SLOVENSKI STANDARD
SIST EN 303-5:1999

01-december-1999

Kotli za gretje – 5. del: Kotli na trdna goriva z ročnim in samodejnim polnjenjem z imensko grelno močjo do 300 kW - Terminologija, zahteve, preskušanje in označevanje

Heating boilers - Part 5: Heating boilers for solid fuels, hand and automatically stocked, nominal heat output of up to 300 kw - Terminology, requirements, testing and marking

Heizkessel - Teil 5: Heizkessel für feste Brennstoffe, hand- und automatisch beschickte Feuerungen, Nenn-Wärmeleistung bis 300 kW - Begriffe, Anforderungen, Prüfungen und Kennzeichnung

Chaudieres de chauffage - Partie 5: Chaudieres spéciales pour combustibles solides, a chargement manuel et automatique, puissance utile inférieure ou égale a 300 kW - Définitions, exigences, essais et marquage

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EUROPEAN STANDARD
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EN 303-5

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English version

Heating boilers - Part 5: Heating boilers for solid fuels, hand and automatically stocked, nominal heat output of up to 300 kW - Terminology, requirements, testing and marking

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This European Standard was approved by CEN on 12 November 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 57 "Central heating boilers", the secretariat of which is held by DIN.

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 October 1999, and conflicting national standards shall be withdrawn at the latest by October 1999.

The following structure is intended for the European standards for heating boilers:

EN 303–1
Heating boilers – Part 1: Heating boilers with forced draught burners – Terminology, general requirements, testing and marking

EN 303–2
Heating boilers – Part 2: Heating boilers with forced draught burners – Special requirements for boilers with atomizing oil burners

EN 303–3
Heating boilers – Part 3: Gas-fired central heating boilers – Assembly comprising a boiler body and a forced draught burner

EN 303–4
Heating boilers – Part 4: Heating boilers with forced draught burners – Special requirements for boilers with forced draught oil burners with outputs up to 70 kW and a maximum operating pressure of 3 bar – Terminology, special requirements, testing and marking

EN 303–5
Heating boilers – Part 5: Heating boilers for solid fuels, hand and automatically stoked, nominal heat output of up to 300 kW – Terminology, requirements, testing and marking

EN 304
Heating boilers – Test code for heating boilers for atomizing oil burners

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.

1 Scope

This standard applies to heating boilers up to a nominal heat output of 300 kW which are designed for the burning of solid fuels only and are operated according to the instructions of the boiler manufacturer either with negative pressure or with positive pressure in the combustion chamber.

Solid fuels in this standard are:

(a) biogenic types of fuel:
wood in natural state in form of
- A - log wood with water content w < 25 %;
- B1 - chipped wood (wood chipped by machine with and without bark, usually up to a maximum length of 15 cm) water content from w > 15 % to < 35 %;
- B2 - chipped wood as under B1, except w > 35 %;
- C - compressed wood (briquettes and pellets without binding agents, made of wood and/or bark particles; permitted are natural binding agents such as molasses, vegetable paraffins and starch);
- D - sawdust w > 20 % to < 50 %;

(b) fossil types of fuel:
- a - bituminous coal;
- b - brown coal;
- c - coke;
- d - anthracite.

The boilers can be used with natural draught or forced draught.

The stoking can be manual or automatic.

The regulations of this standard apply to heating boilers which are to be tested on an accepted boiler test stand.

Heating boilers in accordance with this standard are designed for central heating installations whose heat carrier is water and whose maximum allowable operating temperature is 100 °C and which can operate at a maximum allowable operating pressure of 6 bar. For heating boilers with a built-in or attached water heater (storage or continuous flow heater) this standard only applies to those parts of the water heater which are necessarily subject to the operating conditions of the heating boiler (heating part).

The standard does not apply to

- central heating boilers and other heating appliances which do not have minimum heat loss within the requirements of the standard and which are also designed for the direct heating of the place of installation;
- cooking appliances;
- the design and construction of automatic stoking devices.

