



# SLOVENSKI STANDARD

## SIST EN 12953-5:2002

01-november-2002

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### Mnogovodni kotli - 5. del : Preskusi med proizvodnjo, dokumentacija in žigovanje tlačno obremenjenih delov kotla

Shell boilers - Part 5: Inspection during construction, documentation and marking of pressure parts of the boiler

Großwasserraumkessel - Teil 5: Prüfung während der Herstellung, Dokumentation und Kennzeichnung für drucktragende Kesselteile

Chaudières a tubes de fumée - Partie 5: Contrôles en cours de construction, documentation et marquage des parties sous pression des chaudières

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Ta slovenski standard je istoveten z: EN 12953-5:2002

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#### ICS:

27.060.30	Grelniki vode in prenosniki toplote	Boilers and heat exchangers
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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 12953-5**

May 2002

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English version

## Shell boilers - Part 5: Inspection during construction, documentation and marking of pressure parts of the boiler

Chaudières à tubes de fumée - Partie 5: Contrôles en cours  
de construction, documentation et marquage des parties  
sous pression des chaudières

Großwasserraumkessel - Teil 5: Prüfung während der  
Herstellung, Dokumentation und Kennzeichnung für  
drucktragende Kesselteile

This European Standard was approved by CEN on 15 May 2002.

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

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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## Foreword

This document (EN 12953-5:2002) has been prepared by Technical Committee CEN/TC 269 "Shell and water-tube boilers", the secretariat of which is held by DIN.

This European Standard 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 standard.

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 November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

The European Standard EN 12953 concerning shell boilers consists of the following Parts:

- *Part 1: General.*
- *Part 2: Materials for pressure parts of boilers and accessories.*
- *Part 3: Design and calculation for pressure parts.*
- *Part 4: Workmanship and construction of pressure parts of the boiler.*
- *Part 5: Inspection during construction, documentation and marking of pressure parts of the boiler.*
- *Part 6: Requirements for equipment for the boiler.*
- *Part 7: Requirements for firing systems for liquid and gaseous fuels for the boiler.*
- *Part 8: Requirements for safeguards against excessive pressure.*
- *Part 9: Requirements for limiting devices of the boiler and accessories.*
- *Part 10: Requirements for boiler feedwater and boiler water quality.*
- *Part 11: Acceptance tests.*
- *Part 12: Requirements for firing systems for solid fuels for the boiler.*
- *Part 13: Operational instructions.*

CR 12953-14: *Guidelines for the involvement of an inspection body independent of the manufacturer.*

Although, these Parts can be obtained separately, it should be recognized that the Parts are inter-dependent. As such, the design and manufacture of shell boilers requires the application of more than one Part in order for the requirements of the standard to be satisfactorily fulfilled.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

**EN 12953-5:2002 (E)****1 Scope**

This Part of the European Standard specifies requirements for the inspection during construction, documentation and marking of shell boilers as defined in EN 12953-1.

**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 (including amendments).

EN 288-3:1992, *Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for the arc welding of steels.*

EN 473, *Non destructive testing — Qualification and certification of NDT personnel — General principles.*

EN 571-1, *Non-destructive testing — Penetrate testing — Part 1: General principles.*

EN 764, *Pressure equipment — Terminology and symbols — Pressure, temperature, volume.*

EN 875, *Destructive tests on welds in metallic materials — Impact tests — Test specimen location, notch orientation and examination.*

EN 876, *Destructive tests on welds in metallic materials — Longitudinal tensile test on weld metal in fusion welded joints.*

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EN 895, *Destructive tests on welds in metallic materials — Transverse tensile test.*

EN 910, *Destructive tests on welds in metallic materials — Bend tests.*

EN 970, *Non-destructive examination of fusion welds — Visual examination.*

EN 1290, *Non-destructive examination of welds — Magnetic particle examination of welds.*

EN 1321, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds.*

EN 1435, *Non-destructive examination of welds — Radiographic examination of welded joints.*

EN 1712, *Non-destructive examination of welds — Ultrasonic examination of welded joints — Acceptance levels.*

