

SVENSK STANDARD

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**Värmepannor – Värmepannor med fläktbrännare – Nominellt
avgiven effekt ej överstigande 10 MW och högsta
arbetstemperatur 110 °C**

**Heating boilers – Heating boilers with forced draught burners –
Nominal heat output not exceeding 10 MW and maximum
operating temperature of 110 °C**

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Denna standard ersätter SS-EN 14394:2005, utgåva 1.

The European Standard EN 14394:2005+A1:2008 has the status of a Swedish Standard. This document contains the official English version of EN 14394:2005+A1:2008.

This standard supersedes the Swedish Standard SS-EN 14394:2005, edition 1.

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EUROPEAN STANDARD

EN 14394:2005+A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2008

ICS 01.040.91; 91.140.10

Supersedes EN 14394:2005

English Version

**Heating boilers - Heating boilers with forced draught burners -
Nominal heat output not exceeding 10 MW and maximum
operating temperature of 110 °C**

Chaudières de chauffage - Chaudières avec brûleurs à air
soufflé - Puissance utile inférieure ou égale à 10 MW et
température maximale de service de 110 °C

Heizkessel - Heizkessel mit Gebläsebrennern -
Nennwärmeleistung kleiner oder gleich 10 MW und einer
maximalen Betriebstemperatur von 110 °C

This European Standard was approved by CEN on 14 October 2005 and includes Amendment 1 approved by CEN on 28 June 2008.

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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 CEN Management Centre has the same status as the official versions.



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Foreword

This document (EN 14394:2005+A1:2008) 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of an identical text or by endorsement, at the latest by February 2009 and conflicting national standards shall be withdrawn at the latest by February 2009.

This document includes Amendment 1 approved by CEN on 2008-06-28.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This document supersedes EN 14394:2005.

According to edition 2005 the following fundamental changes are given:

- Consideration of the Directive 97/23/EC Pressure Equipment Directive (PED) and including of Annex ZB;
- Correction of some typing errors.

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 Directives.

A1 For relationship with EU Directives, see informative Annexes ZA and ZB, which are integral parts of this document. A1

A1 The requirements and test methods related to the Essential Requirements of the Council Directive 90/396/EEC relating to appliances burning gaseous fuels (Gas Appliance Directive – GAD) for assemblies made up of a boiler body complying with EN 303-1 and a forced draught gas burner complying with EN 676 with a nominal heat output not exceeding 1.000 kW are covered in the Harmonized European Standard EN 303-3:1998 and its Amendment A2:2004. For assemblies with a heat output between 1.000 kW and 10 MW however no Harmonized European Standard does exist at the moment. The relevant clauses of EN 303-3:1998 can be taken as a basis to prove conformity with the essential requirements of the GAD. A1

This European Standard specifies requirements for boilers operating with a temperature of 100 °C and 110 °C which are not covered by the Pressure Equipment Directive (PED, $TS \leq 110$ °C), on the other hand the document specifies requirements for those boilers, which have a maximum allowable temperature $TS > 110$ °C (according to the PED).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

SS-EN 14394:2005+A1:2008 (E)

1 Scope

A1 This European Standard specifies the requirements and test methods for the design, manufacturing, safe operation and the rational energy usage for standard boilers and low temperature boilers (with „boiler" in the sense of „boiler body") from steel and cast iron to be equipped with separately marketed forced draught burners according to the relevant burner standards (for automatic forced draught burners for gaseous fuels see EN 676 and for atomising oil burners see EN 267) up to a nominal heat output of 10 MW. They are operated, either with negative pressure (natural draught boiler) or with positive pressure (pressurised boiler) in the combustion chamber, in accordance with the boiler manufacturer's instructions. **A1**

A1 This European Standard specifies requirements for boilers with normal operating temperatures between 100 °C and 110 °C and has a "dual structure":

- For boilers where the shut off temperature of the safety temperature limiter does not exceed 110 °C the Pressure Equipment Directive (PED) requires "Sound Engineering Practice",
- For boilers where the shut off temperature of the safety temperature limiter exceeds 110 °C this European Standard specifies the requirements of the PED as stated in Annex ZB.

NOTE 1 The "maximum allowable temperature TS" is defined in the PED and its Guidelines. **A1**

Boilers in accordance with this European Standard are designed for the heating of central heating installations in which the heat carrier is water, and the maximum allowable operating temperature of which is up to 110 °C and the maximum safety temperature limiter of 120 °C. The maximum allowable operating pressure is 10 bar.