The purpose of this standard is to specify the necessary terminology for solid fuel heating boilers, the design requirement, the technical heating requirements (taking into account the environmental requirements) and testing, as well as the marking requirements.

2 Normative references

This European 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 European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 287–1 : 1992
Approval testing of welders – Fusion welding – Part 1: Steels

EN 287–2 : 1992
Approval testing of welders – Fusion welding – Part 2: Aluminium and Aluminium alloys

EN 303–1
Heating boilers – Part 1: Heating boilers with forced draught burners – Terminology, general requirements, testing and marking

EN 304 : 1992
Heating boilers – Test code for heating boilers for atomizing oil burners

EN 10003–1 : 1994
Metallic materials – Brinell hardness test – Part 1: Test method

EN 10025 : 1990
Hot rolled products of non-alloy structural steels – Technical delivery conditions (includes amendment A1:1993)

EN 10027–2
Designation systems for steels – Part 2: Numerical system

EN 10028–2 : 1992
Flat products made of steels for pressure purposes – Part 2: Non-alloy and alloy steels with specified elevated temperature properties

EN 10029 : 1991
Hot rolled steel plates 3 mm thick or above – Tolerances on dimensions, shape and mass

EN 10088–2 : 1995
Stainless steels – Part 2: Technical delivery conditions for sheet/plate and strip for general purposes

EN 10120
Steel sheet and strip for welded gas cylinders

EN 10204
Metallic products – Types of inspection documents

EN 22553 : 1994
Welded, brazed and soldered joints - Symbolic representation on drawings (ISO 2553 : 1992)

EN 24063 : 1992
Welding, brazing, soldering and braze welding of metals – Nomenclature of processes and reference numbers for symbolic representation on drawings (ISO 4063 : 1990)

EN 60335–1 : 1994
Safety of household and similar electrical appliances – Part 1: General requirements

EN 60529
Degrees of protection provided by enclosures (IP-Code) (EC 529:1989)

CENELEC HD365–S3:1988
CENELEC Harmonization Document Classification of degrees of protection provided by enclosures

ISO 7–1 : 1982
Pipe threads where pressure-tight joints are made on the threads – Part 1: Designation, dimensions and tolerances

ISO 7–2 : 1982
Pipe threads where pressure-tight joints are made on the threads – Part 2: Verification by means of limit gauges

ISO 185 : 1988
Grey cast iron – Classification

ISO 228–1 : 1994
Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation

ISO 228-2 : 1987
Pipe threads where pressure-tight joints are not made on the threads – Part 2: Verification by means of limit gauges

ISO 857 : 1990
Welding, brazing and soldering processes – Vocabulary

ISO 7005–1
Metallic flanges – Part 1: Steel flanges

ISO 7005–2
Metallic flanges – Part 2: Cast iron flanges

ISO 7005–3
Metallic flanges – Part 3: Copper alloy and composite flanges

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1 maximum allowable operating pressure: highest pressure at which the boiler can be operated safely.

NOTE: The maximum operating pressure is less than the test pressure and the type test pressure.

3.2 test pressure: pressure to which all boilers and their parts are subjected during production at the manufacturer's plant or during setting up by the installer [EN 303–1].

3.3 type test pressure: pressure to which the heating boilers and their parts are first subjected before start of mass production at the manufacturing plant.

3.4 maximum allowable temperature: the maximum allowable temperature of the flow water is limited by safety devices.

3.5 operating temperature: the operating temperature is that temperature range at which the boiler can be operated under normal operating conditions at the setting on the boiler's water temperature controller, and the manufacturers' specifications.

3.6 heat output Q: the useful heat to water in accordance with the requirements of this standard delivered by a boiler per unit time.

NOTE: The heat output data for solid fuel boilers are average values over a related test period which are established in accordance with the requirements of this standard.

3.7 nominal heat output Q_N: maximal continuous output specified by the manufacturer for a special fuel in accordance with the requirements of this standard.