EN 1713, *Non-destructive examination of welds — Ultrasonic examination — Characterization of indications in welds.*

EN 1714, *Non-destructive examination of welds — Ultrasonic examination of welded joints.*

EN 12953-1:2002, *Shell boilers — Part 1: General.* EN 12953-3:2002, *Shell boilers — Part 3: Design and calculation for pressure parts.*

EN 12953-4:2002, *Shell boilers — Part 4: Workmanship under construction of pressure parts of the boiler.*

EN 25817, *Arc-welded joints in steel — Guidance on quality levels for imperfections (ISO 5817:1992).*

EN ISO 6520-1, *Welding and allied processes - Classification of geometric imperfections in metallic materials - Part 1: Fusion welding (ISO 6520-1:1998).*

### 3 Terms and definitions

For the purposes of this Part of this European Standard, the terms and definitions given in EN 12953-1 and EN 764 apply.

### 4 Symbols

For the purposes of this Part of this European Standard, the symbols given in EN 12953-1:2002, Table 4-1 shall apply.

### 5 Inspection and testing

#### 5.1 General

The manufacturer shall be responsible for ensuring the boiler conforms to the requirements of this European Standard. Conformity shall be confirmed by the completion of a series of inspection activities as given in Table 5.4-1.

Depending upon the conformity assessment module chosen by the manufacturer for the design and manufacture of each boiler (see EN 12953-1:2002, Annex B), the inspection activities shall involve, to a greater or lesser extent, organisations which are independent of the manufacturer.

NOTE For the guidance of the manufacturer, the specific involvement of such organisations, known as responsible authorities (RA), is described in CR 12953-14.

The manufacturer shall provide all the necessary access to enable the responsible authority to carry out the activities in which it is required to be involved.

#### 5.2 Approval of personnel

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##### 5.2.1 Check of welder and welding operator approval

The manufacturer shall certify that the welding of the boiler has been done by welders and welding operators who have been approved under the requirements of EN 12953-4:2002, 5.15.3.2 and the appropriate certification shall be made available on request.

##### 5.2.2 Approval of non-destructive examination personnel

For the purposes of this standard the term non-destructive examination (NDE) covers the conventional techniques of visual, radiographic, ultrasonic, magnetic particle examination and/or penetrant testing as specified in 5.5.2 to 5.5.4.

Personnel responsible for non-destructive examination, including interpretation, evaluation and reporting shall be certified in accordance with EN 473.

An exception to this requirement shall be made for visual examination of welds and final inspection of boilers, for which EN 473 is not applicable. Visual examination shall be in accordance with EN 970.

Visual examination shall be carried out by experienced personnel having sufficient knowledge in welding techniques, and a full comprehension of this European Standard, to identify and interpret imperfections that might occur at the surface of the weld and the heat affected zone.

Radiographs shall be viewed by personnel qualified to level 2 of EN 473 as a minimum.

Magnetic particle inspection, penetrant inspection and ultrasonic examination shall be performed under the direct supervision of personnel qualified to level 2 of EN 473 as a minimum.

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### 5.3 Calibration of equipment

The manufacturer shall establish procedures to ensure that tools, gauges, instruments and other measuring and testing devices used in the manufacture and inspection activities affecting boiler quality, are properly controlled, calibrated and adjusted at specific intervals, to maintain accuracy within defined limits.

### 5.4 Inspection activities

The manufacturer shall confirm that the boiler components, as a minimum, conform to the requirements of this European Standard by performing and authenticating the inspection activities listed in Table 5.4-1.