This standard does not apply to gas boilers with atmospheric burners, boilers for solid fuels, oil or gas fired condensation boilers, boilers with oil vaporisation burners. For these boilers there are further requirements.

For gas-fired central heating boilers equipped with a forced draught burner of nominal heat out put not exceeding 1000 kW, see **A1** EN 303-7 **A1**.

For shell boilers with a nominal heat output exceeding 10 MW and a maximum safety temperature limiter exceeding 120 °C, see EN 12953 series.

A1 NOTE 2 Definitions for standard boiler and low temperature boiler see Council Directive 92/42/EEC. **A1**

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 267, *Forced draught oil burners – Definitions, requirements, testing, marking*

EN 287–1, *Qualification test of welders – Fusion welding – Part 1: Steels*

A1 *deleted text* **A1**

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 atomising oil burners*

A1 EN 303-3, *Heating boilers - Part 3: Gas-fired central heating boilers - Assembly comprising a boiler body and a forced draught burner* **A1**

EN 304, *Heating boilers – Test code for heating boilers for atomising oil burners*

EN 1561, *Founding – Grey cast irons*

EN 1563, *Founding – Spheroidal graphite cast irons*

EN 10025-1, *Hot rolled products of structural steels - Part 1: General technical delivery conditions*

EN 10025-2, *Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10025-3, *Hot rolled products of structural steels - Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*

EN 10088-1, *Stainless steels - Part 1: List of stainless steels*

EN 10088-2, *Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10216-1, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10216-2, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10216-3, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes*

EN 10216-4, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10216-5, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 5: Stainless steel tubes*

EN 10217-1, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10217-2, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-3, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes*

EN 10217-4, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 4: Electric welded non-alloy steel tubes with specified low temperature properties*

EN 10217-5, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-6, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties*

EN 10217-7, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 7: Stainless steel tubes*

EN 10226-1, *Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*

EN 10226-3, *Pipes threads where pressure tight joint are made on the threads - Part 3: Verification by means of limit gauges*

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EN 12828, *Heating systems in buildings - Design for water-based heating systems*

EN 12953-8, *Shell boilers - Part 8: Requirements for safeguards against excessive pressure*

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

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

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60730-2-9, *Automatic electrical controls for household and similar use - Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2000, modified)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

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

EN ISO 4063, *Welding and allied processes – Nomenclature of processes and reference numbers (ISO 4063:1998)*

EN ISO 6506-1, *Metallic materials – Brinell hardness test – Part 1: Test method A_1 (ISO 6506-1:2005) A_1*

EN ISO 9606-2, *Qualification test of welders - Fusion welding - Part 2: Aluminium and aluminium alloys (ISO 9606-2:2004)*

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2003)*

EN ISO 15609-1, A_1 *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004) A_1*

EN ISO 15610, *Specification and qualification of welding procedures for metallic materials - Qualification based on tested welding consumables (ISO 15610:2003)*

EN ISO 15611, *Specification and qualification of welding procedures for metallic materials - Qualification based on previous welding experience (ISO 15611:2003)*

EN ISO 15612, *Specification and qualification of welding procedures for metallic materials - Qualification by adoption of a standard welding procedure (ISO 15612: 2004)*

EN ISO 15613, *Specification and qualification of welding procedures for metallic materials - Qualification based on pre-production welding test (ISO 15613:2004)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

EN ISO 15614-2, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 2: Arc welding of aluminium and its alloys (ISO 15614-2:2005)*

ISO 185, *Grey cast irons – Classification*

ISO 857-1, *Welding and allied processes – Vocabulary – Part 1: Metal welding processes*

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 Terms and definitions

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

3.1

maximum allowable pressure PS

maximum pressure for which the equipment is designed, as specified by the manufacturer

3.2

test pressure

pressure to which all boilers and their parts are subjected during production in the works of the manufacturer or during setting up by the installer

3.3

type test pressure

pressure to which the pre-production heating boiler(s) and associated parts are subjected before start of mass production in the manufacturing works

3.4

temperature

3.4.1

maximum/minimum allowable temperature TS

maximum/minimum temperatures for which the equipment is designed, as specified by the manufacturer

3.4.2

operating temperature

maximum allowable temperature at which the boiler can be operated under normal operation conditions at the maximum setting of the boiler's water temperature controller

3.5

heat output P (heat output range)

amount of heat transferred to the water per unit of time

The heat output range is the span of output below the nominal heat output specified by the manufacturer over which the boiler meets the requirements of this standard and over which it can be used.