3.8 minimum heat output Q_{min}: minimum continuous output specified by the manufacturer for each type of fuel in accordance with the requirements of this standard.

3.9 heat output range: is the range of output between minimum and nominal to which the boiler can be adjusted and meets the requirements of this standard.

NOTE: The heat output range lies between nominal heat output and minimum heat output.

3.10 partial load T: quotient of heat output in the heat output range over the nominal heat output, expressed in percent.

$$T = \frac{Q}{Q_N} \cdot 100$$

3.11 partial load operation: a reduced heat output within the heat output range and obtained using a regulating device.

3.12 heat input Q_B: the amount of heat in unit time which is supplied to the furnace of the heating boiler by the fuel based on its net calorific value H_u.

3.13 boiler efficiency η_K: ratio of the delivered useful heat output to the heat input.

$$\eta_K = \frac{Q}{Q_B}$$

3.14 draught: pressure differential between the static air pressure in the place of installation and the static pressure of the exhaust gases (flue gas measuring section) [EN 303–1].

3.15 gas side resistance: the difference in pressure that exists between the combustion chamber and the flue gas outlet of the boiler (flue gas measuring section).

3.16 gas side tightness: tightness of the hopper, combustion chamber, flueways and the boiler sections traversed by the flue gas in relation to the place of installation.

3.17 exit flue temperature t_A: temperature measured at the flue exit of the boiler (flue gas measuring section) [EN 303–1].

3.18 water side resistance: pressure loss in the boiler measured at the flow and return connections of the boiler, with a volume flow corresponding to the nominal heat output [EN 303–1].

3.19 temperature controller: a device which detects and regulates the water flow temperature in the boiler.

3.20 safety temperature limiter (automatic reset): automatically operating device which, when the highest limiting temperature of the water is reached, causes the shutdown of the fuel supply and/or the combustion air supply respectively. The fuel supply and/or the combustion air supply respectively can only be restored once the water temperature has fallen to a preset lower limit value.

3.21 safety temperature limiter (manual reset): automatically operating device which, when the highest limiting temperature of the water is reached, causes the shutdown and lockout of the fuel supply and/or the combustion air supply respectively.

The fuel supply and/or the combustion air supply respectively can only be restored once the water temperature has fallen below the limit value and after resetting manually or with the use of a tool.

3.22 test fuel: fuel of commercial quality used for testing heating boilers and characteristic of the type of fuel.

3.23 stoking device: device for feeding the fuel to the hopper or combustion chamber.

3.24 stoking by hand: fuel is supplied by hand at intervals depending on the burning rate or heat output.

3.25 automatic stoking: fuel is supplied automatically according to thermal output.

It can be done continuously or intermittently.

3.26 combustion period: with hand stoking the time taken to burn the maximum fuel charge down to the basic fire bed level.

The combustion process shall not be interfered with during that time. The residual fire bed shall be sufficient to bring the boiler back to the nominal heat output with a new fuel charge.

3.27 nominal combustion period T_B: combustion period at a nominal heat output.

3.28 bypass device: device which, in the open position, allows combustion gases to pass direct to the exhaust stack (preheating aid or to overcome low temperature exhaust).

3.29 safety heat exchanger or other device for dissipating surplus heat: device for dissipating excess heat from the boiler to limit the boiler temperature to a specified maximum.

3.30 fuel hopper or filling chamber: boiler part from which fuel is fed to combustion. The filling chamber or fuel hopper is the storage space necessary for obtaining a sufficient combustion duration.

3.31 combustion chamber: boiler part for thermal preparation and/or burning of fuel. The combustion chamber may be part of the filling chamber.

3.32 exhaust gas cleaning equipment: techniques used for reducing air pollutants contained in the exhaust gas.

3.33 ash chamber: part of firing plant for keeping combustion residues (ash/clinker).

