INTERNATIONAL STANDARD

ISO 5156

First edition
2022-12

Corrosion of metals and alloys — Corrosion test method for disinfectant — Total immersion method

Corrosion des métaux et alliages — Méthode d'essai de corrosion pour les désinfectants — Méthode d'immersion totale

Reference number
ISO 5156:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Apparatus **1**
4.1 Test cell 1
4.2 Specimen-supporting device 2
4.3 Analytical balance 2
4.4 Constant-temperature device 2
4.5 Evaporation-preventing device 2
4.6 Digital microscope 2
4.7 Oven 3
4.8 Vernier calliper 3
5 Reagents and materials **3**
6 Test specimens **3**
7 Precleaning of test specimens **3**
8 Conditioning **3**
9 Procedure **4**
10 Test report **5**
Annex A (informative) **Recommended report form** **6**
Bibliography **8**

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*.

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

Disinfecting is one of the most important means of preventing the spread of infectious diseases. In the current environment, it is of great practical significance to establish International Standards for corrosion detection of disinfectants scientifically. This document is intended to provide a basis for corrosion detection of disinfectants and to help prevent potential hazards caused by improper use of disinfectants worldwide.

This document only provides the corrosion test method for disinfectants under the condition of total immersion. Other corrosion test methods are not included in this document. This document does not include the evaluation of corrosion test results.

Corrosion of metals and alloys — Corrosion test method for disinfectant — Total immersion method

1 Scope

This document specifies a method for testing the corrosivity of disinfectants against metals and alloys (for example, apparatus, reagents and materials, test specimens, pre-cleaning of test specimens, conditioning, procedure, test report) under total immersion conditions.

This document is applicable to the determination of corrosion of disinfectants to metal materials under total immersion. Other corrosion test methods are not included in this document, and this document does not include the evaluation of corrosion test results.

This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility for the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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 8044, *Corrosion of metals and alloys — Vocabulary*

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

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

3 Terms and definitions

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

ISO and IEC maintain terminology 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 Apparatus

4.1 Test cell

The containers selected should ensure that the specimens can be put in freely and fully immersed in a vertical way and that the solution is not easy to volatilize during testing. A wide-mouth sealable glass jar or stoppered flask of suitable size is preferred. Suitable precautions should be taken to prevent the containing vessel from exploding. Alternatively, the vessel should be so chosen as to withstand the resulting pressure.

4.2 Specimen-supporting device

A glass or inert plastic supporting system should be designed to keep the specimen fully immersed while ensuring free contact with the solution and isolating the specimens from each other and the wall physically.

4.3 Analytical balance

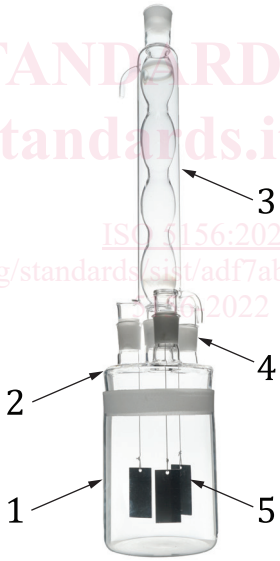
The precision of analytical balance for weighing should be 0,1 mg.

4.4 Constant-temperature device

Any suitable regulated heating device (mantle, hot plate, or bath) may be used to maintain the solution at the required temperature.

4.5 Evaporation-preventing device

For materials containing low boiling point solvents, a means of preventing evaporation losses should be used (e.g. using the test apparatus in Part III, sub-section 37.4 of ST/SG/AC.10/11/Rev.7-2019), as shown in Figure 1.



Key

1 wide-mouth sealable glass jar
2 sealing cover
3 condensing tube
4 suspension hole
5 corrosion test specimens

Figure 1 — Evaporation-preventing device

4.6 Digital microscope

The magnification is 1x to 100x, complementary metal oxide semiconductor (CMOS) effective pixels should be more than 3 million, or superior products. A three-dimensional microscope is preferred.

