chamber/heat exchanger

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3.10
forced draught burner
burner in which the combustion air is introduced by means of a fan

3.11
automatic forced draught burner
forced draught burner that is fitted with automatic ignition, flame monitoring and burner control devices. Ignition, flame monitoring and the on/off switching of the burner occur automatically. The heat input of the burner can be adjusted during operation either automatically or manually

3.12
total pre-mixed burner
burner in which at least all the air theoretically required for complete combustion of the gas is mixed with the gas upstream of the mixture outlet ports

3.13
nozzle mixed burner
burner in which part, or all, of the air theoretically required for combustion of the gas is mixed with the gas at, or downstream of, the air and gas ports

3.14
start gas rate
gas rate ignited by the ignition device during the start-up of the burner

3.15
combustion chamber
part of the boiler in which the combustion of the mixture of the gas and air takes place

3.16
gas line
part of the burner which is made up of the valves and controls and safety devices in which gas is conveyed between the inlet connection and the burner head

3.17
range-rating device
component on the burner intended to be used for adjusting the heat input, within a range of heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation

This adjustment may be progressive or in discrete steps.

3.18
automatic shut-off valve
device that automatically opens, closes or varies the gas rate on a signal from the control circuit and/or the safety circuit

3.19
ignition device
any means (flame, electrical ignition or other means) used to ignite the gas at the ignition burner or at the main burner

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3.20
purge
forced introduction of air into the combustion chamber and flue passages, in order to displace any remaining gas/air mixture and/or products of combustion

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3.21
flame stability
capacity of flame to remain on the burner head or in the flame reception zone intended by the design

3.22
flame lift
total or partial lifting of the base of the flame away from the burner head or the flame holding zone provided by the design

3.23
light back
unintended movement of the flame front to a point upstream of its normal stable operating position

3.24
control thermostat
device enabling the water temperature to be kept automatically, within a given range, at a predetermined value

3.25
adjustable control thermostat
control thermostat that permits the operator to obtain setting temperatures between a minimum and a maximum value

3.26
safety temperature limiter
device that causes safety shutdown and non-volatile lockout so as to prevent the water temperature exceeding a pre-set limit

3.27
flue damper
device having a closure member which virtually blocks the flue gas passage when the main burner is off

3.28
air damper
device having a closure member which virtually blocks the air supply passage when the main burner is off

3.29
ignition safety time (t_{SA})
time that elapses between the order to open and the order to close the gas supply to the burner in the event of no flame being detected

3.30
extinction safety time (t_{SE})
time that elapses between extinction of the supervised flame and the order to shut off the gas supply to the burner

3.31
first safety time
period between the ignition burner gas valve, the start gas valve or main gas valve(s), as applicable, being energized and the pilot gas valve, start gas valve or main gas valve(s), as applicable, being de-energized if the flame detector device signals the absence of a flame

NOTE Where there is no second safety time, this is called the safety time.

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3.32
second safety time
where there is a first safety time applicable to either an ignition burner or start gas flame only, the second safety time is the period between the main gas valves being energized and the main gas valves being de-energized if the flame detector device signals the absence of a flame

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3.33
total closing time
period that starts with the signal that the flame has been extinguished and ends with the shut-off valves being closed

3.34
automatic recycling
after loss of flame during operation, the gas supply is interrupted and the full start procedure is re-initiated automatically

3.35
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

3.36
condensate
liquid formed from the combustion products during the condensation process

3.37
standard boiler
boiler for which the average water temperature can be restricted by design

3.38
low-temperature boiler
boiler which can work continuously with a water supply temperature of 35 °C to 40 °C, possibly producing condensation in certain circumstances

3.39
excess coefficient or air ration, λ
ratio of the real air volume (in m^3) to the stœchiometric air volume (in m^3)

4 Constructional and operational requirements

4.1 General principles

The boiler body shall comply with the relevant requirements of EN 303-1.

The construction and the equipment of the forced draught gas burner shall be in accordance with EN 676.

The operational requirements of the forced draught burner shall be checked on the boiler.

The corresponding requirements and tests are described in this standard.

In the case where the forced draught burner complies with EN 676, only the tests defined in Annex F are necessary.

For low-temperature boilers, all parts of the heat exchanger(s) and other parts of the boiler likely to come into contact with condensate shall be constructed of sufficiently corrosion resistant materials or materials protected by a suitable coating in order to ensure a reasonable life for a boiler that is installed, used and maintained in accordance with the manufacturer's instructions.

