International Standard 6988

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Metallic and other non-organic coatings — Sulfur dioxide test with general condensation of moisture

Revêtements métalliques et autres revêtements non organiques — Essai au dioxyde de soufre avec condensation générale de l'humidité

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Descriptors : coatings, metal coatings, non organic coatings, tests, corrosion tests, test equipment, sulphur dioxide.

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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Metallic and other non-organic coatings — Sulfur dioxide test with general condensation of moisture

0 Introduction

0.1 Moist air containing sulfur dioxide quickly produces easily visible corrosion of many metals in a form resembling that occurring in industrial environments. It is therefore a test medium well suited to detect pores or other sources of weakness in protective coatings and deficiencies in corrosion resistance associated with unsuitable alloy composition or treatments.

The results obtained in the test should not be regarded as a direct guide to the corrosion resistance of the tested materials in all environments where these materials may be used. Similarly, performances of different materials in the test should not be taken as a direct guide to the relative corrosion resistance of these materials in service.

0.2 The exposure conditions may be varied by either proceeding continuously or in cycles of alternate exposure to the sulfur dioxide-containing atmosphere and to the ambient atmosphere.

0.3 The variant of the test to be used, the test duration, the type of test specimen and the criteria of failure are not specified in this International Standard. Such details are provided in appropriate material and product specifications.

1 Scope and field of application

This International Standard specifies a method for assessing the resistance of materials or products to condensed moisture containing sulfur dioxide.

The method has been found to be suitable for testing metallic and non-organic coatings.

NOTE — For testing paints and varnishes, see ISO 3231, *Paints and varnishes — Determination of resistance to humid atmospheres containing sulphur dioxide.*

2 References

ISO 1462, *Metallic coatings — Coatings other than those anodic to the basis metal — Accelerated corrosion tests — Method for the evaluation of the results.*

ISO 4540, *Metallic coatings — Coatings cathodic to the substrate — Rating of electroplated test specimens subjected to corrosion tests.*

3 Apparatus and material

3.1 Test cabinet, of preferred capacity 300 ± 10 dm^3, with a door capable of being closed hermetically, and fitted with the components specified in 3.2, 3.3 and 3.4. Typical test cabinets are shown in figures 1 and 2.

NOTE — Test cabinets of capacities other than 300 ± 10 dm^3 may be used, provided that the other test conditions to which the test specimens are submitted are the same. The details and instructions given in this International Standard are, however, appropriate to test cabinets of the preferred capacity and will require corresponding modifications for other capacities.

3.1.1 Materials of construction

All the materials used in the construction of the test cabinet shall be resistant to the action of moist sulfur dioxide and shall themselves not emit any gas or vapour likely to influence corrosion of the test specimens.

The floor and lower parts of the walls shall be capable of being heated and shall be able to retain without leakage at least 2,5 dm^3 of water containing dissolved sulfur dioxide, this volume being required to flush the apparatus. Lead-clad construction material is suitable for these parts and for the framework and fittings of the cabinet, but the greater part of the walls and door should be made of transparent sheet, such as glass or suitable plastics material.

A new cabinet shall be operated at least once, without introduction of test specimens, following the procedure applicable to an atmosphere containing 2 dm^3 of sulfur dioxide, before it is brought into use for testing. This should reduce risks of contamination of the atmosphere by vapours from the materials of construction.

3.1.2 Shape

Some variation in the shape of the test cabinet can be tolerated, but the roof should be shaped so that moisture condensing on it does not fall on test specimens in the test cabinet. An inclination of the roof of about 12° to the horizontal provides a suitable safeguard.

3.1.3 Ambient conditions

The test cabinet shall be installed in a room in which there is a clean atmosphere and shall be protected from large or rapid temperature fluctuations, strong direct sunlight and draughts. (See also 6.5.2.)

3.2 Temperature-regulating device, with its actuating element placed in the upper part of the test cabinet, and a thermometer capable of being read from outside the cabinet with its bulb 150 mm from the roof and door and 250 mm from a side.

