

ICS 77.060
CCS H 25



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 46215-2025

**Corrosion of metals and alloys - Evaluation of selective
corrosion of Cu alloys and grey cast iron for power plant
components by visual inspection and hardness measurement**

金属和合金的腐蚀 用目测法和硬度法对电厂部件铜合金和灰铸铁的选择性腐蚀评价

(English Translation)

Issued on: August 29, 2025

Implemented on: March 1, 2026

Issued by: State Administration for Market Regulation

Table of Contents

Preface
Introduction
1 Scope
2 Normative References
3 Terms and Definitions
4 Principles
5 Program
5.1 Selection of Selectively Corrosion-Sensitive Components and Test Components
5.2 Visual inspection and hardness testing of selective corrosion in alloys
5.3 Visual Inspection Procedure for Selective Corrosion of Alloys
5.4 Alloy Selective Corrosion Hardness Test Procedure
6 Responsibilities
7 Assessment Criteria and Corrective Actions
7.1 Evaluation Criteria
7.2 Corrective measures for unsatisfactory results
Appendix A (Informative) Visual Inspection Data Table for Selective Corrosion of Alloys
Appendix B (Informative) Table 7. Description of Selective Corrosion Damage Zones in Alloys
Appendix C (Informative) Alloy Selective Corrosion Hardness Test Evaluation Table
Appendix D (Informative) Table of Hardness Test Data for Selective Corrosion of Alloys (Example)
Appendix E (Informative) Sample of 10 Case Photos of Selective Corrosion
Reference

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document adopts ISO 17918:2015 "Corrosion of metals and alloys - Visual inspection and hardness testing of copper alloys and ash metals in power plant components".

Evaluation of selective corrosion of cast iron.

This document adds a chapter on "Normative References".

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the China Iron and Steel Association.

This document is under the jurisdiction of the National Steel Standardization Technical Committee (SAC/TC183).

Introduction

Alloys such as brass, bronze, and cast iron can undergo selective corrosion when left in stagnant solutions for extended periods. Materials subjected to selective corrosion may...

Various signs of degeneration may appear, such as localized areas becoming porous (loose and brittle), fading, and discoloration.

This type of corrosion occurs when an alloying element dissolves from the matrix due to a potential difference with other alloying elements.

Common types of selective corrosion include dezincification of brass and graphitization of gray cast iron. Selective corrosion is a slow and difficult-to-detect process.

Once it occurs, it can adversely affect the integrity of components and structures in industrial materials. Therefore, it is necessary to distinguish the symptoms of selective corrosion.

The condition is assessed, and before conducting an engineering assessment, the integrity of components and structures on site that are susceptible to selective corrosion is roughly evaluated.

This document describes components in systems and parts exhibiting selective corrosion susceptibility, made of gray cast iron and brass containing more than 15% zinc.

Visual inspection and hardness testing are used to evaluate corrosion resistance. Susceptible materials, high temperatures, non-flowing conditions, and corrosive environments, such as those rich in zinc, are susceptible.

For brass, acidic solutions and dissolved oxygen are both causes of selective corrosion. Components include pipes, valve bodies, valve covers, pump casings, and heat exchangers.

These components are susceptible to selective corrosion. They may be exposed to raw water, purified water, closed-loop cooling water, groundwater, or contaminated with fuel oil or lubricating oil.

In the water.

The guidelines presented in this document are used to determine whether materials exhibiting selective corrosion can continue to be used or whether an engineering assessment is appropriate.

To allow for a more thorough and accurate examination. The following procedure can be followed to determine the symptoms of selective corrosion and the degree of corrosion degradation.

---Selection of selectively corrosion-sensitive components and test components (sampling);

---Visual inspection of selective corrosion in alloys;

---Alloy selective corrosion hardness test.

This document provides a data table describing and relating to selective corrosion damage to materials obtained through visual inspection.

For example, it also provides historical case reference photos that can be used for comparison with actual damage to materials on site, and also provides options for selective...

Examples of description and evaluation tables for corrosion hardness testing.

Corrosion of metals and alloys is assessed by visual inspection and Hardness test on copper alloys of power plant components and Evaluation of selective corrosion of gray cast iron

1 Scope

This document outlines procedures for on-site testing and assessment to identify components in industrial facilities such as nuclear power plants that are susceptible to selective corrosion.

And the effects on structure caused by material degradation (such as material loss).

This method includes in-situ visual inspection and hardness testing, supplemented by sampling. These procedures include. a) for selectively corrosion-sensitive components.

a) Conduct representative sampling; b) Visual inspection; c) Hardness testing. Additional laboratory testing is recommended for accurate analysis.

This method is particularly suitable for gray cast iron and copper alloys with a zinc content exceeding 15%. If applied to other alloys, verified [certification/testing] is required.

Supporting evidence.

The evaluation criteria for nuclear power plant applications define the procedures for conducting further engineering assessments and taking measures within five years prior to the end of the extended operating period.

The necessity of corresponding measures, such as further sampling, increasing the frequency of inspections, and repairing or replacing components.

This document does not apply to representative components that are in contact with fluid surfaces and cannot be tested by optical means or portable hardness testers.

Similarly, this document does not apply to the selection of non-representative components such as heating, ventilation and air conditioning (HVAC) systems or building service facilities.

For components not used in nuclear power plants, evaluation criteria must be negotiated between the parties. Evaluation criteria relying solely on hardness testing are not applicable to aluminum bronze and nickel-aluminum alloys.

Structural integrity assessment of bronze (NAB) and copper-nickel alloys.

2 Normative references

This document has no normative references.

3 Terms and Definitions

The following terms and definitions apply to this document.

Selective corrosion

Corrosion occurs when certain components do not preferentially dissolve into the medium according to their proportion in the alloy.

Example. Dezincification, graphitization.

Note: The phenomenon where a certain element in the alloy is electrochemically active and sensitive to corrosion leads to the selective removal of this element, while the concentration of other elements relatively increases.

This phenomenon can occur, for example, in alloys such as bronze, brass, and gray cast iron.

[Source. GB/T 10123-2022, 4.19] 3.1.1 dezincification Selective corrosion occurs in brass, where zinc is preferentially lost.

Note: Zinc, with its higher electrochemical activity, preferentially dissolves from copper-zinc alloys with a zinc content (mass fraction) greater than 15%, resulting in the formation of a porous copper layer, which reduces its mechanical properties.

The phenomenon of energy decline.

[Source. GB/T 10123-2022, 4.20, with modifications]