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Ships and marine technology — Protective coatings and inspection method —

Part 4:
Automated measuring method for the total amount of water-soluble salts

Navires et technologie maritime — Revêtements de protection et méthode d'inspection —

Partie 4: Méthode de mesure automatisée de la quantité totale de sels solubles dans l'eau

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16145-4 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Ship design*.

ISO 16145 consists of the following parts, under the general title *Ships and marine technology — Protective coatings and inspection method*:

- *Part 1: Dedicated sea water ballast tanks*
- *Part 2: Void spaces of bulk carriers and oil tankers*
- *Part 3: Cargo oil tanks of crude oil tankers*
- *Part 4: Automated measuring method for the total amount of water-soluble salts*

The following part is under preparation:

- *Part 5: Assessment and calculating method for damaged coating areas of ballast tanks*

Introduction

The ISO 16145 series addresses qualified coating and inspection works in accordance with the requirement of IMO PSPC.

Technical Committee ISO/TC 8, *Ships and marine technology*, SC 8, *Ship design,* has decided to standardize a coating and inspection method for the IMO PSPC series.

Coating quality itself depends largely on the surface preparation and coating application. Therefore, the right application of surface preparation and coating in accordance with the coating manufacturer's recommendations, including inspections at each step, are of vital importance.

This part of ISO 16145 is intended to serve as a standard for ship owners, shipyards, coating manufacturers, coating inspectors and coating applicators in applying IMO PSPC in the new building stage.

Ships and marine technology — Protective coatings and inspection method —

Part 4:
Automated measuring method for the total amount of water-soluble salts

1 Scope

This part of ISO 16145 describes the characteristics of an automated measuring method by using a conductivity meter for the assessment of the total surface density of various water-soluble salts on steel surfaces prior to coating applications for dedicated sea water ballast tanks, void spaces of bulk carriers and oil tankers, and cargo oil tanks of crude tankers in compliance with PSPC stipulated by IMO Res. MSC.215(82), IMO Res.MSC.244(83), and IMO Res.MSC.288(87).

This method describes a procedure for rapid evaluation of the surface of steel for the presence of ionic contamination by determining the total concentration of water-soluble ionic contaminants by means of a conductivity test.

This method may be equivalent to ISO 8502-9:1998.

NOTE 1 The individual surface densities of chlorides, sulphates, etc. cannot be determined by this method. This method assesses ionic contaminants only. These represent the greater part of the contamination. The ionic contaminants are thus considered as one single contaminant.

NOTE 2 This method is used as an alternative measurement method for PSPC when demonstrated to comply with NACE SP0508:2010 as described in the footnote of PSPC regarding seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers and cargo oil tanks.

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, *Water for analytical laboratory use — Specification and test methods*

ISO 8502-9:1998, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 9: Field method for the conductometric determination of water-soluble salts*

IMO Res.MSC.215(82), Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers

IMO Res.MSC.244(83), Performance standard for protective coatings for void spaces on bulk carriers and oil tankers

IMO Res.MSC.288(87), Performance standard for protective coatings for cargo oil tanks of crude oil tankers

3 Terms and definitions

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

3.1
conductivity
reciprocal of the electrical resistance measured under specified conditions, between the opposite faces of a unit cube of defined dimensions of an aqueous solution

4 Principle of measurement

A detector that consists of a sampling device and electrodes is fixed onto the steel surface and held in place by some means, like a magnet base or adhesive tape. The water-soluble salts on the substrate surface and within the given detector is dissolved and extracted by a known volume of water.

A conductivity meter measures the conductivity of the extracted solution in the detecting part.

5 General requirements

5.1 Standard solutions

Standard solutions shall be commercially available and ready-made. The concentration of soluble salts shall correspond to a range that is more than 66 % of the full scale of the conductivity meter.

5.2 Composition of detector

The detector shall have a constant area to dissolve salts, a pair of conductivity electrodes, an extraction of salt function, and a temperature sensor.