3.3 Gas inlet tube, through which gas can be introduced into the test cabinet, placed about 50 mm above the base, a valve, by which excess pressure can be relieved, placed in or near the roof of the cabinet, and a drain-cock in the floor of the test cabinet.

3.4 Heating device, capable of heating the test cabinet to 40 ± 3 °C in 1,5 h and of maintaining the interior at this temperature. (See 6.5.) A 1 kW electrically heated hotplate is suitable for the preferred size of test cabinet.

3.5 Source of sulfur dioxide, and means of measuring the volumes of gas required for delivery into the test cabinet. A container of liquid sulfur dioxide is the usual source, but the gas may be generated externally in suitable apparatus from sodium sulfite and sulfuric acid.

The volume of gas delivered into the test cabinet may be measured by any suitable method, for example :

a) by means of a gas burette using viscous liquid paraffin as the pressure-controlling fluid. As the volume to be measured will usually be 0,2 dm^3, measures shall be taken to avoid errors from causes such as air contained in delivery tubes between the burette and the chamber;

b) by means of a gas jar of known volume filled with sulfur dioxide and opened in the chamber;

c) by means of a calibrated flowmeter.

4 Test specimens

4.1 The number, type, shape and dimensions of test specimens, shall be selected according to the specification for the coating or product being tested. When not so specified, details concerning the specimens shall be agreed between the interested parties. (See 5.3.)

4.2 Thoroughly clean the test specimens before testing. The cleaning method employed will depend on the nature of the surface and the contaminants, but shall not include the use of any abrasives or solvents which may attack the surface of the test specimens. Take care that the test specimens are not recontaminated, after cleaning, by excessive or careless handling.

4.3 If test specimens are cut from a larger coated article, the cutting shall be carried out in such a way that the coating is not damaged, especially in the area adjacent to the cut. Unless otherwise specified, the cut edges shall be adequately protected by coating them with a suitable medium, stable under the conditions of the test, such as wax or adhesive tape.

5 Method of exposure of test specimens

5.1 Place the test specimens in the cabinet. The distance between the test specimens shall be not less than 20 mm, the distance between the test specimens and the walls or roof of the test cabinet shall be not less than 100 mm. The distance between the lower edges of the specimens and the surface of the water in the base of the test cabinet shall be not less than 200 mm. The surface area of contact between a test specimen and its holder shall be as small as possible.

5.2 Arrange the test specimens so that any moisture condensing on any of them or on their supports does not fall on to other test specimens placed at lower levels.

5.3 The orientation of the exposed test surface is critical. In the case of flat surfaces, the angle of inclination to the vertical, unless otherwise specified, shall be 15 ± 2 °.

5.4 The total exposed surface area of the test specimen(s) tested at any one time should be substantially the same and, unless otherwise agreed, shall be 0,5 ± 0,1 m^2 for the test cabinet of preferred capacity (see 3.1) and proportionately more or less for different sizes of cabinet.

5.5 The supports for the test specimens shall be of non-metallic material such as glass, plastics material or suitably coated wood. Any material used to suspend the test specimens in the cabinet shall be of synthetic fibre or other inert insulating material; metallic materials shall not be used.

6 Procedure

6.1 Introduce 2 ± 0,2 dm^3 of distilled water, having a conductivity of 500 µS/m or less, into the base of the test cabinet.

NOTE — The quantity of water depends on the size of the test cabinet. A proportional change is valid only for test cabinets of similar shape.

6.2 Place the test specimens in position and close the door of the test cabinet hermetically.

6.3 Introduce 0,2 dm^3 of sulfur dioxide into the test cabinet through the inlet pipe.

6.4 Switch on the heater and raise the temperature inside the test cabinet to 40 ± 3 °C in about 1,5 h. Maintain heating, under control, so as to keep the temperature inside the test cabinet at 40 ± 3 °C for the specified period.

6.5 One test cycle is 24 h, but this may be made up either by continuous exposure of the test specimens inside the test cabinet or by exposure inside the test cabinet for 8 h, followed by exposure to the ambient atmosphere for 16 h. For either form of test, replace the water in the test cabinet and the sulfur dioxide in the test cabinet atmosphere before a 24 h cycle begins.

