

INTERNATIONAL
STANDARD

ISO
3231

Second edition
1993-01-15

**Paints and varnishes — Determination of
resistance to humid atmospheres
containing sulfur dioxide**

*Peintures et vernis — Détermination de la résistance aux atmosphères
humides contenant du dioxyde de soufre*



Reference number
ISO 3231:1993(E)

ISO 3231:1993(E)**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 3231 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Sub-Committee SC 9, *General test methods for paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 3231:1974), of which it constitutes an editorial and minor technical revision.

Annex A forms an integral part of this International Standard.

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Paints and varnishes — Determination of resistance to humid atmospheres containing sulfur dioxide

1 Scope

This International Standard is one of a series of standards dealing with the testing of paints, varnishes and related products. This International Standard specifies a procedure for determining the resistance of a single-coat film or a multi-coat system of paints or related products to humid atmospheres containing sulfur dioxide.

The test method allows for different amounts of sulfur dioxide; a volume of 0,2 litre, measured at atmospheric pressure, is generally recommended for testing coatings of thickness not exceeding approximately 40 μm .

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 1512:1991, *Paints and varnishes — Sampling of products in liquid or paste form.*

ISO 1513:1992, *Paints and varnishes — Examination and preparation of samples for testing.*

ISO 1514:1984, *Paints and varnishes — Standard panels for testing.*

ISO 2808:1991, *Paints and varnishes — Determination of film thickness.*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods.*

ISO 4628-2:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 2: Designation of degree of blistering.*

ISO 4628-3:1982, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 3: Designation of degree of rusting.*

3 Principle

A coated test panel is exposed to specified humid atmospheres containing sulfur dioxide and the effects of exposure are evaluated by criteria agreed in advance between the interested parties, these criteria usually being of a subjective nature.

4 Required supplementary information

For any particular application, the test method specified in this International Standard needs to be completed by supplementary information. The items of supplementary information are given in annex A.

5 Reagent

5.1 Sulfur dioxide, either supplied from a gas cylinder or gas-generating device fitted with appropriate regulating and measuring apparatus to ensure the supply of the correct volume of gas, or generated within the cabinet, for example by mixing analytical-grade sodium sulfite, Na_2SO_3 , with an excess of analytical-grade sulfuric acid ($\rho = 1,84 \text{ g/ml}$).

NOTE 1 To obtain 0,2 (or 1,0) litre of sulfur dioxide, use $(1 \pm 0,025) \text{ g}$ [or $(5,25 \pm 0,12) \text{ g}$] of sodium sulfite and at least 0,9 g (or 4,2 g) of sulfuric acid. It is recommended to dissolve the sodium sulfite in 50 ml of water of at least grade 3 as specified in ISO 3696, to dilute the sulfuric acid 1:1 by adding it to the water, to place both reagents in the cabinet, to shut the door or hood and to add the diluted sulfuric acid to the sodium sulfite solution with the aid of a tilting device.

ISO 3231:1993(E)**6 Apparatus**

6.1 Airtight cabinet, of capacity (300 ± 10) litre, in the base of which is a watertight trough, of suitable capacity (see 9.1.1), fitted with a means of heating the water to meet the requirements of 9.3.

The dimensions and design of the airtight cabinet are not critical, provided the requirements of 6.2 are met. It shall be constructed of an inert material and have a roof which prevents condensed water from dripping on to the test panels.

The airtight cabinet shall be provided with a means of relieving excess pressure, and a gas inlet pipe shall be situated immediately above the water surface.

The airtight cabinet shall also be provided with a means of controlling the temperature, which shall be measured in the space above the test panels.

NOTE 2 The apparatus may also be fitted with a door or a removable hood. Suitable designs of apparatus are shown in figures 1 and 2.

6.2 Stand for test panels, made of, or coated with, an inert material. The test panels shall be arranged vertically so that they are at least 100 mm from any wall or cover and at least 20 mm from each other, and so that the lower edges of the panels are at least 200 mm above the water. If possible, the test panels shall be arranged at the same level for comparative tests; if this is not possible, care shall be taken to ensure that water that has condensed on upper panels does not drip on to the lower panels.

The stand shall be of sufficient size to accommodate test panels with a total surface area (all panels together) of $0,5 \text{ m}^2$ (see also 9.1.2).

6.3 Environmental cabinet (optional, see 9.1), capable of being maintained at a temperature of $(23 \pm 5) \text{ }^\circ\text{C}$ and relative humidity of $(50 \pm 20) \%$, also including a stand for test panels.

7 Sampling

Take a representative sample of the product to be tested (or of each product in the case of a multi-coat system), as described in ISO 1512.

Examine and prepare each sample for testing, as described in ISO 1513.

8 Test panels**8.1 Materials and dimensions**

Unless otherwise specified or agreed, the test panels shall be of burnished steel complying with ISO 1514, and of approximate dimensions $150 \text{ mm} \times 100 \text{ mm} \times (0,75 \text{ to } 1,25) \text{ mm}$.

