SLOVENSKI STANDARD
SIST EN 12953-10:2004

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Mnogovodni kotli – 10. del: Zahteve za kakovost napajalne in kotelne vode

Shell boilers - Part 10 : Requirements for feedwater and boiler water quality

Großwasserraumkessel - Teil 10 : Anforderungen an die Speisewasser- und Kesselwasserqualität

Chaudieres a tubes de fumée - Partie 10 : Exigences relatives à la qualité de l'eau d'alimentation et de l'eau en chaudiere

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English version

Shell boilers - Part 10 : Requirements for feedwater and boiler water quality

Chaudières à tubes à fumée - Partie 10 : Exigences relatives à la qualité de l'eau d'alimentation et de l'eau en chaudière

Großwasserraumkessel - Teil 10 : Anforderungen an die Speisewasser- und Kesselwasserqualität

This European Standard was approved by CEN on 4 August 2003.

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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 Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 12953-10:2003) 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 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

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 feedwater and boiler water quality*
- *Part 11: Acceptance tests*
- *Part 12: Requirements for grate firing systems for solid fuels for the boiler*
- *Part 13: Operating instructions*

CR 12953 Part 14: *Guideline for the involvement of an inspection body independent of the manufacturer*

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This Part of this European Standard applies to all shell boilers as defined in EN 12953-1 which are heated by combustion of one or more fuels or by hot gases for the generation of steam and/or hot water.

This Part of this European Standard applies to those components between the feedwater inlet and the steam outlet of the steam generator. The quality of the steam produced is outside the scope of this standard.

This Part of this European Standard aims to ensure that the boiler is able to be operated to minimize risk to personnel, the boiler and associated plant components located near it.

NOTE 1 This part of this European Standard does not aim to achieve optimum economic operation. For certain purposes, it will be more appropriate to optimize the chemical characteristics in order to:

— increase the thermal efficiency;

— increase the availability and reliability of the plant;

— increase the steam purity;

— reduce the maintenance costs – repair, chemical cleaning, etc.

This Part of this European Standard sets out minimum requirements for the specific types of water to reduce the risk of corrosion, sludge precipitation or formation of deposits which may lead to any damage or other operating problems.

NOTE 2 This Part of this European Standard has been prepared on the assumption that the user of this European Standard possesses a sufficient knowledge of the construction and operation of the boiler as well as an adequate appreciation of water and steam chemistry.

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 12953-1:2002, *Shell boilers — Part 1: General.*

EN ISO 9963-1, *Water quality — Determination of alkalinity — Part 1: Determination of total and composite alkalinity (ISO 9963-1:1994).*

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes.*

ISO 5667-3, *Water quality — Sampling —Part 3: Guidance on the preservation and handling of samples.*

ISO 5814, *Water quality — Determination of dissolved oxygen — Electrochemical probe method.*

ISO 6059, *Water quality — Determination of the sum of calcium and magnesium — EDTA titrimetric method.*

ISO 6332, *Water quality — Determination of iron — Spectrometric method using 1,10-phenanthroline.*

ISO 6878, *Water quality* — Spectrometric determination of phosphorus using ammonium molybdate.

ISO 7888, *Water quality — Determination of electrical conductivity.*

ISO 8245, *Water quality — Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC).*

ISO 8288, *Water quality — Determination of cobalt, nickel, copper, zinc, cadmium and lead — Flame atomic absorption spectrometic methods.*

ISO 9964-1, *Water quality — Determination of sodium and potassium — Part 1: Determination of sodium by atomic absorption spectrometry.*

ISO 9964-2, *Water quality — Determination of sodium and potassium — Part 2: Determination of potassium by atomic absorption spectrometry.*

ISO 10523, *Water quality — Determination of pH.*

3 Terms and definitions

For the purpose of this part of this European Standard, the terms and definitions given in EN 12953-1:2002 and the following definitions apply.