**Table 5.4-1 — List of inspection activities to be undertaken by the manufacturer**

Reference no.	Area of activity	Inspection operation
<b>1</b>	<b>Design and general documentation</b>	
1.1	Design data/calculations	Ensure that the design data/calculations conform to: <ul style="list-style-type: none"> <li>— technical specifications, if applicable</li> <li>— the requirements of this European Standard</li> </ul>
1.2	Manufacturing drawings	Ensure that drawing information conforms to: <ul style="list-style-type: none"> <li>— design data and calculations</li> <li>— technical specifications, if applicable</li> <li>— the requirements of this European Standard</li> </ul>
1.3	Purchase specifications	Ensure that material and component specifications conform to: <ul style="list-style-type: none"> <li>— technical specifications, if applicable</li> <li>— manufacturing drawings</li> <li>— the requirements of this European Standard</li> </ul>
1.4	Specifications for sub-contracted parts	Ensure that the specification for sub-contracted parts conform to: <ul style="list-style-type: none"> <li>— technical specifications, if applicable</li> <li>— manufacturing drawings</li> <li>— the requirements of this European Standard</li> </ul>
<b>2</b>	<b>Material</b>	
2.1	Material certificates	Verify that certificate information and results conform to the design specification
2.2	Welding consumables	Verify that the consumables to be used are in accordance with the design specification
2.3	Material identification	Identify the material with the material certificates and check the markings
2.4	Transfer of identification marks	Ensure that the transfer of identification marks is in accordance with the approved procedure
2.5	Acceptance of sub-contracted parts	Verify that sub-contracted parts conform to the manufacturer's specification
<b>3</b>	<b>Fabrication and welding</b>	
3.1	Welding procedure specifications	Verify that appropriate welding specifications are available and that their contents are compatible with the welding procedure approvals
3.2	Welding procedure approvals	Verify that the welding procedures are appropriate for the materials and the field of welding application, and that they have been approved by a responsible authority
3.3	Welder approval	Verify that the welder approvals have been approved by a responsible authority and that they are available and valid



Table 5.4-1 (continued)

Reference	Area of activity	Inspection operation
3.4	Forming procedures	Verify that forming procedures are available, where applicable, and their contents are appropriate to the product to be formed
3.5	Formed parts	Examine formed parts in accordance with the requirements of EN 12953-4:2002, clause 5
3.6	Weld preparations	Examine material cut edges where thermal cutting has been used and confirm machined preparations are to the correct profile
3.7	Weld seam set-up	Examine set-up of seams for welding, including dimensional check
3.8	Welding	Verify that the welding is conducted in accordance with the requirements of the welding procedure specification
3.9	Production test plates, if any	Witness removal and marking of production test plates
		Verify that any PWHT on production test plates independent of the boiler complies with the specific heat treatment applied to the boiler
		Examine NDE reports on production test plates
		Identify and mark the test specimens taken from production test plates for mechanical tests
		Verify that the test information and results from the mechanical tests contained in the manufacturer's report conform to the requirements of this European Standard
<b>4</b>	<b>Non-destructive examination of welds</b>	
4.1	Non-destructive examination procedures	Verify that appropriate non-destructive examination procedures are available and ensure the qualification of the originator is appropriate
4.2	Non-destructive examination operator qualifications	Ensure the non-destructive examination operator's qualifications are appropriate
4.3	Non-destructive examination operation	Scrutinise any radiographs and check conformance to the acceptance criteria
		Verify that the results of any ultrasonic examination conforms to the acceptance criteria
4.4	Non-destructive examination reports	Verify that the information and results conform to the acceptance criteria
<b>5</b>	<b>Post-weld heat treatment (PWHT)</b>	
5.1	PWHT procedures	Verify that the post-weld heat treatment procedures conform to this European Standard
5.2	PWHT records	Verify that temperature/time recordings conform to the requirements of this European Standard
<b>6</b>	<b>Final inspection and marking</b>	
6.1	Pre-hydrostatic pressure test inspection	Carry out dimensional checking, visual examination and identification of accessible parts after component completion, prior to hydrostatic pressure test
6.2	Hydrostatic pressure test	Ensure the final hydrostatic pressure test is carried out in accordance with the requirements of this European Standard
6.3	Post-hydrostatic pressure test inspection	Perform visual examination on completion of the hydrostatic pressure test
		Check marking on nameplate
6.4	Safety devices	Ensure the provision of safety equipment
6.5	Manufacturer's data dossier	Ensure completeness of the data dossier (see 6.2)

## EN 12953-5:2002 (E)

## 5.5 Non-destructive examinations

## 5.5.1 General

The NDE shall be performed after any PWHT.