Surfaces in contact with condensate (except purpose provided drains, water traps and siphons) shall be designed to prevent condensate retention.

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4.2 Operational requirements

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The following requirements are checked on the boiler in accordance with the test conditions of 5.1 unless otherwise specified

4.2.1 General operational requirements

A controlling device shall not override the operation of any safety device.

4.2.2 External tightness of the gas circuit

When tested as specified in 5.2 the gas carrying parts of the burner, up to the last downstream shut-off device, shall be sound.

4.2.3 Heat input range

Under the test conditions of 5.3 at the normal test pressure, the maximum and minimum heat inputs declared by the manufacturer shall be obtained to within ± 5 %.

4.2.4 Gas pressure governor

The gas regulators shall be conform to the relevant clause of EN 676.

The gas supply for operation and start up shall be controlled by a governor to ensure that the pressure at the burner head remains stable. Under the test conditions of 5.4, the heat input shall not vary by more than ± 5 % from the specified value, if the supply pressure changes in the limits of the minimum and maximum pressure.

4.2.5 Safety of operation

4.2.5.1 Limiting temperature of control and safety devices

Under the test conditions of 5.5.1, the ambient temperature of the control and safety devices shall not exceed the maximum value stated by the devices manufacturer, and their operation shall remain satisfactory.

4.2.5.2 Limiting temperature of control knobs and parts to be touched

Under the test conditions of 5.5.2 the surface temperatures of control knobs and of all parts intended to be touched shall not exceed the ambient temperature by more than:

— 35 K for metals;

— 45 K for porcelain;

— 60 K for plastics.

4.2.5.3 Limiting temperature of the side walls, the front and the top

Under the test conditions of 5.5.3:

— the temperature of the side walls, front and top of the boiler shall not exceed the ambient temperature by more than 80 K.

Nevertheless, the parts of the case within 5 cm of the sight glass and within 15 cm of the boiler combustion products evacuation duct are exempt from this requirement;

— the average temperature of the boiler doors and of the cleaning doors shall not exceed the ambient temperature by more than 100 K.

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4.2.5.4 Limiting temperature of the floor and the test panels

Under the test conditions of 5.5.4, the temperature of the floor on which the boiler is placed and that of the test panels placed at the side of and behind the boiler shall at no point exceed 80 °C when measured.

Where the temperature is between 50 °C and 80 °C, the manufacturer's technical manual shall include information regarding the installation of protection between the boiler and the floor or walls, where these latter consist of flammable materials

4.2.5.5 Start-up

Boiler start-up shall be possible only if the following conditions have been complied with:

a) any interlock integral with the boiler (e.g. flue damper) is indicating its correct position;

b) the flame detector has been checked to be functioning correctly for flame simulation. This check may also be carried out during the pre-purge or after a controlled shut-down;

c) any valve proving system has completed its check successfully. This check may also be carried out during the pre-purge or after a controlled shut-down;

d) the air flow proving device has been proved to be functioning correctly.

Under the conditions of 5.5.5, no excessive pressure fluctuation or flame pulsation shall take place in the boiler.

4.2.5.6 Ignition and flame stability

a) Under the test conditions of 5.5.6, ignition shall be effected correctly, rapidly and without any pulsation. The flames shall be stable and shall not create any disturbing noise. A slight tendency to lift at the moment of ignition is permissible, but the flames shall be stable thereafter.

For boilers fitted with a range-rating device, these requirements shall be satisfied in the range of the maximum and minimum heat inputs declared by the manufacturer.

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b) The ignition of the boiler at reduced pressure before the action of the low pressure gas switch or the flame supervision device shall not lead to a dangerous situation for the user or damage to the boiler.

4.2.5.7 Resistance of the burner to over-heating

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Under the test conditions of 5.5.7 the various parts of the burner shall not suffer any deterioration other than the superficial alterations inherent in combustion.

4.2.5.8 Pre-purge

Before energising the ignition device the combustion chamber shall be purged.

The duration of the pre-purge shall be either:

a) at least 20 s at the full combustion air rate corresponding to the maximum nominal heat input or

b) where the air rate is reduced, a time period increased by an amount inversely proportional to the reduced air rate.

EXAMPLE 100% air rate – at least 20 s pre-purge time;
50% air rate – at least 40 s pre-purge time;
33% air rate (minimum permitted) – at least 60 s pre-purge time.

This reduced air flow rate shall not be less than 33 % of the full combustion air rate.