3.34 accumulator storage boiler: boiler which stores excess heat (resulting from the difference between the boiler's heat output and the actual heat output to the heating system).

3.35 rapidly disconnectable firing system: a firing system is considered as rapidly disconnectable if in all instances of operation and malfunction (e. g. such as power failures or sudden absence of heat reduction) the generation of heat can be interrupted so rapidly that hazardous operating states cannot occur either on the water side or on the firing side.

In this context "hazardous operating state" is understood as meaning any rise in boiler water temperature above 110 °C or any forming of explosive gas-air mixtures in the combustion chamber and/or the flue gas passages. Any evaluation of the system's rapid disconnectability shall therefore not focus on the firing as an isolated element but as part of the overall boiler design (storage capacity), stoking device, air and exhaust gas circuit and, particularly, the control and safety devices.

3.36 partly disconnectable firing system: a large portion of the heat output can be briefly interrupted by the action of control and safety devices without causing hazardous operating states on the firing side.

3.37 residual heat output: the remaining portion of heat output that is still transferred from the firing side to the water side after the boiler shut down table.

4 Requirements

4.1 Construction requirements

4.1.1 General requirements

Boilers shall be fire-resistant and safe to operate. They shall be made of non-combustible materials and shall be resistant to deformation and shall be such that:

- they shall withstand the stresses arising during normal operation;
- the heat carrier (water) shall not become heated to a dangerous extent;
- gases shall not leak from the boiler in dangerous quantities into the place of installation;
- when the boiler is operated correctly flames do not flare out and embers do not fall out;
- dangerous accumulations of combustible gases in the combustion chamber and in the flues are prevented.

Combustible materials are admissible for

- components of accessories, if the parts are fitted outside the boiler;
- internal components of controls and safety equipment;
- operating handles;
- electrical equipment.

Component parts of covers, operating controls, safety devices and electrical accessories shall be arranged in such a way that their surface temperature, under steady state conditions, do not exceed those specified either by the manufacturer or in the component part Standard.

The materials for the parts subject to pressure shall be in accordance with generally accepted technical requirements. They shall be suitable for the purpose and treatment intended. The mechanical and physical properties as well as the chemical composition of the materials shall be guaranteed by the relevant material producer.

4.1.2 Production documentation

4.1.2.1 Drawings

The following shall be specified in the boiler drawings or in the relevant documents:

- the materials used;
- the welding process, the seam type (generally the symbol for the seam type is sufficient) and the welding fillers;
- the maximal allowable operating temperature in °C;
- the maximal allowable operating pressure in bar;
- the test pressure in bar;
- the nominal heat output or the heat output range for every boiler size in kW in accordance with the fuel.

4.1.2.2 Manufacturing controls

A Quality Manual shall be compiled on the inspections and tests necessary during the manufacturing process.

The manual shall:

- describe the inspection system;
- specify the person responsible for Quality Assurance;
- specify the necessary inspections and tests as well as the pertinent limit values and
- lay down the requisite measuring and testing equipment and their inspection.

4.1.3 Heating boilers made of steel and non-ferrous materials

4.1.3.1 Execution of welding work

Boiler manufacturers who carry out welding work shall meet the requirements of EN 287–1 and EN 287–2:

- only welders who are qualified in the welding of the materials to be processed may be used;
- equipment shall be available to allow defect free welding to be carried out;
- supervision of the welding shall be carried out by staff qualified in welding (at least one supervisor shall be so qualified).

4.1.3.2 Welding seams and welding fillers

The materials shall be suitable for welding. The materials in table 1 are suitable for welding and do not require additional heat treatment after welding.

The welded seams shall not show any cracks or bonding faults and shall be defect free over the whole cross-section for butt welds. One-sided fillet welds, and half Y-welds which have been welded through, shall be kept substantially free from bending stresses. Smoke tubes, inserted stays and similar components need not be counterwelded.

Double fillet welds are only permissible when sufficiently cooled. Projections into the flue gas side in areas of high thermal stresses shall be avoided.