## 5.5.2 Extent of non-destructive examination

All welded seams shall be subjected to visual examination and, in addition, to NDE in accordance with Table 5.5-1.

Table 5.5-1 — Extent of NDE for welds

Component	Type of weld	Weld location	Figure No. EN 12953-4:2002	Testing technique	Footnotes	Percentage of total length of weld to be tested	
						Weld factor	
						1	0,85
All welds	—	—	—	Visual		100	100
<b>Branch welds and pads</b>		In shell section	A.5 to A.7	MP & DP	<sup>a</sup>	25	10
<b>Shell</b>	Longitudinal	In shell section	A.1	Radiographic or ultrasonic	<sup>b</sup> and <sup>c</sup>	100	10
	Circumferential	Between shell sections	A.1	Radiographic or ultrasonic	<sup>b</sup> , <sup>c</sup> and <sup>d</sup>	25	10
	Circumferential	Between shell sections and flanged end plates	A.1	Radiographic or ultrasonic	<sup>b</sup> , <sup>c</sup> , <sup>d</sup> and <sup>e</sup>	25	10
	Circumferential	Between shell sections and set- on end plates	A.13c) and A.13d)	Radiographic or ultrasonic	<sup>f</sup>	100	100
	T-butt	At junction of shell with set-in end plates	A.13a) and A.13b)	Radiographic or ultrasonic	<sup>c</sup> and <sup>g</sup>	10	10
<b>Flat end plates</b>	Butt	Between the two sections in large diameter end plates	A.1	Radiographic or ultrasonic	<sup>c</sup>	100	10
<b>Furnaces</b>	Longitudinal	In furnace sections	A.1	Radiographic or ultrasonic	<sup>c</sup>	10	10
	Circumferential	Between furnace sections and between furnace and bowling hoops	A.1	Radiographic or ultrasonic	<sup>b</sup> and <sup>c</sup>	10	10
	Circumferential	Between furnace sections and flanged end plates	A.17c)	Radiographic or ultrasonic	<sup>b</sup> and <sup>c</sup>	10	10
	T-butt	Between furnace sections and set-in end plates	A.15	Radiographic or ultrasonic	<sup>c</sup> , <sup>f</sup> and <sup>g</sup>	25	25
	T-butt	Furnace to reversal chamber end plates	A.15	Radiographic or ultrasonic	<sup>c</sup>	10	10
<b>Reversal chambers</b>	Longitudinal	In wrapper plate	A.1	Radiographic or ultrasonic	<sup>c</sup> , <sup>f</sup> and <sup>g</sup>	25	25
	Circumferential	Between wrapper plate and flanged end plate	A.13d)	Radiographic or ultrasonic	<sup>b</sup> and <sup>c</sup>	10	10
	T-butt	Between wrapper plate and flanged end plate	A.14a) to A.14c)	Radiographic or ultrasonic	<sup>c</sup> , <sup>f</sup> and <sup>g</sup>	10	10
<b>Reversal chamber access tube</b>	Longitudinal	In access tube	A.1	Radiographic or ultrasonic	<sup>c</sup>	10	10
	T-butt	Access tube to boiler and rever- sal end plate chamber end plates	A.16a) A.16b)	Radiographic or ultrasonic	<sup>c</sup> , <sup>f</sup> and <sup>g</sup>	10	10
<b>Gusset and girder stays</b>	T-butt	Between stay and plate	EN 12953-3:2002, Figures 10.2-11 and 10.2-14	Radiographic or ultrasonic	<sup>f</sup>	10	10

<sup>a</sup> Type P355GH steel only.

<sup>b</sup> The percentage of welds to be examined shall include each intersection of longitudinal and circumferential seams. For each longitudinal and circumferential seam there shall be at least one radiograph, or where ultrasonic testing is specified, at least a 200 mm length shall be examined.

<sup>c</sup> In each case the section of weld to be tested shall be selected at random.

<sup>d</sup> If the end plates are fully stayed to each other by bar stays, stay tubes, or a combination of bar stays and reversal chamber stays, 10 % of the length of the circumferential seams shall be non-destructively examined. All seam intersections shall be NDE.

