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**Corrosion of metals and alloys —
Performance test method for
corrosion inhibitors used in chemical
cleaning of industry equipment**

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Foreword

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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 document 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).

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

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.

Introduction

Corrosion inhibitor can markedly decrease the corrosion rate during metals and alloys chemical cleaning process, but there is no standard for detection the performance of industry equipment chemical cleaning corrosion inhibitor. In the current environment, it is of great practical significance to establish International Standards for the performance evaluation test method of corrosion inhibitor used in industry equipment chemical cleaning process scientifically and perfectly. This document provides a basis for performance detection of corrosion inhibitor used in industry equipment chemical cleaning process and helps prevent potential hazards caused by chemical cleaning.

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Corrosion of metals and alloys — Performance test method for corrosion inhibitors used in chemical cleaning of industry equipment

1 Scope

This document specifies the performance evaluation test method for corrosion inhibitors used in chemical cleaning of industry equipment. It includes instruments, reagents, preparation and pretreatment of the specimen, test conditions, test methods, reports, etc. The performance evaluation test method includes the static or the dynamic test.

This document is applicable to testing the performance of corrosion inhibitors used in chemical cleaning of industry equipment.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 6353-2, *Reagents for chemical analysis — Part 2: Specifications — First series*

ISO 7539-1, *Corrosion of metals and alloys — Stress corrosion testing — Part 1: General guidance on testing procedures*

ISO 7539-5, *Corrosion of metals and alloys — Stress corrosion testing — Part 5: Preparation and use of C-ring specimens*

ISO 11463, *Corrosion of metals and alloys — Guidelines for the evaluation of pitting corrosion*

3 Terms and definitions

3.1

solubility and dispersion

ability that the corrosion inhibitor can form uniform and stable solution or form tiny particles suspended in solution without precipitation in water or cleaning liquid

3.2

time effectiveness

chemical cleaning time within which the corrosion inhibitor can maintain a good corrosion resistance performance in chemical cleaning liquid

4 Apparatus

4.1 Container used in the static test below 100 °C

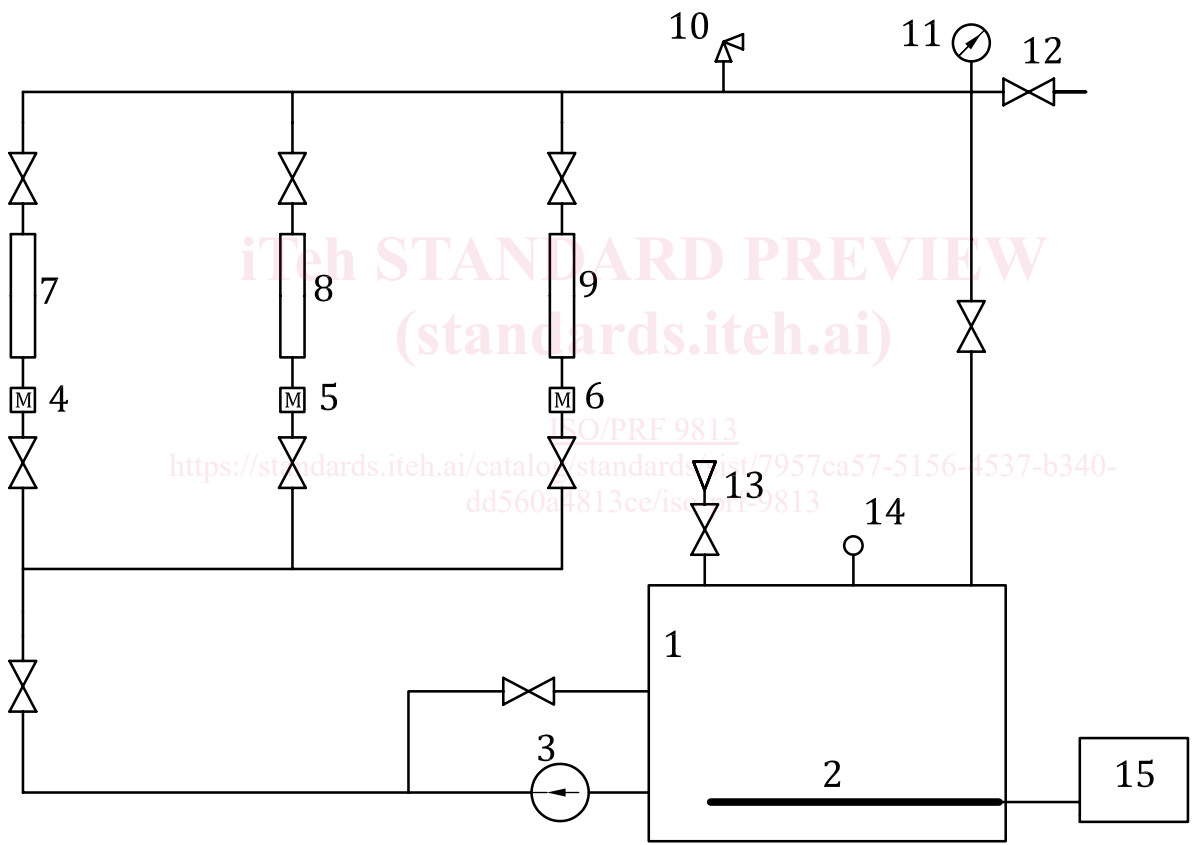
The wide-mouth jar is chosen in the static test below 100 °C. The volume of the wide-mouth jar should not be less than 500 ml. The plastic container should be used to evaluate corrosion inhibitor in hydrofluoric acid medium. A matched reflux cooler shall be equipped to the wide-mouth jar or the plastic container to prevent the solution from evaporation.

