SLOVENSKI STANDARD
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Korozijski preskusi v umetni atmosferi pri zelo majhnih koncentracijah škodljivih plinov (ISO/DIS 10062:2022)

Corrosion tests in artificial atmosphere at very low concentrations of polluting gas(es) (ISO/DIS 10062:2022)

Korrosionsprüfungen in künstlicher Atmosphäre mit sehr niedrigen Konzentrationen von Schadgas(en) (ISO/DIS 10062:2022)

Essais de corrosion en atmosphère artificielle à très faible concentration en gaz polluants (ISO/DIS 10062:2022)

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Corrosion tests in artificial atmosphere at very low concentrations of polluting gas(es)

Corrosion des métaux et alliages — Essais de corrosion en atmosphère artificielle à très faible concentration en gaz polluants

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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*.

This third edition cancels and replaces the second edition (ISO 10062:2006), which has been technically revised.

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

- simplified method has been deleted due to safety issues for operator;
- warnings about each gas have been added in 5.1.2:
- installation environment has been added in Annex A.

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

Products with, for example, sensitive electrical functions, may, during storage or operation in indoor locations, be affected by atmospheric corrosion dependent on climatic factors such as temperature, relative humidity, air velocity and rate of change caused by temperature and humidity. Additionally, gaseous pollutants may seriously affect the rate of corrosion, as well as the occurrence of different corrosion mechanisms. Contaminants on the surface, such as salt, dust, oil and compounds liberated from plastics, may also affect the rate and mechanism of corrosion.

Different corrosion-promoting gaseous pollutants dominate in different field environments:

- sulfur dioxide and nitrogen oxides in atmospheres influenced by combustion of fossil fuels and in traffic environments,
- hydrogen sulfide in atmospheres in the vicinity of petrochemical and steel industry, decaying organic matter, stagnant waters and animal shelters, and
- hydrogen sulfide and chlorine compounds in the vicinity of pulp and paper industry; if chlorine is used for bleaching

Those gaseous pollutants are known to act as single corrosion-promoting factors. However, in atmospheres where more than one gaseous pollutant is present, synergistic effects may be initiated. As a result, a considerable increase in the corrosion rate may occur, compared to the case when the different gaseous pollutants act as single corrosion-promoting factors.

This document is intended to

a) define a general method using atmospheres polluted by one or more gases at very low volume fractions $\leq 10^{-6}$ under specified conditions of temperature and relative humidity, so as to avoid condensation phenomena during the test,

b) define the test apparatus and procedure required to achieve the best possible reproducibility,

c) assess performance under test conditions which accelerate corrosion; as knowledge of operating conditions proceeds, more suitable pollutants or pollutant mixtures could be used.

Corrosion tests in artificial atmosphere at very low concentrations of polluting gas(es)

1 Scope

This document specifies tests which are intended to determine the influence of one or more flowing polluting gas(es) at volume fractions less than or equal to 10^{-6} on test samples and/or articles of metals and alloys with or without corrosion protection under determined conditions of temperature and relative humidity.

These tests apply to

a) metals and their alloys,

b) metallic coatings (anodic and cathodic),

c) metals with conversion coatings,

d) metals with anodic oxide coatings,

e) metals with organic coatings.

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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

ISO 558, *Conditioning and testing — Standard atmospheres — Definitions*

ISO 7384, *Corrosion tests in artificial atmosphere — General requirements*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

3.1
exposure time
interval of time elapsed between the moment when the specimens are introduced into the test chamber and the end of the test

3.2
test duration
interval of time during which the specimens are exposed to polluting gases

4 Apparatus

WARNING — Safety rules for personnel: Handling of the gases used for testing can be hazardous and must be done by skilled personnel trained to handle such gases. The test equipment must be used and maintained by skilled personnel, not only so that the tests can be performed correctly, but also because of the hazards to health and safety that are involved.

Special attention shall be paid to equipment design and the choice of construction materials, in order that the conditions (less than ± 1 °C for temperature and less than ± 3 % for relative humidity) are uniformly consistent throughout the working space, able to ensure no condensation in the test chamber, and are repeatable.

The apparatus shall enable the use, singly or in mixtures, of polluting gas(es) such as SO_2, H_2S, Cl_2 and NO_2 up to at least the concentration required, for each gas, by the test method.

