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Water-tube boilers and auxiliary installations - Part 6: Inspection during construction; documentation and marking of pressure parts of the boiler

Wasserrohrkessel und Anlagenkomponenten - Teil 6: Prüfung während der Herstellung; Dokumentation und Kennzeichnung für drucktragende Kesselteile

Chaudières a tubes d'eau et installations auxiliaires - Partie 6: Contrôle en cours de construction, documentation et marquage des parties sous pression de la chaudière

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27.060.30	Grelniki vode in prenosniki toplote	Boilers and heat exchangers
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Water-tube boilers and auxiliary installations - Part 6: Inspection during construction; documentation and marking of pressure parts of the boiler

Chaudières à tubes d'eau et installations auxiliaires - Partie 6: Contrôle en cours de construction, documentation et marquage des parties sous pression de la chaudière

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

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Foreword

This document (EN 12952-6:2002) 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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.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 12952 concerning water-tube boilers and auxiliary installations 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: In-service boiler life expectancy calculations.
- Part 5: Workmanship and construction of pressure parts of the boiler.
- Part 6: Inspection during construction, documentation and marking of pressure parts of the boiler.
- Part 7: Requirements for equipment for the boiler.
- Part 8: Requirements for firing systems for liquid and gaseous fuels for the boiler.
- Part 9: Requirements for firing systems for pulverized solid fuels for the boiler.
- Part 10: Requirements for safeguards against excessive pressure.
- Part 11: Requirements for limiting devices of the boiler and accessories.
- Part 12: Requirements for boiler feedwater and boiler water quality.
- Part 13: Requirements for flue gas cleaning systems.
- Part 14: Requirements for flue gas DENOX-systems.
- Part 15: Acceptance tests.
- Part 16: Requirements for grate and fluidized bed firing systems for solid fuels for the boiler.

CR 12952 Part 17: Guideline 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 water-tube boilers requires the application of more than one Part in order for the requirements of the standard to be satisfactorily fulfilled.

NOTE Parts 4 and 15 are not applicable during the design, construction and installation stages.

Annex A is normative.

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 12952-6:2002 (E)**1 Scope**

This Part of this European Standard specifies requirements for the inspection during construction, documentation and marking of water-tube boilers as defined in EN 12952-1.

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 287-1, *Approval testing of welders — Fusion welding — Part 1: Steels.*

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

EN 288-8, *Specification and approval of welding procedures for metallic materials — Part 8: Approval by a pre-production welding test.*

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

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

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

EN 1289, *Non-destructive examination of welds — Penetrant testing of welds — Acceptance levels.*

EN 1291, *Non-destructive examination of welds — Magnetic particle testing of welds — Acceptance levels.*

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

EN 1418:1997, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials.*

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

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method.*

EN 12952-1:2001, *Water-tube boilers and auxiliary installations — Part 1: General.*

EN 12952-2, *Water-tube boilers and auxiliary installations — Part 2: Materials for pressure parts of boilers and accessories.*

EN 12952-3:2001, *Water-tube boilers and auxiliary installations - Part 3: Design and calculation for pressure parts.*

EN 12952-5:2001, *Water-tube boilers and auxiliary installations — Part 5: Workmanship and 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 6520-1:1998, *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 purpose of this Part of this European Standard, the terms and definitions given in EN 12952-1 and the following apply.

3.1

inspection

conformity evaluation by observation and judgement accompanied as appropriate by measurement, testing or gauging

[EN ISO 9000]

4 General organization

4.1 General

The manufacturer shall be responsible for ensuring the boiler conforms to the requirements of this European Standard. Conformance shall be confirmed by completing a series of inspection activities as detailed in Table 4.5-1.

Except where explicitly stated otherwise in this standard, inspection activities applicable to a manufacturer's works shall also be applicable to operations carried out on a construction site.

4.2 Conformity assessment

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Guidance in the use of the conformity assessment procedures is given in EN 12952-1:2001, Annex A.

4.3 Competency of the manufacturer

If an assessment of the competency of the manufacturer is required, guidance is given in EN 12952-5:2001, Annex F.

4.4 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 product quality, are properly controlled, calibrated and adjusted at specific intervals, to maintain accuracy within defined limits. A system for calibration in compliance with the EN ISO 9000 series shall be deemed to meet these requirements.

4.5 Inspection activities

The manufacturer shall confirm that the boiler components, as a minimum, conform to the requirements of this standard by performing and authenticating the activities listed in Table 4.5-1.

