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Part 12: Requirements for boiler feedwater and boiler water quality

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Water-tube boilers and auxiliary installations - Part 12: Requirements for boiler feedwater and boiler water quality

Chaudières à tubes d'eau et installations auxiliaires - Partite 12: Exigences relatives à la qualité de l'eau d'alimentation et de l'eau en chaudière

Wasserrohrkessel und Anlagenkomponenten - Teil 12: Anforderungen an die Speisewasser- und Kesselwasserqualität

This European Standard was approved by CEN on 24 July 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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Foreword

This document (EN 12952-12:2003) 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of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.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 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 using liquified pressurized ammonia and ammonia water solution.*
- *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.

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 water-tube boilers as defined in EN 12952-1 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 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 12952-1:2001, *Water-tube boilers and auxiliary installations — 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 spectrometric 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 European Standard, the terms and definitions given in EN 12952-1:2001 and the following terms and definitions apply.

3.1
direct conductivity
direct measured conductivity of water

3.2
acid conductivity
conductivity of water, measured in the hydrogenion concentration form continuously flow through downstream of a strongly acidic caution 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 $< 0{,}2\ \mu S/cm$ 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.

Coordinated phosphate treatment can also be beneficial in controlling pH in the boiler water.

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 It is important to realize that the solubility of sodium phosphate decreases with increasing temperatures. This can lead to the precipitation of phosphates from oversaturated solution (hide-out phenomenon). If a boiler exhibits hide-out tendency (PO_4 concentration in the boiler water is lower than to be expected by calculation from injected quantity and concentration factor) only sodium hydroxide should be used as alkalizing agent, or the mode of operation should be changed to "All volatile treatment (AVT)".

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 to 5.3 and figures 5.1 to 5.5.

NOTE In certain cases when demineralized feedwater is used, oxygen may be applied as a conditioning agent to reduce corrosion mainly for once through boiler. This further limits the amount of impurities under normal operation as well as during load cycling.