The important parameters are

a) the materials used for the test chamber and the gas handling system,

b) the geometry of the test chamber,

c) the rate and pattern of the gas flow,

d) the homogeneity of gas mixing,

e) the incident illumination (see A.1.6)

The apparatus shall be constructed according to Annex A and shall meet its requirements.

A typical apparatus for polluting-gas corrosion tests is also shown in Annex B.

5 Test methods

5.1 Test severity

5.1.1 General

The test severity, to be given in the relevant specification, is defined by

- the type, concentration and flow rate of polluting gas,
- the temperature,
- the relative humidity, and
- the test duration.

5.1.2 Suggested test methods

The method to be used depends upon the purposes of the test, the nature of the metals and alloys and the type of protection to be tested.

WARNING — Sulfur dioxide (SO_2, CAS no. 7446-09-5) is toxic, corrosive and irritating. Refer to Safety Data Sheet for details. Handling of sulfur dioxide shall be restricted to skilled personnel or conducted under their control. The apparatus shall be used and maintained by skilled personnel, not only so that the procedures can be performed correctly, but also because of the hazards to health and safety that are involved.

WARNING — Hydrogen sulfide (H_2S, CAS no. 7783-06-4) is flammable gas, toxic, corrosive, irritating and very toxic to aquatic life. Refer to Safety Data Sheet for details. Handling of hydrogen sulfide shall be restricted to skilled personnel or conducted under their control. The

apparatus shall be used and maintained by skilled personnel, not only so that the procedures can be performed correctly, but also because of the hazards to health and safety that are involved.

WARNING — Chlorine (Cl_2, CAS no. 7782-50-5) is oxidizing gas, toxic, corrosive and irritating. Refer to Safety Data Sheet for details. Handling of chlorine shall be restricted to skilled personnel or conducted under their control. The apparatus shall be used and maintained by skilled personnel, not only so that the procedures can be performed correctly, but also because of the hazards to health and safety that are involved.

WARNING — Nitrogen dioxide (NO_2, CAS no. 10102-44-0) is oxidizing gas, toxic, corrosive and irritating. Refer to Safety Data Sheet for details. Handling of nitrogen oxide shall be restricted to skilled personnel or conducted under their control. The apparatus shall be used and maintained by skilled personnel, not only so that the procedures can be performed correctly, but also because of the hazards to health and safety that are involved.

- **Method A**

Polluting gas	SO_2 at a volume fraction of (0,5 ± 0,1) × 10^{-6}
Temperature and relative humidity	(40 ± 1) °C and (80 ± 5) % or (25 ± 1) °C and (75 ± 3) %

The condition of (40 ± 1) °C and (80 ± 5) % RH is more aggressive than the condition of (25 ± 1) °C and (75 ± 3) % RH. Either of them shall be optionally selected and be stated in the test report.

- **Method B**

Polluting gas	H_2S at a volume fraction of (0,10 ± 0,02) × 10^{-6}
Temperature and relative humidity	(40 ± 1) °C and (80 ± 5) % or (25 ± 1) °C and (75 ± 3) %

The condition of (40 ± 1) °C and (80 ± 5) % RH is more aggressive than the condition of (25 ± 1) °C and (75 ± 3) % RH. Either of them shall be optionally selected and be stated in the test report.

- **Method C**

Polluting gas	Cl_2 at a volume fraction of (0,02 ± 0,005) × 10^{-6}
Temperature and relative humidity	(40 ± 1) °C and (80 ± 5) % or (25 ± 1) °C and (75 ± 3) %

The condition of (40 ± 1) °C and (80 ± 5) % RH is more aggressive than the condition of (25 ± 1) °C and (75 ± 3) % RH. Either of them shall be optionally selected and be stated in the test report.

- **Method D**

Mixture of polluting gases	SO_2 at a volume fraction of (0,5 ± 0,1) × 10^{-6}, and H_2S at a volume fraction of (0,10 ± 0,02) × 10^{-6}
Temperature and relative humidity	(40 ± 1) °C and (80 ± 5) % or (25 ± 1) °C and (75 ± 3) %

The condition of (40 ± 1) °C and (80 ± 5) % RH is more aggressive than the condition of (25 ± 1) °C and (75 ± 3) % RH. Either of them shall be optionally selected and be stated in the test report.

- **Method E**