NOTE Depending upon the conformity assessment module adopted, some of the inspection activities listed should also be assessed by a responsible authority. For the guidance of the manufacturer, the specific involvement of such a responsible authority is indicated in CR 12952-17.

Table 4.5-1 — List of inspection activities to be undertaken by the manufacturer

Reference	Area of activity	Inspection operation
1	Design and general documentation	
1.1	Design data/calculations	Ensure that the design data/calculations conform to: — technical specifications, if applicable — the requirements of this European Standard
1.2	Manufacturing drawings	Ensure that drawing information conforms to: — design data and calculations — technical specifications, if applicable — the requirements of this European Standard
1.3	Purchase specifications	Ensure that material and component specifications conform to: — technical specifications, if applicable — manufacturing drawings — the requirements of this European Standard
1.4	Specifications for sub-contracted parts	Ensure that the specification for sub-contracted parts conform to: — technical specifications, if applicable — manufacturing drawings — the requirements of this European Standard
2	Material	
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
3	Fabrication and welding	
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
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	Weld preparations	Examine material cut edges where thermal cutting has been used and confirm machined preparations are to the correct profile

Table 4.5-1 (continued)

Reference	Area of activity	Inspection operation
3.6	Formed parts	Examine formed parts in accordance with the requirements of EN 12952-5:2001, clause 7
3.7	Weld seam set up	Examine set up of seams for welding, including dimensional check
3.8	Weld root	Examine second side of weld preparation, if applicable, after the first side of weld has been completed and the root cleaned
3.9	Production test plates, if any	Identify and mark production test plates
		Verify that any PWHT on production test plates independent of the component complies with the specific heat treatment applied to the component
		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 conform to the requirements of this European Standard
4	Non-destructive examination of welds	
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
		Scrutinise the operator's ultrasonic examination reports
4.4	Non-destructive examination reports	Verify that the information and results conform to the acceptance criteria
5	Post-weld heat treatment (PWHT)	
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
6	Final inspection and marking	
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 clause 11

EN 12952-6:2002 (E)**5 Non-destructive examination of parent materials**

The NDE of parent materials shall be in accordance with EN 12952-2.

6 Approval of welding procedure specification**6.1 General**

The welding procedure specifications shall be approved for all welds in components forming the pressure circuit or attached to that circuit.

For application to water-tube boilers, these approvals shall be in accordance with EN 288-3 or EN 288-8 as appropriate. Approval records and fusion welding procedure specifications shall be approved as part of the design approval process. The general rules of EN 288-3 shall be supplemented for the purpose of this European Standard by application of the specific rules detailed in 6.2.

The manufacturer shall supply, as part of the technical documentation, a list of all the welding procedure specifications required for the fabrication of the water-tube boiler.

Where a manufacturer can furnish proof that he has previously carried out successful procedure approval tests in accordance with the requirements of this European Standard, he shall be deemed exempt from the necessity for re-approval within the essential variables covered by the previous test.

NOTE A document on 'Flash butt welding procedures' is in preparation. See Bibliography.

In addition to the requirements of EN 288-8, procedure qualification test for welded water-tube wall construction shall comply with the requirements of EN 12952-5:2001, Annex A.

6.2 Application of EN 288-3**6.2.1 Tests required**

The welding procedure approval tests shall be in accordance with the requirements of EN 288-3.

In addition, the following requirements shall be met for drums and headers made from steel groups 1, 2.1, 4 or 5:

- a) Boiler drums: For longitudinal and circumferential welded joints in drums of thicknesses greater than 20 mm, the welding procedure approval test shall include a longitudinal tensile test on weld metal. This test shall be performed at not less than the following minimum temperatures:

250 °C for steel group 1;

350 °C for steel group 2.1, 4 or 5.

- b) Headers: For headers containing longitudinal welds having a thickness greater than 20 mm, the welding procedure approval test for the longitudinal welds shall include a longitudinal tensile test on weld metal. This test shall be performed at not less than the following minimum temperatures:

250 °C for steel group 1;

350 °C for steel group 2.1, 4 or 5.

6.2.2 Mechanical tests

6.2.2.1 General

All mechanical tests performed during the welding procedure qualification shall be carried out in accordance with EN 288-3.

The Charpy V-notch impact tests shall be carried out at room temperature in accordance with EN 10045-1.

The test values to be achieved shall be as defined in EN 288-3 and 6.2.2.2 to 6.2.2.5.