<sup>e</sup> If the flange is thicker than the end plate, the flange shall be machined to a taper and welded in a manner to that shown in EN 12953-4:2002, Figure A.1a).

<sup>f</sup> If T-butt welds cannot be radiographically or ultrasonically examined due to physical limitations, they shall be visually examined at the following stages — weld preparation, tack welding, initial root run, finished weld, and shall be subjects to MP or DP on completion.

<sup>g</sup> The position of the tested section of weld shall be marked on the boiler and recorded.

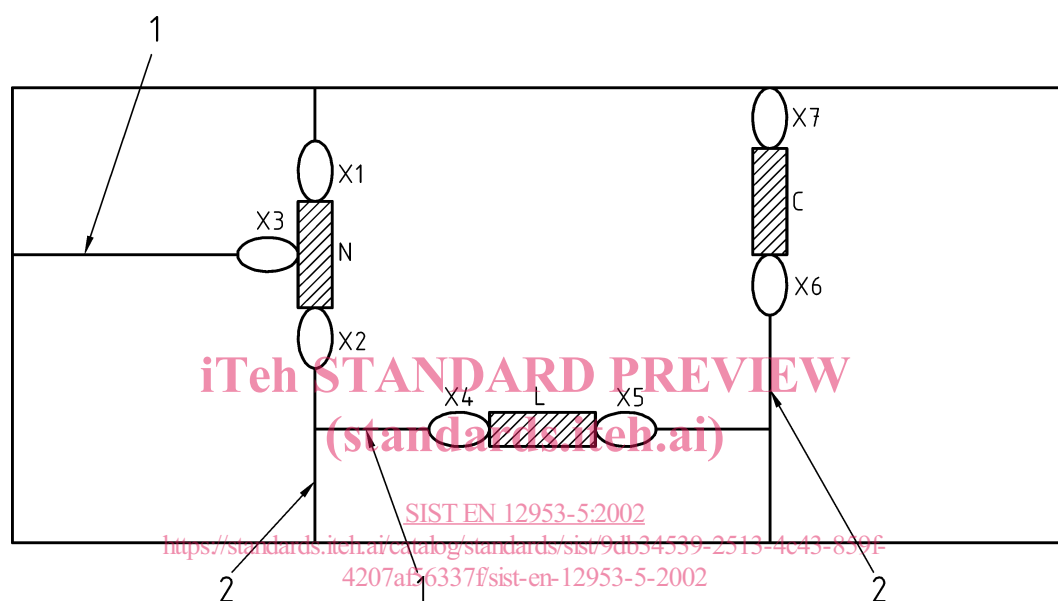
If, during inspection, a defect is detected in the weld under examination, the following additional inspections shall be carried out prior to any repair, (see Figure 5.5-1).

a) Cross welds

If the defect occurs in the region of a weld intersection, a check shall be made in the longitudinal and circumferential weld at each side of the intersection.

b) Circumferential and longitudinal welds

For defects in the circumferential and longitudinal seam welds, a check shall be made at each side of the defect.



**Key**

Weld under examination

Additional examinations  $\geq 200$  mm

1 Longitudinal weld

2 Circumferential weld

X1 ... X7 checks points

N Cross weld defect

L Longitudinal weld defect

C Circumferential weld defect

**Figure 5.5-1 — Additional inspection of defective welds**

If the results of a) and b) are satisfactory, no further action is required and the weld shall be repaired.

If additional defects are detected, the particular seam shall be subjected to 100 % examination together with all other welds produced by the recorded welder to the same procedure.

Any repair to a weld shall be documented. If the repair is made as a consequence of a radiographic examination, the films of the original defects shall be made available.

### 5.5.3 Non-destructive examination of repairs

On completion of repairs, the re-welded portions shall be examined by all the techniques specified for the original weld.

### 5.5.4 Non-destructive examination of welded joints – techniques and acceptability of imperfections

#### 5.5.4.1 General

All welded joints which are to be subjected to non-destructive examination shall be prepared so as to be suitable for the method to be used.