4.2 Container used in the static test above 100 °C

The autoclave is chosen in the static test above 100 °C. The volume of autoclave should not be less than 500 ml. The using temperature range of the autoclave is between 100 °C and 200 °C. The using pressure range of the autoclave is between 0,1 MPa and 2,0 MPa.

4.3 Dynamic test device

The diagrammatic sketch of dynamic test device is shown in Figure 1. The specimens can be suspended in the sample tube of dynamic test device. The flow rate in the sample tube, which the specimens are suspended to, can be adjusted and controlled. The flow rate adjustment range is from 0 m/s to 1,0 m/s and the control accuracy is ±5 %. The dynamic test device is capable of heating and controlling temperature. The temperature control accuracy is ±3 °C. If the test temperature is below 100 °C, heat resistant plastics such as polypropylene should be used in the place where the chemical cleaning liquid contact with the device. If the test temperature is above 100 °C, stainless steel should be used in the place where the chemical cleaning liquid contact with the device.



Key

- | | |
|----------------------------|---------------------------|
| 1 cleaning tank | 9 high speed sample tube |
| 2 heater | 10 safety valve |
| 3 pump | 11 pressure gauge |
| 4 flowmeter | 12 exhaust port |
| 5 flowmeter | 13 dosing position |
| 6 flowmeter | 14 thermometer |
| 7 low speed sample tube | 15 temperature controller |
| 8 middle speed sample tube | |

Figure 1 — Diagrammatic sketch of dynamic device

4.4 Specimen suspending device

The material used to suspend the specimen should be made of acid-resistant, heat-resistant and inert insulation material, such as synthetic fibre, etc.

4.5 Constant temperature device

Heating sleeve, heating plate, water bath or oil bath, etc. is used to maintain the solution at the required temperature. The temperature control accuracy is ± 3 °C.

4.6 Oven

The oven shall be capable of controlling temperature more than 120 °C and the precision of temperature controlling should be ± 3 °C.

4.7 Analytical balance

The precision of analytical balance for weighing shall be $\pm 0,1$ mg.

4.8 Vernier caliper

The precision of vernier caliper should be $\pm 0,02$ mm.

4.9 Magnifier

The magnification of the magnifier is 10 ×.

4.10 Colorimetric tube

The volume of colorimetric tube should be 100 ml. The plastic colorimetric tube should be used to evaluate corrosion inhibitor in hydrofluoric acid medium.

4.11 Pipette

The volume of the pipette tube should be 1 ml.

5 Reagents and materials

5.1 Experimental water

The experimental water used shall conform to the specifications in ISO 3696.

5.2 Acetone

The acetone used shall conform to the specifications in ISO 6353-2.

5.3 Ethanol

The ethanol used shall conform to the specifications in ISO 6353-2.

5.4 Abrasive paper

The abrasive paper shall meet the requirements of ISO 8486-1.

6 Test specimens

The material of the specimen shall be the same as the kind of material of the system which the corrosion inhibitor is used. The dimension of the specimens should be 50 mm by 10 mm by 4 mm with two 5 mm diameter mounting hole suitably located at each end of the specimen. Each specimen shall be clearly identified.

7 Pretreatment of specimens

7.1 The specimens shall be free from oil and grease. Prior to use, the surface shall be degreased, with ethanol or acetone. A water-based degreaser can be used as long as it does not leave any residues.

7.2 All sides of specimens shall be polished with at least 120 grid abrasive paper. The grade of the final abrasive paper used should be reported. Each sheet of abrasive paper can grind only one kind of metal material.

7.3 The specimens shall be rinsed with ethanol. Then the specimens shall be rinsed with grade 3 water which conforms to ISO 3696 and dried using a hot air or an oven.

8 Test condition

8.1 Ratio of solution volume to surface area of immersed metal

The ratio of solution volume to surface area of immersed metal shall be no less than 15 ml/cm².

8.2 Concentration of cleaning agent

The mass concentration of cleaning agent shall be the highest concentration which is permit in the cleaning process. The water that conforms to ISO 3696 of grade 3 is recommended to dilute the cleaning agent to the certain concentration.

8.3 Concentration of corrosion inhibitor

The mass concentration of corrosion inhibitor shall be the concentration the manufacturer recommended.

8.4 Temperature

The test temperature shall be the permitted upper limit temperature of the chemical cleaning process.

8.5 Test duration

8.5.1 Corrosion rate evaluation test

The test time of corrosion rate evaluation test is 6 h.

8.5.2 Corrosion inhibition time effectiveness evaluation test

The test time of corrosion inhibition time effectiveness evaluation test is the permitted upper limit time of the chemical cleaning process.