

# Protection of metallic materials against corrosion — Guidance on the assessment of corrosion likelihood in closed water circulation systems

The European Standard EN 14868:2005 has the status of a British Standard

ICS 77.060

# National foreword

This British Standard is the official English language version of EN 14868:2005.

The UK participation in its preparation was entrusted to Technical Committee ISE/NFE/8, Corrosion of metals and alloys, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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### Summary of pages

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English Version

Protection of metallic materials against corrosion - Guidance on  
the assessment of corrosion likelihood in closed water  
circulation systems

Protection des matériaux métalliques contre la corrosion -  
Recommandations pour l'évaluation du risque de corrosion  
dans les systèmes fermés à recirculation d'eau

Korrosionsschutz metallischer Werkstoffe - Leitfaden für  
die Ermittlung der Korrosionswahrscheinlichkeit in  
geschlossenen Wasser-Zirkulationssystemen

This European Standard was approved by CEN on 8 July 2005.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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## Foreword

This European Standard (EN 14868:2005) has been prepared by Technical Committee CEN/TC 262 “Metallic and other inorganic coatings”, the secretariat of which is held by BSI.

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 2006, and conflicting national standards shall be withdrawn at the latest by February 2006.

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

## Introduction

This European Standard results mainly from investigations into and experience gained on the corrosion of metallic materials normally present in water circulation systems in buildings (unalloyed and low alloyed steels, cast iron, aluminium, copper and copper alloys, stainless steels).

Because of the complex interactions between the various influencing factors, which can alter during service life due either to normal operation changes in service conditions or accidental events, the extent of corrosion can only be expressed in terms of likelihood. This European Standard therefore is a guidance document and does not set explicit rules for the use of metallic materials in water systems.

A correct evaluation of the corrosion likelihood therefore needs a corrosion expert (or at least a person with technical training in the corrosion field) and knowledge of the technology and operating conditions of the system considered.

Though incidences of severe damage because of corrosion (and/or scaling) are generally rare, certain basic precautions should be taken in order to maintain a long-term, trouble-free service. This European Standard should therefore be considered as a guidance document. On the basis of the information provided herein, decisions can be made during design, installation and service life to minimize the likelihood of corrosion damage occurring.

## 1 Scope

This European Standard gives a review of influencing factors on the corrosion likelihood of metallic components (pipes, tanks, vessels, heat exchangers, pumps etc.) in water circulation systems in buildings.

The water circulation systems considered are:

- heating systems (up to 110 °C service water temperature);
- cooling and chilling systems;

which are filled with potable water or water of similar composition according to the Directive 98/83/EC.

NOTE 1 Sanitary hot water systems with a re-circulation loop are not considered in this European Standard as they are not really closed system, because the water is continually renewed. The corrosion likelihood of these systems is discussed in EN 12502 Parts 1 to 5 [1], [2], [3], [4], [5].

NOTE 2 Cooling systems with open atmospheric towers are not considered in this European Standard because fresh water is generally added to the system periodically to compensate for losses by evaporation or blow-down.

NOTE 3 Heating systems in buildings, connected to district heating systems without an intervening heat exchanger, are not considered in this European Standard. However, local heating systems, where several buildings are heated by one boiler plant, are included.

## 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 12502-1:2004 *Protection of metallic materials against corrosion - Guidance on the assessment of corrosion likelihood in water distribution and storage systems - Part 1: General*

EN ISO 8044:1999 *Corrosion of metals and alloys - Basic terms and definitions (ISO 8044:1999)*

## 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 8044:1999, EN 12502-1:2004 and the following apply.

### 3.1

#### **ferrous materials**

cast iron, unalloyed and low alloyed steel (excluding stainless steel)

### 3.2

#### **sludge formation**

build-up of non-adherent particulate corrosion products which can be suspended and/or deposited in the system

### 3.3

#### **scaling**

formation of relatively thick layers of calcium carbonate and/or corrosion products, especially on heat transfer surfaces

## 4 Symbols and abbreviations

|                       |                                                                  |
|-----------------------|------------------------------------------------------------------|
| $c(\text{Cl}^-)$      | Concentration of chloride ions in $\text{mmol l}^{-1}$           |
| $c(\text{HCO}_3^-)$   | Concentration of hydrogen carbonate ions in $\text{mmol l}^{-1}$ |
| $c(\text{SO}_4^{2-})$ | Concentration of sulphate ions in $\text{mmol l}^{-1}$           |
| $c(\text{NO}_3^-)$    | Concentration of nitrate ions in $\text{mmol l}^{-1}$            |

## 5 Types of corrosion

When evaluating the corrosion likelihood in water circulation systems almost all types of corrosion should be taken into consideration.

The following types of corrosion can occur in the systems under consideration:

- uniform corrosion;
- localised corrosion:
  - pitting corrosion;
  - bimetallic corrosion;
  - crevice corrosion;
  - deposit corrosion;
  - water-line corrosion;
  - selective corrosion (de-alloying);
  - erosion corrosion;
  - cavitation corrosion;
  - stress corrosion cracking;
  - microbial corrosion.

These types of corrosion can lead to different kinds of corrosion damage:

- leakage;
- constriction of flow;
- reduction of efficiency;
- boiler noise;
- seizure of movable components and other detrimental effects.