If the purge air flow falls below the required rate at any time during the purge either

a) the boiler shall proceed to safety shut-down, or

b) the purge shall be continued upon restoration of the required air rate provided that the air flow does not fall below 33 % of the required air rate and that the total purge time at the required air rate is not reduced.

After a controlled shut-down a restart of the following boilers may be achieved without a pre-purge:

a) boilers of heat input up to and including 70 kW fitted with either two class A safety shut-off valves in series, or with two class B safety shut-off valves in series plus a valve proving system;

b) boilers of heat input greater than 70 kW fitted with two class A safety shut-off valves in series plus a valve proving system.

A pre-purge shall be carried out at any restart after every safety shut-down.

4.2.6 Control and safety equipments

4.2.6.1 Start-up heat input

Boilers with a nominal heat input up to and including 120 kW may be ignited directly.

For burners with a nominal heat input exceeding 120 kW, the start gas rate shall not exceed 120 kW or the value given by the equation

$t_{SA} \times Q_s \leq 100$ or $t_{SA} \times Q_S \leq 150$ where appropriate (see Table 1);

where:

t_{SA} is the ignition safety time in seconds (s);

Q_s is the maximum start gas rate expressed as a percentage of the main gas rate.

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The tests shall be carried out under the conditions of 5.6.1.

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4.2.6.2 Start-up

The start-up gas valves shall not be energised before the ignition spark (or other means of ignition) is energized.

However, where a hot surface ignition system is used, the ignition system shall be so energised that the ignition source is capable of igniting incoming gas before the start gas valve(s) are opened.

The start gas flame proving period shall establish that the flame is stable on its own. In the case of a flame failure, the requirements of 4.2.6.5 apply.

Where the gas line is designed such that the gas supply to the ignition burner is taken from between the two main burner gas valves, it is checked under the test conditions of 5.5.6 that it is not possible for a hazardous situation to arise in the event of defective closure of the gas valve immediately upstream of the main burner when the ignition burner is lit.

Where the start gas rate is controlled by a start gas rate position contained within the downstream main safety shut-off valve any means of adjustment of the start gas rate shall be capable of being pre-set and sealed.

The tests shall be carried out under the conditions of 5.5.6.

4.2.6.3 Main burner ignition

4.2.6.3.1 Establishment by means of a start gas flame

If the start gas flame has been ignited at a separate ignition burner and proved the second safety time shall be not more than the safety time mentioned in Table 1 at the end of which time sensing of the main flame shall begin. If the main flame is not detected at the end of this period, the requirements of 4.2.6.5 apply.

The tests shall be carried out under the conditions of 5.5.6.

4.2.6.3.2 Direct establishment of the main gas flame

The ignition source shall not be energised before completion of the pre-purge period and shall be de-energized at, or before, the end of the safety time.

For boilers where a hot surface ignition system is used, the ignition system shall be so energised that the ignition source is capable of igniting incoming gas before the main gas valves are opened.

The tests shall be carried out under the conditions of 5.5.6.

4.2.6.4 Safety times

4.2.6.4.1 Ignition safety time

The ignition safety time shall be determined from the equation given in 4.2.6.1 as a function of the start gas rate, but in no case shall the safety time exceed 5 s.

The ignition of the main and ignition burners, the maximum start gas rate and the corresponding safety time shall be as specified in Table 1 according to the maximum heat input of the burner. Figures 8 to 11 illustrate the ignition systems referred to in this clause.

Burner start up may be achieved in accordance with one of the following methods:

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— direct ignition of the main burner at full rate Q_n; (see Table 1, column 2, Figure 8);

— direct ignition of the main burner at reduced rate; (see Table 1, column 3, Figure 9);

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— direct ignition of the main burner at reduced rate with independent start gas supply; (see Table 1, column 4, Figure 10);

— ignition of the main burner by means of an independent ignition burner; (see Table 1, column 5, Figure 11).

Higher start gas rates than those specified in Table 1 may be achieved at the end of the safety time provided that it is proved that the total amount of energy released in the combustion chamber during the safety time is not greater than the energy release calculated by multiplying the values of maximum start gas heat input and safety time given by Table 1.

When the electrical supply voltage U_N is varied between 85 % of the minimum nominal voltage and 110 % of the maximum nominal voltage declared by the manufacturer, the safety times declared by the manufacturer shall not be exceeded.

The safety times given in Table 1 are absolute maxima.

The tests shall be carried out under the conditions of 5.6.2.1.