

# INTERNATIONAL STANDARD

**ISO**  
**10062**

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

**iTeh STANDARD PREVIEW**  
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*Essais de corrosion en atmosphère artificielle à très basse concentration  
de gaz polluant(s)*

ISO 10062:1991

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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.

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.

International Standard ISO 10062 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

It is derived from the work undertaken by IEC Technical Committee IEC/TC 50 B on climatic testing.

This work resulted in the publication of a technical trend document IEC/TD 68-2-60:1990 entitled *Test Ke — Corrosion tests in artificial atmosphere at very low concentrations of polluting gas(es)*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

## Introduction

This International Standard is intended to

- define a general method using atmospheres polluted by one or more gases at very low concentrations [ $\leq 10^{-6}$  (by volume)] under specified conditions of temperature and relative humidity so as to avoid condensation phenomena during the test;
- define the test apparatus and procedure required to achieve the best possible reproducibility;
- assess performance under test conditions which accelerate corrosion; as knowledge of operating conditions proceeds, more suitable pollutants or pollutant mixtures could be used.

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

**WARNING — Safety rules for personnel:** Handling of the gases used for testing can be hazardous and must be left to skilled chemists or conducted under their control.

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.

## 1 Scope

This International Standard specifies tests which are intended to determine the influence of one or more flowing polluting gas(es) at concentrations less than or equal to  $10^{-6}$  (by volume) on coated or uncoated metallic material test pieces and/or articles under determined conditions of temperature and relative humidity.

These tests apply to

- metals and their alloys;
- certain metallic coatings (anodic and cathodic);<sup>1)</sup>
- certain conversion coatings;<sup>1)</sup>
- certain anodic oxide coatings;<sup>1)</sup>
- organic coatings on metallic materials.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications.*

ISO 558:1980, *Conditioning and testing — Standard atmospheres — Definitions.*

ISO 7384:1986, *Corrosion tests in artificial atmosphere — General requirements.*

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

## 3 Apparatus

Special attention shall be paid to equipment design and the choice of construction materials, in order that the conditions (less than  $\pm 1$  °C for temperature and  $\pm 3$  % 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<sub>2</sub>, H<sub>2</sub>S, Cl<sub>2</sub> and NO<sub>2</sub> up to at least the concentration required, for each gas, by the test method.

The important parameters are

- the materials used for the test chamber and the gas handling system;
- the geometry of the test chamber;

1) See annex B.

- the rate and pattern of the gas flow;
- the homogeneity of gas mixing;
- the incident illumination (see A.1.6).

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

## 4 Test methods

### 4.1 Test severity

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

- the type, concentration and flow of polluting gas;
- the temperature;
- the relative humidity;
- the exposure time.

#### 4.1.1 Suggested test methods

##### — Method A

Polluting gas	$\text{SO}_2 = (0,5 \pm 0,1)10^{-6}$ (by volume)
Temperature	$(25 \pm 1)^\circ\text{C}$
Relative humidity	$(75 \pm 3)\%$

##### — Method B

Polluting gas	$\text{H}_2\text{S} = (0,10 \pm 0,02)10^{-6}$ (by volume)
Temperature	$(25 \pm 1)^\circ\text{C}$
Relative humidity	$(75 \pm 3)\%$

##### — Method C

Mixture of polluting (gases)	$\text{SO}_2 = (0,5 \pm 0,1)10^{-6}$ (by volume) $\text{H}_2\text{S} = (0,10 \pm 0,02)10^{-6}$ (by volume)
Temperature	$(25 \pm 1)^\circ\text{C}$
Relative humidity	$(75 \pm 3)\%$

##### — Method D

Mixture of polluting (gases)	$\text{H}_2\text{S} = (0,10 \pm 0,02)10^{-6}$ (by volume) $\text{SO}_2 = (0,20 \pm 0,05)10^{-6}$ (by volume) $\text{Cl}_2 = (0,02 \pm 0,005)10^{-6}$ (by volume)
Temperature	$(25 \pm 1)^\circ\text{C}$
Relative humidity	$(75 \pm 3)\%$

#### NOTES

- 1 Since the corrosivity is different for methods A, B, C and D, the results obtained by these methods are not comparable.
- 2 Other methods may be added in the future as required (e.g. increase in the relative humidity rate).

#### 4.1.2 Test duration

The total period of testing for each test method depends upon the purpose of the test, the nature of the metals and alloys and the means of protection tested.

