
Korozija kovin in zlitin - Korozija in obraščanje v industrijskih vodnih hladilnih sistemih - 1. del: Smernice za izvajanje vrednotenja pilotne serije aditivov za kontrolo korozije in obraščanja pri odprtih obtočnih hladilnih vodnih sistemih (ISO/DIS 16784-1:2023)

Corrosion of metals and alloys - Corrosion and fouling in industrial cooling water systems - Part 1: Guidelines for conducting pilot-scale evaluation of corrosion and fouling control additives for open recirculating cooling water systems (ISO/DIS 16784-1:2023)

Korrosion von Metallen und Legierungen - Korrosion und Fouling in industriellen Kühlwassersystemen - Teil 1: Leitfaden für die Bewertung von Zusatzstoffen gegen Korrosion und Fouling in offenen Kühlwasserzirkulationssystemen (ISO/DIS 16784-1:2023)

Corrosion des métaux et alliages - Corrosion et entartrage des circuits de refroidissement à eau industriels - Partie 1: Lignes directrices pour l'évaluation pilote des additifs anticorrosion et antitartre pour circuits de refroidissement à eau à recirculation ouverts (ISO/DIS 16784-1:2023)

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Corrosion of metals and alloys — Corrosion and fouling in industrial cooling water systems —

Part 1: Guidelines for conducting pilot-scale evaluation of corrosion and fouling control additives for open recirculating cooling water systems

Corrosion des métaux et alliages — Corrosion et entartrage des circuits de refroidissement à eau industriels —

Partie 1: Lignes directrices pour l'évaluation pilote des additifs anticorrosion et antitartre pour circuits de refroidissement à eau à recirculation ouverts

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 156, Corrosion of metals and alloys.

ISO 16784 consists of the following parts, under the general title Corrosion of metals and alloys — Corrosion and fouling in industrial cooling water systems:

- Part 1: Guidelines for conducting pilot-scale evaluation of corrosion and fouling control additives for open recirculating cooling water systems
- Part 2: Evaluation of the performance of cooling water treatment programmes using a pilot-scale test rig

This second edition cancels and replaces the first edition (ISO 16784-1:2006), which has been technically revised.

The main changes compared to the previous edition are as follows:

- Modified the Introduction
- Modified the Scope
- Modified the Normative references, and added TC156 related standards
- Modified the Terms and definitions, comply with the latest requirements of the ISO/IEC guidelines.
- Modified the content, change "4 Types of testing" to "4 General requirements", adding the latest requirements on environmental protection; Combine [sections 7](#) and [8](#) as "[7](#) Water quality and contamination"; And the content related to new water treatment methods is also added.
- Modified the bibliography.

A list of all parts in the ISO 16784 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Fourteen years have passed since the release of ISO 16784-1:2006. Great changes have taken place in the development environment of global industrial enterprises, and related technologies have further development in the past 14 years. With an increasingly prosperous industry and intensified competition, more stringent environmental pollution requirements, and increasingly scarce of water resource, enterprises have to operate in a safer, more economic and green way. Under the influence of this environment, in many cases, cooling water quality is getting worse than ever, with higher concentration rate, more corrosive and more prone to scaling.

After the publication of previous edition of this document, new cooling water treatment technologies have been greatly developed and widely used gradually; Water pollution caused by additives used in cooling system has attracted public attention, and green environmental protection additives have become a new trend of development; More and more factories need to achieve zero waste water discharge. In this environment, the treatment of cooling water are effective measures to maintain the best operating efficiency, protect the economic life of equipment, suppress corrosion, prevent scaling, microbial pollution and deposition on various heat transfer surfaces.

Taking into account the development of cooling water treatment technology in recent years, the review results of this series of standards over the years and the requirements of the latest ISO/IEC guidelines, this standard has been revised.

