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Korrosion hos metaller och legeringar – Korrosion och beläggningsbildning i industriella kylsystem – Del 2: Utvärdering av funktionen hos kylvattenbehandlingsprogram med hjälp av provningsutrustning i pilotskala (ISO 16784-2:2006)

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 (ISO 16784-2:2006)

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Europastandarden EN ISO 16784-2:2008 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 16784-2:2008.

ISO 16784-2:2006 finns tidigare utgiven som SS-ISO 16784-2:2006.

The European Standard EN ISO 16784-2:2008 has the status of a Swedish Standard. This document contains the official English version of EN ISO 16784-2:2008.

ISO 16784-2:2006 has been implemented and published as a Swedish Standard with the designation SS-ISO 16784-2:2006.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00.
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Information about the content of the standard is available from the Swedish Standards Institute (SIS), tel +46 8 555 520 00.
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EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN ISO 16784-2

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English Version

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 (ISO 16784-2:2006)

Corrosion des métaux et alliages - Corrosion et entartrage des circuits de refroidissement à eau industriels - Partie 2: Évaluation des performances des programmes de traitement d'eau de refroidissement sur banc d'essai pilote (ISO 16784-2:2006)

Korrosion von Metallen und Legierungen - Korrosion und Fouling in industriellen Kühlwassersystemen - Teil 2: Bewertung der Leistung von Kühlwasser-Behandlungsprogrammen unter Anwendung eines Modell-Prüfstands (ISO 16784-2:2006)

This European Standard was approved by CEN on 21 March 2008.

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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

The text of ISO 16784-2:2006 has been prepared by Technical Committee ISO/TC 156 "Corrosion of metals and alloys" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 16784-2:2008 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 October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

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The text of ISO 16784-2:2006 has been approved by CEN as a EN ISO 16784-2:2008 without any modification.

Introduction

Due to more stringent environmental requirements and escalating costs of water, there is an industrial need to improve the safety, reliability and cost-effectiveness of open recirculating cooling water systems. Correspondingly, it is important to establish a standard framework for evaluating the performance of cooling water treatment programmes. The aim is to provide users of cooling systems and vendors of treatment materials for those systems with a procedure to make consistent evaluations of cooling water treatment programmes on a pilot scale.

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

1 Scope

This part of ISO 16784 applies to corrosion and fouling in industrial cooling water systems

This part of ISO 16784 describes a method for preliminary evaluation of the performance of treatment programmes for open recirculating cooling water systems. It is based primarily on laboratory testing but the heat exchanger testing facility can also be used for on-site evaluation. This part of ISO 16784 does not include heat exchangers with cooling water on the shell-side (i.e. external to the tubes).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 8407:1991, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 8501-1:1988, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 11463:1995, *Corrosion of metals and alloys — Evaluation of pitting corrosion*

3 Terms, abbreviations and definitions

For the purposes of this document, the following terms, abbreviations and definitions apply.

3.1
ATP
adenosine tri-phosphate, an active chemical present in living bacteria

NOTE ATP concentrations can be indirectly measured and are used as an indicator for the presence of biology in cooling water

3.2
blow-down
discharge of water from the cooling water circuit expressed as a discharge rate

3.3
Cfu
colony forming units which are a unit of measure for the amount of bacteria in cooling water

3.4
cooling tower
tower used for evaporative cooling of circulating cooling water, normally constructed of wood, plastic, galvanized metal or ceramic materials

3.5
cooling water treatment
adjustment of cooling water chemistry by which corrosion and fouling can be controlled

3.6
cycles of concentration
ratio of the concentration of specific ions in the circulating cooling water to the concentration of the same ions in the make-up water

3.7
heat rejection capacity
amount of heat that can be rejected by a cooling-tower system

3.8
half-life
time needed to reduce the initial concentration of a non-degradable and/or non-precipitable compound to 50 % of its concentration in the cooling water

3.9
make-up water
total water mass per time unit, which is added to the system to compensate for the loss of water due to evaporation, blow-down, leakage and drift loss

3.10
Reynolds number
dimensionless form, $\frac{LV\rho}{\eta}$ which is proportional to the ratio of inertial force to viscous force in a flow system

where:

L is the characteristic dimension of the flow system, expressed in metres (m)

V is the linear velocity, expressed in metres per second (m/s)

ρ is the fluid density, expressed in kilograms per cubic metre (kg/m^3)

η is the fluid viscosity, expressed in kilograms per metre per second (kg/m/s)

3.11
surface temperature
temperature of the interface between the cooling water film and the heat-transfer surface, whether the surface be the tube wall or the outside of a fouling deposit

3.12
TOC
total organic carbon

3.13
tower fill
portion of a cooling tower, which constitutes its primary heat-transfer surface, over which water flows as evaporation occurs

3.14
wall shear stress
shear stress of the fluid film immediately adjacent to the tube wall

NOTE The wall shear stress is expressed in N/m^2.

3.15
wall temperature
temperature sensed by a thermocouple placed between the heater element and the inside of the heat-transfer tube wall, preferably as close to the tube wall as possible

4 Principle

A test assembly of metallic test tubes is submitted under heat-transfer conditions to the circulation of cooling water for a specified period. This may be connected directly to the cooling water system on-site, to be representative of service conditions. For laboratory testing, the cooling water composition is designed to reflect the chemistry for the service application but modified with the appropriate treatment programme under investigation. The adoption of synthetic chemistry in laboratory tests can be effective for comparative purposes, e.g. screening, but will not be representative of service conditions. The effect of the cooling water circulation and the treatment programme on the corrosion and fouling of the test tubes is assessed using a number of measurement parameters.

5 Reagents and materials

The cooling water composition of the test should reflect the likely service application. For laboratory testing using synthetic water, only reagents of recognized analytical grade and only water complying with the minimum requirements of grade 3 of ISO 3696 shall be used.

There are two main operating environments, which may be adopted. The first is to use the make-up water as used in the specific cooling system on-site (a variation on this is to use synthetic make-up water), and concentrate it to the required number of cycles in the test system. Annex A includes forms recommended for recording test conditions, compositions of make-up and recirculating water, and test results.

The second approach involves using a synthetic water simulating the on-site circulating water for the required number of cycles. The use of synthetic circulating water obviates the need to concentrate the synthetic water to obtain the desired cycles of concentration. This approach simplifies the test by avoiding the use of the pilot cooling tower.

Synthetic circulating water will usually contain a higher level of dissolved ionic solids than corresponding natural water, thus making the synthetic water more corrosive.