Recommended periods of exposure are 24 h - 48 h - 96 h - 240 h - 480 h - 720 h and 2 160 h.

#### 4.2 Treatment of the specimens prior to testing (see clause 6)

The relevant specification may require a preconditioning of specimens, for example chemical or mechanical cleaning of surface.

#### 4.3 Examination of the specimens prior to testing

Measurements shall be carried out as required by the relevant specification (see ISO 7384).

#### 4.4 Filling of the test chamber

The filling of the chamber by the specimens shall satisfy the following conditions:

- the total surface, in square centimetres, for thin flat specimens, shall not exceed the critical level at which the concentration of polluting gases would change;
- the specimens shall be placed in the working space, as defined in the relevant specification.

Care shall be taken that the specimens are placed so that they do not come into contact with one another or with the walls of the chamber, and that they do not shield one another from the test atmosphere.

The specimens shall be distributed uniformly in the working space.

## 4.5 Procedure

### 4.5.1 Basis for calculation

**4.5.1.1 Exposure time:** The interval of time elapsed between the moment when the specimens are introduced into the test chamber and the end of the test.

- For the reference method, this corresponds to  $t_3 - t_1$  (see figure 1).
- For the simplified method, this corresponds to  $t_3 - t_2$  (see figure 2).

**4.5.1.2 Test duration:** The interval of time during which the specimens are exposed to polluting gases.

- For the reference method, this corresponds to  $t_3 - t_2$  (see figure 1).
- For the simplified method, this corresponds to  $t_3 - t_5$  (see figure 2).

### 4.5.2 Reference method

The conditions of the specimens and the test chamber shall be such that condensation does not occur on the specimens when they are introduced into the test chamber.

The temperature and relative humidity inside the chamber shall be adjusted according to the specified method (see 4.1.1 and A.1.4).

A waiting period of at least 1 h between temperature adjustments is recommended.

The polluting gas(es) shall be introduced simultaneously into the damp air flow and their concentrations shall be adjusted to the value specified by the test method; during this adjustment, the maximum specified concentrations should not be exceeded (see 4.1).

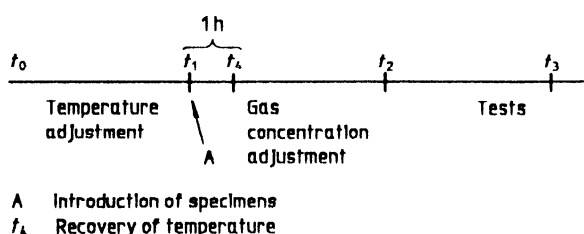


Figure 1 — Reference method

The concentration of polluting gas(es) shall be stabilized in less than 1 h.

The test duration shall be measured as indicated in 4.5.1.

At the end of the test, the injection of polluting gas(es) shall be stopped and the specimens shall be maintained in the flow of the damp atmosphere without polluting gas(es) for 2 h.

### 4.5.3 Simplified method

It is possible to stabilize the conditions within the test chamber and then to introduce the polluting gases quickly so that conditions are not disturbed. Recovery time is then very short: about 1 h.

The test duration shall be measured as indicated in 4.5.1.

At the end of the test, the injection of polluting gas(es) shall be stopped and the specimens shall be maintained in the flow of the damp atmosphere without polluting gas(es) for 2 h.

## 4.6 Monitoring of test behaviour

In order to monitor the chamber performance for each test, appropriate metal control coupons (copper or silver) should be exposed simultaneously with the specimens in the working space of the test chamber, and the corrosive effects on these coupons should be assessed (other examples: copper, silver, nickel, and gold on copper).

NOTE 3 The coupon preparation and method of evaluation are under consideration.

## 4.7 Post test storage

The specimens shall be removed from the chamber and stored under standard conditions as specified in ISO 554 and ISO 558. The reaction of specimens during storage after testing should be considered.

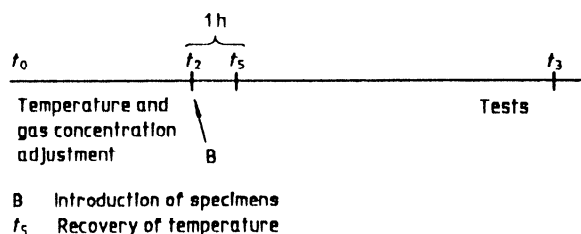


Figure 2 — Simplified method

## 5 Information to be given in the relevant specification

The following information shall be given in the relevant specification:

- a) a reference to this International Standard;
- b) conditions and duration of the test;
- c) treatment of the specimens prior to testing if required;
- d) a report on the examination of the specimens prior to testing;
- e) assessment of corrosion effects and a report on the visual examination during and after testing.