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Corrosion of metals and alloys — Corrosion and fouling in industrial cooling water systems —

Part 1: Guidelines for conducting pilot-scale evaluation of corrosion and fouling control additives for open recirculating cooling water systems

1 Scope

This document specifies the general requirements, test unit parameter design, operation parameters, water quality and contamination, parameters to be evaluated in pilot test units, design and operation of pilot test device, etc., to be followed in the pilot test evaluation of corrosion and scaling additives in open circulation cooling water systems.

This part of ISO 16784 covers the criteria that must be defined and implemented in a pilot scale testing programme to select water treatment programmes for use in specific recirculating cooling water systems.

This part of ISO 16784 covers only open recirculating cooling water systems. Closed cooling systems and once through cooling water systems are specifically excluded.

This part of ISO 16784 applies only to systems incorporating shell and tube heat exchangers with standard uncoated smooth tubes and cooling water on the tube side. Heat exchangers with shell side water, plate and frame and/or spiral heat exchangers, and other heat exchange devices are specifically excluded. However, when the test conditions are properly set up to model the surface temperature and shear stress in more complex heat transfer devices, the test results may predict what may occur in an operating heat exchanger of that design.

The test criteria established in this part of ISO 16784 are not intended to govern the type of bench and pilot scale testing normally carried out by water treatment companies as part of their proprietary product development programmes. However, water treatment companies may choose to use the criteria in this part of ISO 16784 as guidelines in the development of their own product development test procedures.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For undated references, only the edition cited applies, For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8044, *Corrosion of metals and alloys — Basic terms and definitions*

ISO 8407, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 11463, *Corrosion of metals and alloys — Evaluation of pitting corrosion*

ISO 11845, *Corrosion of metals and alloys — General principles for corrosion testing*

ISO 16784-2, *Corrosion of metals and alloys — Corrosion and fouling in industrial cooling water systems — Part 2: Evaluation of the performance of cooling water treatment programmes using a pilot-scale test rig*

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ISO 22449-2:2020, *Use of reclaimed water in industrial cooling systems — Part 2: Guidelines for cost analysis*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8044 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 General requirements

4.1 Selection of test methods

4.1.1 Laboratory and off site testing

4.1.1.1 Laboratory testing, or testing at alternative off-site locations, may in some cases be necessary for selecting cooling water chemical treatment programmes. This type of testing could be used for new construction start-up programmes, when operating systems are not available, or for evaluating alternative treatment programmes. In such cases, the evaluation should include site-specific design criteria and environmental regulations that affect the cooling water system. Site-specific water supplies should be used whenever possible. All criteria in this part of ISO 16784 relating to water compositions, water treatment methods (as described in [Annex A](#)), test unit configuration, heat exchanger design, and operating conditions should be followed insofar as possible.

4.1.1.2 No laboratory or off-site testing programme can completely duplicate plant conditions. Site-specific factors, such as process leaks, microbiological growth, corrosion products, airborne contamination, etc., may affect the operation of cooling water systems and the performance of chemical treatment programmes in ways that override the results of laboratory or off-site testing programmes.

4.1.2 On-site testing

Whenever possible, water treatment programmes should be evaluated on site, using plant water supplies and actual design and operating conditions, particularly those that cannot be duplicated in the laboratory.

4.1.3 On-line testing

Whenever possible, all off site, laboratory, and on-site pilot scale testing should be validated by monitoring actual performance results on line. Pilot units can be adapted for on line work by using a side stream from the plant circulating cooling water as feedwater, bypassing the pilot unit cooling tower. Such on line testing serves to validate the off line/laboratory tests. Cooling systems may be evaluated on line; however, the data collected will be the result of the combination of any existing treatment and all additional chemicals that were added for the evaluation period. On line testing in this way can be useful for optimizing the treatment programme to meet specific plant requirements. For example, small quantities of a treatment chemical may be added just ahead of the test heat exchanger to measure the effects of increasing additive dosage, or the possible synergistic effects of a new chemical added to the existing treatment programme.