3.1
direct conductivity
direct measured conductivity of water

3.2
acid conductivity
conductivity of water measured in the hydrogenion concentration from continuously flow through downstream of a strongly acidic cation exchanger

3.3
make-up water
water which compensates for losses of water and steam from the system

3.4
feedwater
mixture of returned condensate and/or make up water supplied to the boiler inlet

3.5
demineralized feedwater
water with an electrolyte content according to an acid conductivity of < 0,2 µS/cm and a silica content (SiO_2) < 0,02 mg/l

3.6
boiler water
water within a natural or assisted circulation boiler

3.7
attemperator spray water
water for injection to control steam temperature

4 Conditioning

Certain quality characteristics of feedwater and boiler water shall be improved by treatment with chemicals.

This conditioning can contribute:

— to support the formation of magnetite layers or other protective oxide layers;

— to minimize corrosion by optimizing the pH value;

— to stabilize hardness and to prevent or minimize scaling;

— to effect chemical oxygen scavenging;

— to develop special coatings with protective effect by film formation on metallic surfaces.

Conventional inorganic conditioning agents include e.g. sodium and potassium hydroxide, sodium phosphate, sodium sulphite, ammonia and hydrazine.

NOTE 1 The use of some of these chemicals can be restricted in some countries.

However, organic-based conditioning agents have been in use for many years now. If organic-based conditioning agents are used, the quantities and methods for use as well as analysis method shall be specified by the supplier of the chemical products.

NOTE 2 The geometry of shell boilers can give rise to stresses and/or crevices, e. g. at welded or rolled flue tubes to tube sheet joints. Because of evaporation a concentration of dissolved, non-volatile ingredients of the boiler water (salts, solid conditioning agents) will take place. Under such conditions local concentration of alkali can occur which leads to stress corrosion. Therefore, with almost unbuffered feedwater of < 30 µS/cm conductivity, alkalizing with sodium hydroxide is permissible only if the recommended pH range cannot be obtained with sodium phosphate alone. In this case, the pH value will have quick variations with low level of sodium hydroxide.

5 Requirements

5.1 The values for the highest allowable concentrations of a number of impurities and for the maximum and minimum concentrations of chemical agents which are added in order to minimize corrosion, sludge formation and deposits, shall be in accordance with Tables 5-1 and 5-2 and Figures 5-1 and 5-2.

Table 5-1 — Feedwater for steam boilers (except attemperator spray water) and hot water boilers

Parameter	Unit	Feedwater for steam boilers		Make-up water for hot water boilers
Operating pressure	bar (= 0,1 MPa)	> 0,5 to 20	> 20	total range
Appearance	—	clear, free from suspended solids		
Direct conductivity at 25 °C	µS/cm	not specified, only guide values relevant for boiler water see table 5-2		
pH value at 25 °C [a]	—	> 9,2 [b]	> 9,2 [b]	> 7,0
Total hardness (Ca + Mg)	mmol/l	< 0,01 [c]	< 0,01	< 0,05
Iron (Fe) concentration	mg/l	< 0,3	< 0,1	< 0,2
Copper (Cu) concentration	mg/l	< 0,05	< 0,03	< 0,1
Silica (SiO_2) concentration	mg/l	not specified, only guide values for boiler water relevant, see table 5-2		—
Oxygen (O_2) concentration	mg/l	< 0,05 [d]	< 0,02	—
Oil/grease concentration (see EN 12953-6)	mg/l	< 1	< 1	< 1
Organic substances (as TOC) concentration	—	see footnote [e]		

[a] With copper alloys in the system the pH value shall be maintained in the range 8,7 to 9,2.

[b] With softened water pH value > 7,0 the pH value of boiler water according to table 5-2 should be considered.

[c] At operating pressure < 1 bar total hardness max. 0,05 mmol/l shall be acceptable.

[d] Instead of observing this value at intermittent operation or operation without deaerator if film forming agents and/or excess of oxygen scavenger shall be used.

[e] Organic substances are generally a mixture of several different compounds. The composition of such mixtures and the behaviour of their individual components under the conditions of boiler operation are difficult to predict. Organic substances may be decomposed to form carbonic acid or other acidic decomposition products which increase the acid conductivity and cause corrosion or deposits. They also may lead to foaming and/or priming which shall be kept as low as possible.