5.3 Conductivity meter

5.3.1 Measured value shall be compensated to a value at temperature 25 °C.

5.3.2 Measurement range shall cover 0–20 mS/m (0–200 μS/cm) and soluble salt shall be measured up to 300 mg/m^2 in that measurement range. Accuracy should be ± 3 μS/cm max.

5.3.3 Resolution shall be 0,1 mS/m (1 μS/cm) or less.

5.3.4 The conductivity meter shall be calibrated at suitable measurement range by the standard solution specified in 5.1 every twelve months or more frequently if required. Calibration shall be done by the manufacturer or recognized laboratory in accordance with the manufacturer’s instructions.

5.4 Water

Water for measurement and rinsing shall be at least **grade 3** purity in accordance with ISO 3696.

NOTE Distilled or de-ionised water or a proprietary extraction liquid of conductivity 0,5 mS/m (5 μS/cm) or less meets this requirement.

6 Measurement procedure

6.1 General

6.1.1 Accuracy of instruments

The accuracy of instruments should be measured by standard solutions or electrical means according to the manufacturer’s instructions and within the measurement range.

Rinse the cell part of the detector with the water at least twice.

Measure the available standard solution at least twice with water and confirm that the last reading is within ± 5 % of the standard specified value.

Frequency of checking the accuracy shall be in accordance with the manufacturer's instruction.

6.2 Blank test

After rinsing the cell part of the detector at least twice with the water, measure the conductivity of the water and record it as γ_1.

The blank test shall be done before each measurement.

NOTE Each automated meter may differ slightly regarding this step. Depending on the manufacturer, manual recording of γ_1 may not always be necessary. If disposable detectors are used, the blank test is not required.

6.3 General requirements of extraction of salts from the steel surface

6.3.1 Attach the detector to the steel surface where salts are to be extracted and measured.

6.3.2 To extract salts from the steel surface, proceed according to the manufacturer's instructions.

6.3.3 Agitation of the water in the detector to extract salts from the surface shall be carried out for the period of time or by the method specified in the manufacturer's instructions.

NOTE In the case of the flow extraction type, this procedure is not required.

6.4 Conductivity measurement

Measure the conductivity of the water with salts extracted (6.3), and record it as γ_2 expressed in the same units as used in 6.2.

6.5 Cleaning of the detector

After measurement (6.4), the detector shall be emptied and rinsed thoroughly with water before further measurement is carried out. Rinsing shall be repeated at least twice with water to obtain conductivity less than or equal to 0,5 mS/m (5 µS/cm).

NOTE In the case of the disposable type detector, this procedure is not required.

7 Expression of results

7.1 Measurement with direct reading from instrument

The results shall be read directly from the conductivity meter.

Units of measurement of the reading are, e.g. "mS/m" or "µS/cm".

7.2 Calculation results

Calculation results shall be in accordance with ISO 8502-9, Formula (3), as shown below in Formula (1). The derivation of this equation is provided in Clause 7 of ISO 8502-9.

NOTE Total surface density (ρ_A) of the salts is given by Formula (1).

$$\rho_A = \frac{C \times V \times \Delta \cdot \gamma}{A} \qquad (1)$$

$$\Delta \gamma = \gamma_2 - \gamma_1$$

where

C is an empirical constant [5 kg/ ($m^2 \times S$)];

V is the volume of water for extraction (m^3);

A is the area of the surface (m^2);

$\Delta \gamma$ is the change in conductivity (S/m).

Units such as “mg/m^2”or “µg/cm^2” may be required. Instruments may be equipped with a function to display these or other units with automatic calculation.

Bibliography

[1] ISO 8502-6, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 6: Extraction of soluble contaminants for analysis — The Bresle method*

[2] NACE SP0508-2010, *Methods of Validating Equivalence to ISO 8502-9 on Measurement of the Levels of Soluble Salts*

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