6.5.1 For a test of continuous exposure in the test cabinet for longer than 24 h, replace the water and sulfur dioxide after each 24 h period of test with minimum disturbance to the test specimens.

6.5.2 For test specimens exposed to ambient conditions for part of the test cycle, the ambient conditions shall be those described in 3.1.3, with a temperature of 23 ± 5 °C and a relative humidity of less than 75 %.

7 Test duration

The test duration shall be as given in the specification for the material or product being tested or as agreed between the purchaser and supplier.

8 Cleaning of specimens after test

At the end of the test period, remove the test specimens from the cabinet. Before they are examined, allow them to hang freely in a normal indoor atmosphere until any liquid corrosion products have solidified. First examine them with all corrosion products in position. Any cleaning carried out shall depend on the criteria laid down for the evaluation of the results of the test.

9 Evaluation of results

Many different criteria for evaluation of the results of the test may be used to meet particular requirements, for example change in mass, alteration revealed by micrographic examination, or change in mechanical properties. The appropriate criteria will usually be indicated in the specification for the material or product tested. For most routine applications of the test, only the following need to be considered :

a) appearance after test;

b) appearance after removing superficial corrosion products;

c) the number and distribution of corrosion defects, i.e. pits, cracks, blisters etc. These may conveniently be assessed by methods such as those described in ISO 1462 or ISO 4540, whichever is appropriate;

d) the time elapsing before the appearance of the first sign of corrosion.

10 Test report

10.1 The test report shall indicate the results of the test according to the specified criteria for evaluation of results. The result obtained for each test specimen and, when appropriate, the average result for a group of replicate test specimens shall be reported. The test report may, if required, be accompanied by photographic records of the test specimens.

10.2 The test report shall contain information about the conduct of the test. This information may vary according to the purposes of the test and to the procedures specified, but a general list of the details likely to be required is as follows :

a) the specification of the basis material;

b) the type and dimensions of the test specimens or a description of the parts;

c) the preparation of the test specimens including any cleaning treatment applied and any protection given to edges or other special areas;

d) the type of coating with an indication of its surface finish;

e) the number of test specimens of each coating or product subjected to the test;

f) the methods, if any, used to clean the test specimens after test, with, when appropriate, an indication of the loss of mass resulting from the cleaning operation;

g) the temperature readings within the exposure zone of the test cabinet;

h) the test duration (see 6.5 and clause 7);

j) the angle of inclination of the test specimens during exposure;

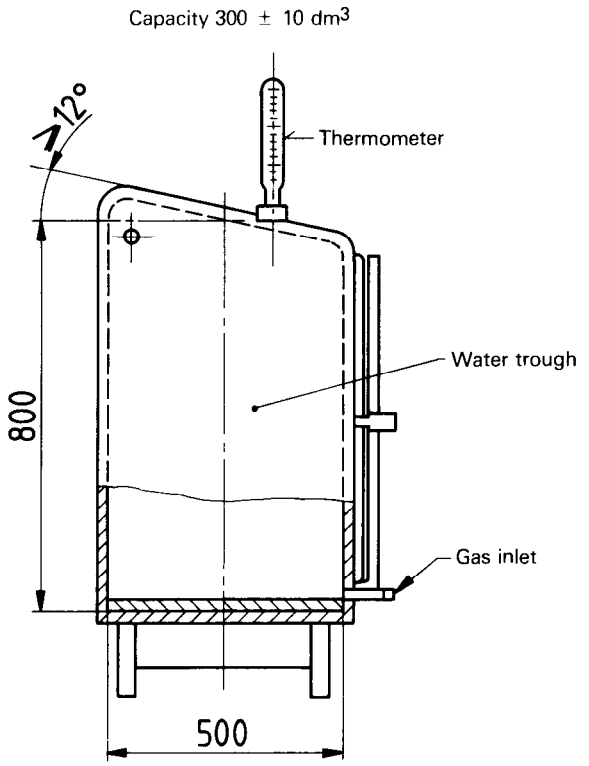
k) the character of any test panels placed in the cabinet expressly to check the correctness of the operating conditions, and the results obtained with them;

m) whether the test was continuous or discontinuous (see 6.5);

n) the concentration of sulfur dioxide used;

p) the results of all inspections.