8.2 Preparation and coating

Unless otherwise specified, prepare each test panel in accordance with ISO 1514 and then coat it by the specified method with the product or system under test.

Unless otherwise specified, coat the back and edges of the panel with the product or system under test.

8.3 Drying and conditioning

Dry (or stove) and age (if applicable) each coated test panel for the specified time and under the specified conditions and, unless otherwise specified, condition them at a temperature of $(23 \pm 2) \text{ }^\circ\text{C}$ and a relative humidity of $(50 \pm 5) \%$ for at least 16 h, with free circulation of air and not exposed to direct sunlight. The test procedure shall then be carried out as soon as possible.

8.4 Thickness of coating

Determine the thickness, in micrometres, of the dried coating by one of the procedures specified in ISO 2808.

9 Procedure**9.1 Ambient conditions**

Either set up the airtight cabinet (6.1) in a room with a clean atmosphere and a temperature of $(23 \pm 5) \text{ }^\circ\text{C}$ and relative humidity of $(50 \pm 20) \%$, or have available the environmental cabinet (6.3). Protect the apparatus from draughts and direct sunlight.

9.1.1 Filling the trough

Fill the trough with $(2 \pm 0,2)$ litres of water of at least grade 3 purity as specified in ISO 3696.

Drain and renew the water prior to each heating operation.

9.1.2 Arrangement of the test panels

Arrange the test panels in the airtight cabinet as specified in 6.2.

As the same volume of sulfur dioxide is introduced at each test cycle, the total surface area of the test panels in the airtight cabinet is important and, for comparative tests, the total test panel area in the cabinet should preferably be the same. In cases of dispute or for critical tests, the total surface area of the test panels shall be $(0,5 \pm 0,1) \text{ m}^2$.

For critical applications, the test panels in the airtight cabinet shall be restricted to the type undergoing evaluation for a particular purpose.

NOTE 3 Different types of film absorb sulfur dioxide at different rates and to different extents, so that the operation of the test may be affected by the types of test panel included in the airtight cabinet. For example, the inclusion of oil paints and matt paints containing reactive basic pigments will reduce the severity of the test for other panels.

9.2 Introduction of sulfur dioxide

Close the airtight cabinet and introduce 0,2 litre or 1,0 litre of sulfur dioxide, measured at atmospheric pressure, as specified.

NOTE 4 By agreement, other amounts of sulfur dioxide may be used.

9.3 Test cycle

After the introduction of the sulfur dioxide, switch on the heating appliance and raise the air temperature to $(40 \pm 3) ^\circ\text{C}$, in not more than 1,5 h, and maintain this temperature for a total period of 8 h from the commencement of the test cycle.

At the end of this period, either

- a) switch off the heating appliance and open the door completely or raise the hood of the apparatus to at least the upper edge of the test panels; or
- b) transfer the panels to the environmental cabinet (see 9.1).

After a further 16 h, remove the test panels from the appropriate cabinet and carry out an interim examination.

Replace the panels in the airtight cabinet, change the water and repeat for the specified number of cycles.

Normally, cycles should follow without interruption, but if breaks occur, for example for the weekend, record this fact in the test report.

9.4 Final inspection

At the end of the specified number of test cycles, remove the panels from the appropriate cabinet, blot them with absorbent paper and immediately examine the whole test surface of each panel for blistering in accordance with ISO 4628-2 and corrosion in accordance with ISO 4628-3.

Allow the panels to stand in the open at room temperature for 24 h and examine the test surface again for loss of adhesion, change of colour, embrittlement or other characteristics which may be specified.

If it is required to examine the substrate for signs of attack, remove the coating by the specified method.

10 Precision

Precision data are irrelevant for this International Standard (see clause 3).

11 Test report

The test report shall contain at least the following information:

- a) all details necessary to identify the coating tested;
- b) a reference to this International Standard (ISO 3231);
- c) the items of supplementary information referred to in annex A;
- d) a reference to the international or national standard, product specification or other document supplying the information referred to in c);
- e) the test cycle used (i.e. the volume, measured at atmospheric pressure, of sulfur dioxide) and the number of cycles, and any interruptions;
- f) the results of the test, in terms of the stated requirements;
- g) any deviation from the test procedure specified;
- h) the date of test.