6.2.2.2 Longitudinal tensile test on weld metal

The test result shall meet the specified minimum $R_{p0.2}$ value for parent material at testing temperature (see 6.2.1).

6.2.2.3 Transverse tensile test

The test results shall meet the following requirements, depending on the position where the fracture occurs during the test:

- if the fracture occurs in base material, the minimum ultimate tensile strength specified for the relevant base material used for the qualification;
- if the fracture occurs in the weld, the minimum ultimate tensile strength specified for the relevant base material used for the qualification, or, for designs based on the $R_{p0.2}$ proof stress, 90 % of the minimum ultimate tensile strength specified for the relevant base material used for the qualification.

6.2.2.4 Charpy V-notch impact tests

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The test results shall meet the following requirements, depending on the base material and the position where the tests are performed:

a) For ferritic steels:

1) Charpy V-notch impact test in the weld deposit:

- minimum average value: the average value specified for the base material used in the welding procedure approval at the test temperature (room temperature);
- minimum single value: one single value may be lower than the value required for the minimum average value, but shall not be less than 70 % of the minimum average value;

2) Charpy V-notch impact tests in the heat affected zone:

- minimum average value of 27 J, except for steel group 6 where 24 J is permitted;
- minimum single value: one single value may be lower than the value required for the minimum average value, but shall not be less than 21 J, or 19 J for steel group 6;

b) For austenitic steels:

Impact testing shall not be required for austenitic steels.

6.2.2.5 Hardness survey

Depending on the base material and whether post-weld heat treatment is required in accordance with EN 12952-5:2001, 10.4, hardness values shall be as specified in EN 288-3.

For non-heat treated steel group 5, the maximum value shall not exceed 380 HV10.

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Provided that the ductility of the weld has been adequately demonstrated in accordance with the bend tests as specified in EN 288-3 and the impact tests as specified in 6.2.2.4, local deviations in the heat affected zone hardness values shall be acceptable.

6.2.2.6 Dissimilar base material joints

In the case of dissimilar base material joints, the weld metal values shall meet the lower of the specified minimum values for the parent material as required in 6.2.2.2, 6.2.2.3 and 6.2.2.4.

7 Welder and welding operator approval

All welders and welding operators engaged on the welding of pressure parts of water-tube boilers fabricated in accordance with this European Standard shall pass the welder approval tests which are designed to demonstrate their ability to make sound welds of the types on which they are to be employed.

Approval testing of welders and welding operators shall be carried out, recorded and reported in accordance with EN 287-1 or EN 1418:1997, 4.2.1 and 4.2.2, as appropriate. Verification of approval of welders testing shall be part of final inspection. The general rules of EN 287-1 or EN 1418:1997, 4.2.1 and 4.2.2 shall be fully applied, as appropriate.

When a welder or and welding operator is approved according to EN 287-1 or EN 1418:1997, 4.2.1 and 4.2.2, as appropriate, for the welding of butt welds, no additional approval shall be required for the welding of branches, nozzles or attachments, provided that the welding operations are carried out in the range of approval of the welder or and welding operator approval given in EN 287-1 or EN 1418:1997, 4.2.1 and 4.2.2 as appropriate.

A list of welders and welding operators, together with records of their approval tests, shall be retained by the manufacturer who may be required to provide evidence of approval of any welder engaged in the fabrication of water- tube boilers.

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8 Production control test plates for drums**8.1 General**

The material used for production control test plates shall comply with the same standard and grade, or the same specification, as that used for the construction of the drums of the water-tube boiler. As a minimum, plates shall be from the same steel making process and of the same nominal thickness as the drum plates. Where possible, the plates shall be selected from the same cast as that used for the manufacture of the drum.

The dimensions of the test plates shall be large enough to allow the preparation of all the test specimens required by 8.3.2, and in no case shall their length be shorter than 350 mm.

The test plates shall be attached, wherever practical, to the drum plate so that the weld carried out on the production control test plate is a continuation of the longitudinal seamweld.

Production control test plates shall receive an identical post-weld heat treatment or stress relief as that applied to the production weld.

8.2 Number of production control test plates

The number of production control test plates required shall be as follows:

- a) longitudinal welds: One production control test plate per welding procedure approval per drum and per headers;
- b) circumferential welds: If the welding procedure approval is the same as that for the longitudinal seam of the drum, no additional production control test plate is required. If the welding procedure approval differs from that of the longitudinal seam, then one production control test plate shall be performed per welding procedure approval per year.