4.7 Oven

Low temperature explosion-proof, capable of maintaining (38 ± 3) °C to (120 ± 3) °C.

4.8 Vernier calliper

Precision of Vernier calliper should be ±0,02 mm.

5 Reagents and materials

5.1 **Acetone** used should conform to ISO 6353-2.

5.2 **Abrasive paper** that is waterproof (#120 grit) should be used to remove the metal oxide layer. This should meet the requirements of ISO 8486-1. Each sheet of abrasive paper should be used to grind only one kind of metal material.

5.3 **Water** used in all experimental procedures should conform to grade 3 water in ISO 3696.

6 Test specimens

6.1 Take test specimens of a given alloy from the same sheet stock, which should be in new or like-new condition, and measure 50 mm × 25 mm × 2 mm, with a 3 mm diameter mounting hole suitably located at one end of the specimen. Test three replicate specimens in each concentration of maintenance chemical solution in accordance with 8.2.

6.2 All specimens should be polished with abrasive paper.

6.3 Specimens should be clearly marked, for example by stamping with letters or numbers.

6.4 Measure the surface dimension of specimen with a Vernier calliper and calculate the surface area.

7 Precleaning of test specimens

7.1 Immerse the test specimens in a beaker of acetone solution at room temperature and swab the surface of the individual specimen thoroughly using clean forceps to hold the test specimen and the cotton swab.

7.2 Wash any oils or grease which may have arisen from manufacturing from the surface of test specimens, place them in a dryer, drying for 2 h.

7.3 Weigh six of seven specimens of the same alloy to the nearest 0,1 mg.

8 Conditioning

8.1 The metal immersion area ratio to volume of solution should be 10 ml/cm^2. Use fresh solution for each set of replicates.

8.2 Unless otherwise specified, test the specimens in solutions of the disinfectants in:

a) the concentrated as-received condition;

b) at the recommended use dilution, using water that conforms to grade 3 water in ISO 3696.

If the disinfectants are not soluble to the extent noted, record this fact and continue with the test.

8.3 Unless otherwise specified, the test temperature should be (38 ± 3) °C and the oven dry temperature should be (120 ± 3) °C.

9 Procedure

9.1 Three weighed specimens should be immersed in the test solution at the prescribed temperature. Only specimens of the same alloy can be placed in one vessel. Maintain at the required temperature for the prescribed exposure period. The other three weighed specimens of each alloy are treated as reagent blank, in the same process as that of other test specimens except soaking in water that conforms to grade 3 water in ISO 3696 without disinfectants. Keep the last test specimen of each alloy as a reference sample for comparison.

9.2 For common disinfectants, unless otherwise specified, testing time shall be 168 h. Other testing times can optionally be used (e.g. 24 h).

9.3 At the end of the testing time, remove the test specimens.

9.4 Follow with a rinse in water that conforms to grade 3 water in ISO 3696 at room temperature. Rinse with a stream of acetone, conforming to ISO 6353-2, in an ultrasound bath and oven dry, desiccate until cooled to ambient temperature, weigh and record. Then, examine and record the following visible changes in comparison with the last virgin specimen of each alloy on the form as illustrated in Annex A:

a) discoloration and dulling,

b) etching,

c) presence of accretions and relative amounts,

d) pitting,

e) presence of other types of corrosion.

9.5 Remove the corrosion products on the specimens in accordance with the procedure described in ISO 8407. Weigh specimens to nearest 0,1 mg, calculate weight loss or gain. Calculate the corrosion rate according to Formula (1).

$$R = (8{,}76 \times 10^7 \times (m - m_t - m_k))/(S \times T \times D) \quad (1)$$

where

R is the corrosion rate, in mm/year;

m is the mass of the specimen before the experiment, in g;

m_t is the mass of the specimen after the experiment, in g;

m_k is the weight loss value of the reagent blank specimen, in g;

S is the surface area, including both sides and edges, in cm^2;

T is the immersion time, in h;

D is the material density of the specimen, in $kg \cdot m^{-3}$.