Dimensions in millimetres



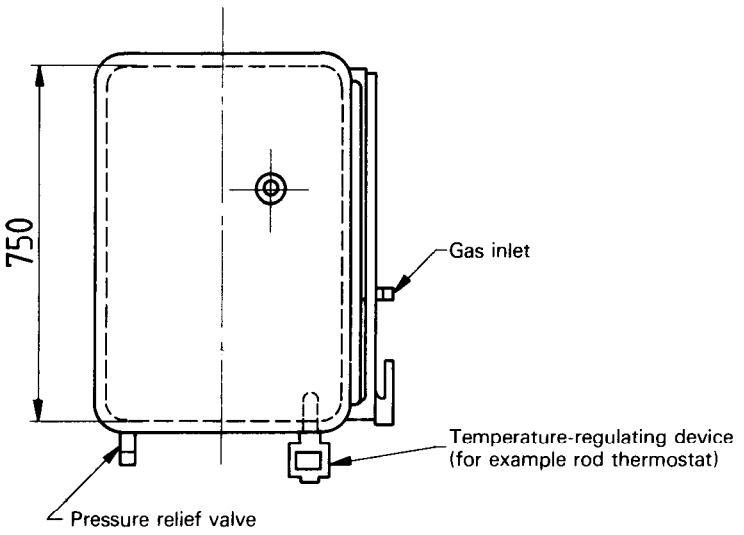
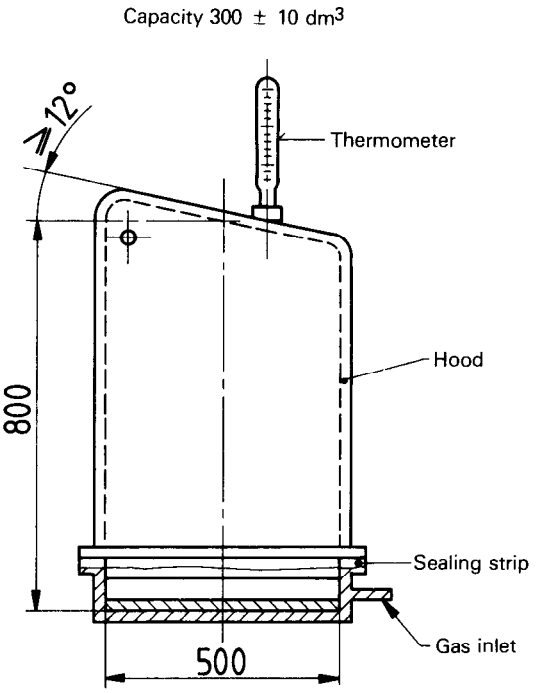


Figure 1 — Cabinet with door



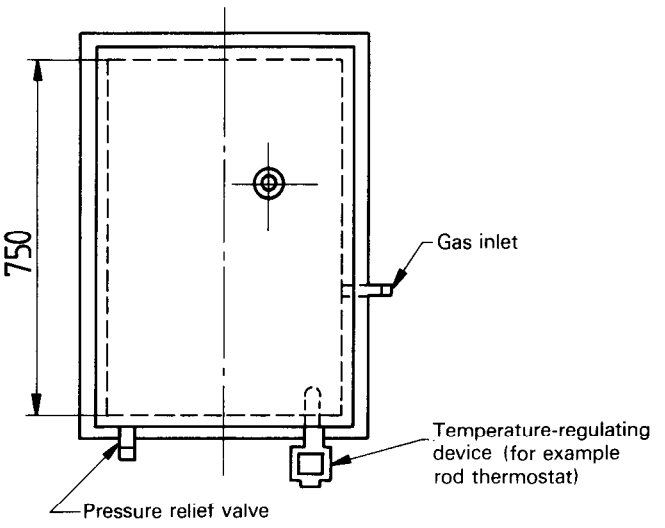


Figure 2 — Hooded apparatus