3.6

nominal heat output P_n

continuous output specified by the manufacturer in accordance with the requirements of this standard. It is the maximum useful quantity of heat transferred to the heat carrier per hour

3.7

heat input Q_B

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_i

3.8

boiler efficiency η_K

ratio of the nominal output (P_n) to the heat input (Q_B) supplied by the fuel

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

3.9

required draught

pressure differential between the static air pressure in the place of installation and the static pressure of the exhaust gases, as measured in the exhaust gas measuring section, which is required for correct operation of the boiler at nominal output

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3.10

gas side resistance

pressure differential between the combustion chamber and the boiler outlet

3.11

soundness of combustion system

pressure tightness of the combustion circuit through which the exhaust gases flow

3.12

exit flue temperature t_A

temperature measured at the flue outlet of the boiler

3.13

flue gas loss

quantity of heat per unit time which leaves the flue gas exit of the boiler unused

3.14

combustion circuit

comprises the combustion chamber, the heat exchanger, and the combustion product circuit up to the flue exit

3.15

standby loss q_B

quantity of heat which is necessary to maintain the boiler at a given temperature when no heat output is used. It is stated as q_B in relation to the heat input Q_B .

3.16

water side resistance

pressure loss across the boiler measured at the flow and return connections of the boiler, with a volume flow corresponding to the nominal heat output

3.17

control thermostat

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

3.18

safety temperature limiter

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

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 can withstand the stresses arising during normal operation and hydraulic tests;
- the burner and the boiler cannot become heated or pressurised to create a hazard;
- dangerous accumulations of combustible gases (fuels mixed with air) in the combustion chamber and in the flues are prevented and
- gases cannot leak from the boiler in dangerous quantities;
- thermal insulation; only asbestos-free materials are allowable.

Combustible materials are allowable for:

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

Component parts of covers, operating, control and safety devices and electrical accessories shall be arranged in such a way that their surface temperatures, 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/supplier.

4.1.2 Production documentation

4.1.2.1 Drawings

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

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

4.1.2.2 Manufacturing controls

Manufacturing control shall be carried out.

4.1.3 Heating boilers of steel and of non-ferrous materials

4.1.3.1 Execution of welding work

Boiler manufacturers who carry out welding work shall meet the following requirements of EN 287-1 and EN ISO 9606-2:

- 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 Welded joints and welding fillers

The materials shall be suitable for welding. The materials in accordance with Clause 5 are suitable for welding and do not require additional heat treatment after welding.

The welding procedure shall be in accordance with EN ISO 15607, EN ISO 15609-1, EN ISO 15614-1, EN ISO 15614-2, EN ISO 15610, EN ISO 15611, EN ISO 15612 and EN ISO 15613 ~~A1~~ deleted text ~~A1~~.

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The welded joints 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 subjected to high bending stresses during production and operation are to be avoided.

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

See Table 1 for details on the welding joints mentioned. Welding fillers shall be suitable for the material being used.

The terms used in Table 1 are in accordance with EN 22553. The reference numbers of welding processes are in accordance with ISO 857-1 and EN ISO 4063.

Table 1 – Weld joints and welding processes

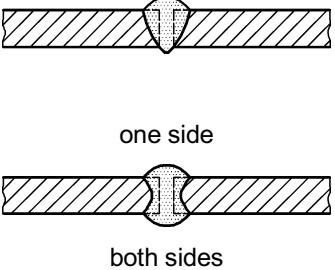
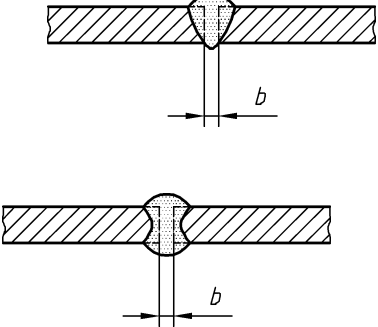
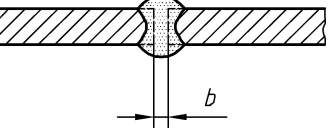
No.	Term	Material thickness t in mm	Welding process ^a	Remarks
1.1	Square butt weld  <p>one side</p> <p>both sides</p>	≤ 6 (8)	135 12 131 (111)	Permissible up to $t = 8$ mm on use of deep penetration electrodes or welding on both sides
1.2	Square butt weld  <p>b</p> <p>b</p>	≥ 6 up to 12	12	Root gap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

Table 1 (continued)