Corner welds, edge welds and similar welded connections which are subject to high bending stresses during production and operation are to be avoided.

When welding longitudinal stay bars or stay tubes the shearing cross section of the fillet weld should be 1,25times the required stay bar or stay tube cross sectional area.

Recommendations are given in table 2 (dimensions in mm), and these parameters shall be met.

Welding fillers shall be suitable for the material being used.

The terms given in table 2 are in accordance with EN 22553; the reference numbers of welding processes are in accordance with ISO 857 and EN 24063.

4.1.3.3 Parts of steel subject to pressure

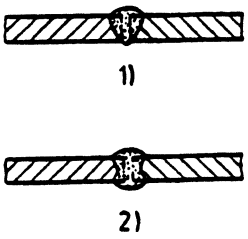
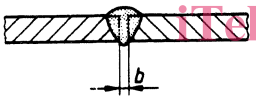
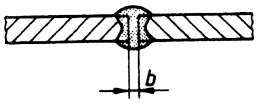
The steels listed in table 1 shall be used.

The specification of the materials shall be documented by a works certificate (EN 10204). These certificates shall be obtained by the boiler manufacturer. This does not apply to components, e. g. sockets up to DN 50, screws and nuts.

Table 1: Materials

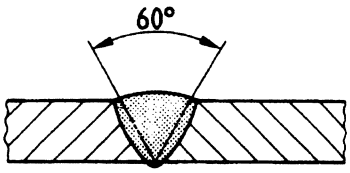
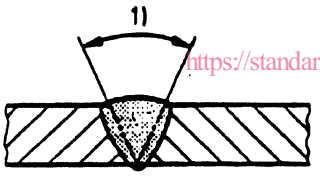
References	Material type	Material numbers (in accordance with EN 10027–2)
EN 10025	S235JR	1.0037
	S235JRG2	1.0038
	S235J0	1.0114
	S235J2G3	1.0116
	S275JR	1.0044
	S275J0	1.0143
	S275J2G3	1.0144
	S355JR	1.0045
	S355J0	1.0553
	S355J2G3	1.0570
	S355K2G3	1.0595
EN 10028–2		
	P235GH	1.0345
	P265GH	1.0425
	P295GH	1.0481
	P355GH	1.0473
	16Mo3	1.5415
	13CrMo4-5	1.7335
	10CrMo9-10	1.7380
	11CrMo9-10	1.7383
EN 10120		
	P245NB	1.0111
	P265NB	1.0423
	P310NB	1.0437
	P355NB	1.0557
EN 10088–2		
	X5CrNi18-10	1.4301
	X6CrNi17-12-2	1.4401
	X6CrNiTi18-10	1.4541
	X6CrNiNb18-10	1.4550
	X6CrNiMoTi17-12-2	1.4571
	X6CrNiMoNb17-12-2	1.4580
	X3CrNiMo17-3-3	1.4436

Table 2: Weld joints and welding processes

No.	Term	Material thickness *t* in mm	Welding process*)	Remarks
1.1	Square butt weld  1) 2) 1) one side 2) both sides	≤ 6 (8)	135 12 131 (111)	Permissible up to *t* = 8 mm on use of deep penetration electrodes or welding on both sides
1.2	Square butt weld  *b*	≥ 6 up to 12	12	Root gap *b* 2 mm to 4 mm with stiffener, powder holder necessary
1.3	Square butt weld (double)  *b*	> 8 up to 12	135 12 (111)	Root gap *b* 2 mm to 4 mm Deep penetration electrodes must be used for manual electro welding

(continued)

Table 2 (continued)

No.	Term	Material thickness *t* in mm	Welding process*)	Remarks
1.4	Single-V butt weld 	up to 12	(111)	Weld preparation V-seam 60°
1.5	Single-V butt weld  1) 30° to 50°	up to 12	135 12	Weld preparation V-seam 30° to 50° depending on thickness of material

(continued)