Dimensions in millimetres, unless otherwise indicated

Capacity (300 ± 10) litres

Capacity (300 ± 10) litres

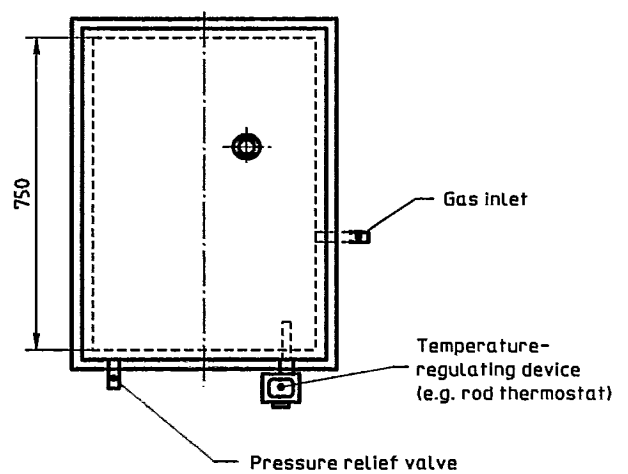
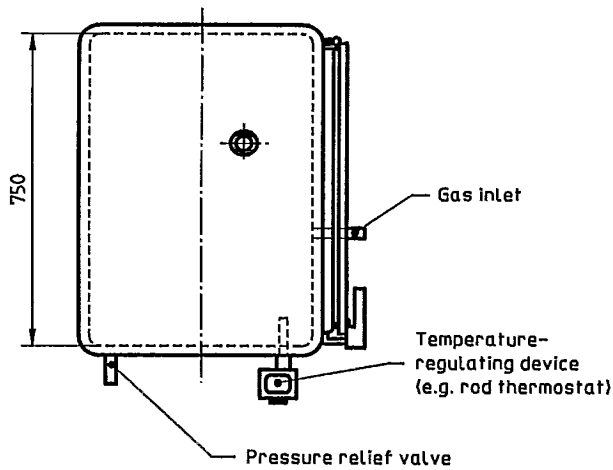
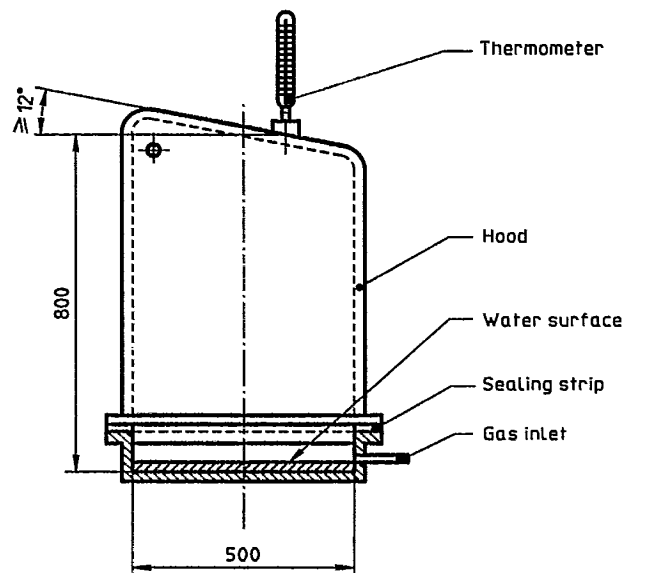
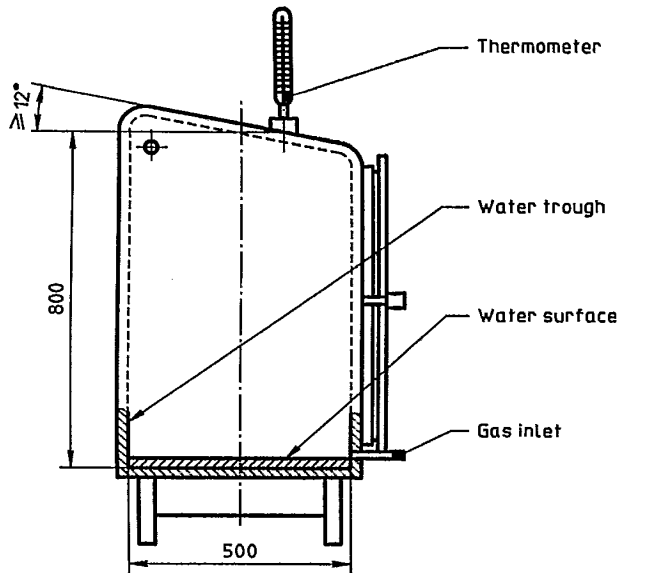


Figure 1 — Airtight cabinet with door

Figure 2 — Airtight cabinet with hood

Annex A

(normative)

Required supplementary information

The items of supplementary information listed in this annex shall be supplied as appropriate to enable the method to be carried out.

The information required should preferably be agreed between the interested parties and may be derived, in part or totally, from an international or national standard or other document related to the product under test.

- a) Material (including thickness) and surface preparation of the substrate (see 8.1 and 8.2).
- b) Method of application of the test coating to the substrate (see 8.2).
- c) Duration and conditions of drying (or stoving) and ageing (if applicable) the coating before testing (see 8.3).
- d) Thickness, in micrometres, of the dry coating and method of measurement in accordance with ISO 2808, and whether it is a single coating or a multi-coat system (see 8.4).
- e) Conditions and duration of the test, including the volume measured at atmospheric pressure of sulfur dioxide to be used (0,2 litre or 1,0 litre or other volumes) (see 9.2 and 9.3).
- f) How inspection of the test coating is to be carried out and the characteristics that are to be considered in evaluating its resistance properties (see 9.4).

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