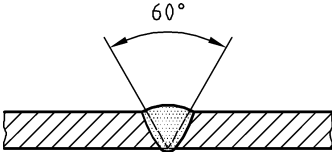
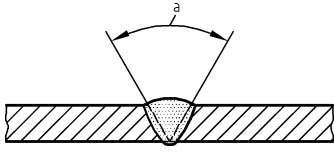
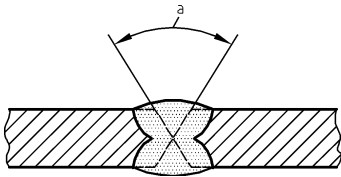
No.	Term	Material thickness t in mm	Welding process ^a	Remarks
1.4	Single-V butt weld 	up to 12	(111)	Weld preparation V-seam 60°
1.5	Single-V butt weld a) 30° to 50° 	up to 12	135 12	Weld preparation V-seam 30° to 50° depending on thickness of material
1.6	Double-V butt weld a) 30° to 50° 	greater than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

Table 1 (continued)

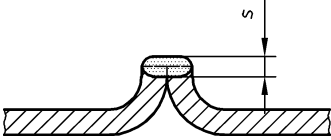
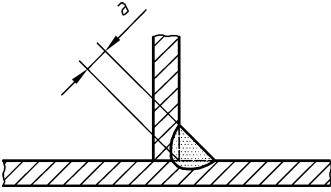
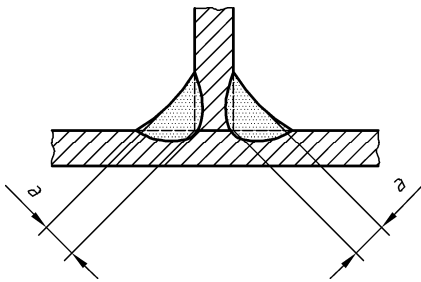
No.	Term	Material thickness t in mm	Welding process ^a	Remarks
1.7	Butt weld between plates with raised edges 	≤ 6	135 141 131 (111)	Only permissible in exceptional cases for parts welded in. Moreover, the welds have to be kept largely free from bending stresses. Not suitable for directly fired wall parts $s = 0,8 t$
2	Fillet weld 	≤ 6	135 12 (111)	Welds of this type are to be kept largely free from bending stresses $a = t$
2.1	Double fillet weld 	≤ 12	135 12 (111)	$a = t$
		> 12	135 12 (111)	$a = 2/3 t$

Table 1 (continued)

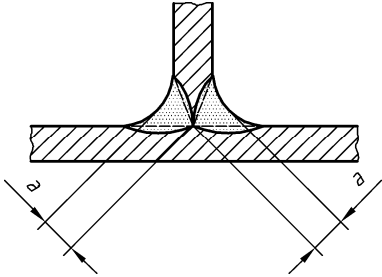
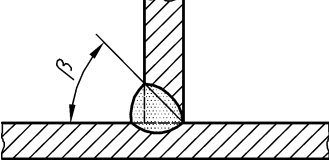
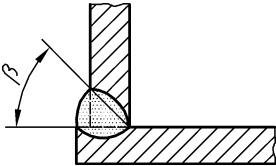
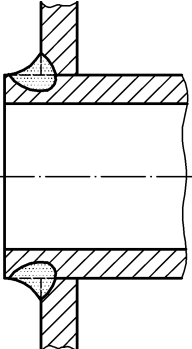
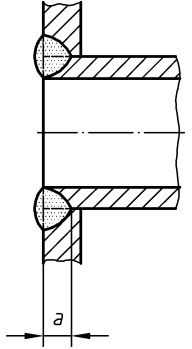
No.	Term	Material thickness t in mm	Welding process ^a	Remarks
2.2	Double-bevel butt weld 	≤ 12	135 12 (111)	$A = t$
		> 12	135 12 (111)	$a = 2/3 t$
2.3	Single-bevel butt weld 	≤ 12	135 12 (111)	For (111) $\beta = 60^\circ$
		> 12	135 12	For 135, 12 $\beta = 45^\circ$ to 50°
2.4	Single-bevel butt weld 	≤ 12	135 12 (111)	For (111) $\beta = 60^\circ$ For 135, 12 $\beta = 45^\circ$ to 50°

Table 1 (continued)

No.	Term	Material thickness t in mm	Welding process ^a	Remarks
2.5		≤ 12	135 (111)	Tube end shall not project beyond fillet weld if it is subjected to heat radiation
2.6		≤ 6	135 (111)	Welding in of tube under high thermal stress $a \geq t$