## 6 Expression of results

There are many criteria for the evaluation of the corrosion resistance of metals and alloys with and without corrosion protection, for example:

- a) change in the specimen appearance during the test;
- b) time elapsed before the first local sign of corrosion of base metal or coating appears;
- c) number, depth and distribution of corrosion defects;
- d) change in mass (see ISO 8407);
- e) changes in dimensions (especially thickness);
- f) change in mechanical, electrical, optical, and other properties.

## 7 Test report

The test report shall contain the following information:

- a) the purpose of the test;
- b) a reference to this International Standard and the test method used (A, B, C or D);
- c) designation and description of the test specimens and control coupons, if used (chemical composition, shape and dimensions, method of treatment: chemical, thermal, and mechanical, type of coating and its thickness);
- d) known characteristics of the specimens tested;
- e) exposure period;
- f) duration of the tests;
- g) method of placing and material for fastening the test specimens during the test;
- h) the results of evaluation of corrosion changes for the tested specimen surfaces, including both descriptive and numerical assessment, possibly with photographs of the test specimens;
- i) comparison of control coupons with previous exposures;
- j) the dates of the test.

If the necessary measurements cannot be made within the specified time, the period of storage under recovery conditions may be extended. This extension shall be mentioned in the test report.

Other data may be included in the test report depending on the purpose of the test as well as on the criteria chosen for expressing the results.



## Annex A (normative)

### Specifications for apparatus for corrosion tests in artificial atmospheres

#### A.1 Test chamber

##### A.1.1 Materials

Precautions shall be taken to compensate for

- adsorption and desorption of gases and steam;
- corrosion of the test chamber by the test atmosphere.

This requires that

- the internal walls and parts of the chamber shall be made of inert material [e.g.: glass or polytetrafluoroethylene (PTFE)];
- any window(s) shall be of PTFE or glass;
- pipes, valves and taps in contact with the polluting gas(es) should preferably be made of inert material;
- gaskets and seals shall be made of inert materials (e.g.: fluoro-elastomers).

NOTE 4 Other materials may be used, but adsorption or desorption phenomena should be taken into account.

##### A.1.2 Design

The chamber shall be designed to avoid condensation at any point and to allow easy and thorough cleaning of inner walls and fittings.

The volume of the chamber shall be not less than 0,1 m<sup>3</sup>.

In the working space, the uniformity of the temperature shall be better than  $\pm 1$  °C and the uniformity of the relative humidity shall be better than  $\pm 3$  %.

##### A.1.3 Pressure seals

The test chamber shall be fitted with suitable gas-tight seals to allow the test conditions to be maintained and monitored.

#### A.1.4 Test atmosphere

The flow rate within the chamber shall be controlled. The test atmosphere shall flow through the chamber in such a manner as to ensure uniform test conditions in the working space.

This flow shall be sufficient to ensure at least three changes per hour of the atmosphere in the test chamber.

The test atmosphere is preferably injected through opening(s) in the bottom of the chamber and extracted through opening(s) in the top of the chamber. Suitable baffles shall be placed in front of the opening(s), to assure the required uniform test conditions in the working space.

The test atmosphere extracted from the chamber shall be collected in such a manner as to conform with legal safety standards.

#### A.1.5 Sampling point

Sampling points for the analysis of the atmosphere during the test (see A.3) are placed close to the injection points and the outlet points, in the working space. Checks should be made to ensure that the concentration of polluting gas(es) do(es) not decrease by more than 10 % during the passage through the working space.

Condensation or adsorption in the lines used to monitor the test atmosphere shall be avoided as far as possible, as this would impair the measurements.

#### A.1.6 Illuminance level

The test chamber shall not be exposed to direct sunlight and the level of illumination (due to daylight or to incandescent or fluorescent lamps) measured inside the test chamber at any point on the exposed surface shall not exceed 300 lx.

### A.2 Generation of the test atmosphere

#### A.2.1 General

The test atmosphere is obtained by continuously introducing the necessary quantity of polluting gas(es) into a damp air flow to obtain the required