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Paints and varnishes — Determination of resistance to liquids —

Part 5: Temperature-gradient oven method

Peintures et vernis — Détermination de la résistance aux liquides —

Partie 5: Méthode au four à gradient de température

Reference number
ISO 2812-5:2007(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 2812-5 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

ISO 2812 consists of the following parts, under the general title *Paints and varnishes — Determination of resistance to liquids*:

— *Part 1: Immersion in liquids other than water*

— *Part 2: Water immersion method*

— *Part 3: Method using an absorbent medium*

— *Part 4: Spotting methods*

— *Part 5: Temperature-gradient oven method*

Paints and varnishes — Determination of resistance to liquids —

Part 5: Temperature-gradient oven method

1 Scope

This part of ISO 2812 specifies a method, using a temperature-gradient oven, for determining the resistance of an individual-layer or multi-layer system of coating materials to the effects of liquids or paste-like products.

This method enables the testers to determine the effects of the test substance on the coating and, if necessary, to assess the damage to the substrate.

2 Normative references

The following referenced documents are indispensable for the application 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 1513, *Paints and varnishes — Examination and preparation of samples for testing*

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

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

ISO 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

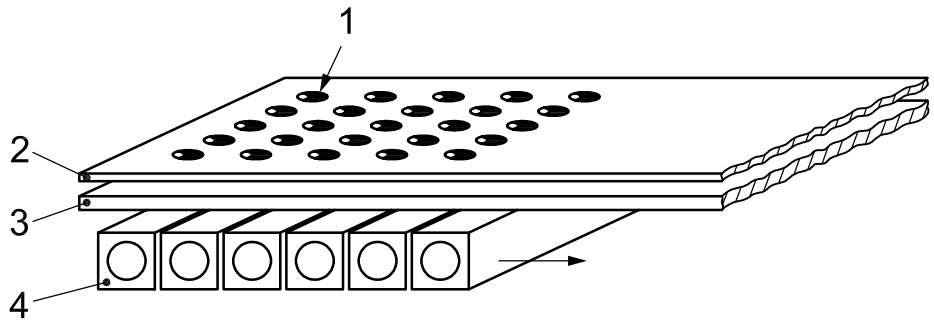
3 Principle

A test substance (see Annex A) is applied to a coated test panel following a specified procedure. The test panel is placed in a gradient oven. The effects of the exposures are assessed in accordance with agreed criteria.

4 Apparatus

Ordinary laboratory equipment and the following apparatus.

4.1 Gradient oven (see Figure 1).



Key

1 test substance
2 test panel
3 special-purpose glass
4 heating elements

Figure 1 — Gradient-oven heating bench

4.2 Metering pipette, suitable for applying droplets of test substance with a volume from 25 µl to 100 µl.

5 Test substances

One or more test substances, as agreed between interested parties, shall be used. Examples of test substances are given in Annex A.

6 Sampling

Take a representative sample of the coating material to be tested, in accordance with ISO 15528.

Pretest each sample in accordance with ISO 1513 and prepare it for further testing (see 7.2).

7 Test panels

7.1 Substrate

Unless otherwise agreed, use steel test panels with dimensions of approximately 560 mm × 100 mm and a thickness of 0,7 mm to 1,0 mm.

7.2 Preparation and coating

Prepare each test panel as described in ISO 1514 and then coat it by the specified application method with the product or system under test. Dry (or stove) and age (if applicable) each coated test panel for the specified time under specified conditions.

7.3 Coating thickness

Determine the dry film thickness of the coating, in micrometres, using one of the non-destructive methods specified in ISO 2808.

8 Procedure

8.1 Conditioning of the test panels

Immediately before testing, condition the test panels for at least 16 h under standard conditions specified in ISO 3270, i.e. (23 ± 2) °C and (50 ± 5) % relative humidity.

8.2 Test conditions

The oven shall be placed in an environment at the standard temperature specified in ISO 3270, i.e. (23 ± 2) °C.

8.3 Determination

Place the test panel horizontally. With the pipette, apply droplets of the liquid test substance (see examples in Annex A) to the test panel, spacing them at a distance corresponding to that between the individual heating segments of the gradient oven, if not otherwise agreed.

Application of the droplets should be carried out at room temperature (18 °C to 28 °C) with the panel placed on a laboratory table and not placed on the gradient oven.

Unless otherwise agreed, set the gradient oven at a gradient from 35 °C to 80 °C. The temperature difference between the individual heating segments shall be 1 °C.

Push the prepared test panel into the gradient oven and press it to the heating bench using a pressing device. Expose the test panel in the gradient oven for 30 min then take it out of the oven.

9 Evaluation

After the test period has expired, wipe the test panel with a smooth cloth. Clean off any dried residue of aqueous test substances under running water, and clean off the dried residue of any other test substances with a solvent that does not attack the coating.

NOTE Dry-cleaning gasoline can be used for eliminating the resin. Dry-cleaning gasoline can also be used for the last cleaning of the panels before evaluation.

Evaluate only the area which has been in direct contact with the test substance.

Then immediately assess the test panel.

If not otherwise agreed, use the following illumination for the assessment: aluminium-coated reflector without raster, light colour at least 840, illuminance on the on the test panel at least 800 lx. The defects are best visible if the reflection of the light source is viewed together with the defect.

Unless otherwise agreed, reassess the exposed areas after 24 h.

Report the result as the temperature showing the first visible change.

10 Precision

10.1 Repeatability limit (r)

The repeatability limit (r) is the value below which the absolute difference between two single test results, each the mean of duplicates, can be expected to lie when this method is used under repeatability conditions. In this case, the test results are obtained on identical material, by one operator in one laboratory within a short interval of time using the standardized test method. In this part of ISO 2812, (r) is 4 °C ($\pm$ 2 °C), with a 95 % probability.

10.2 Reproducibility limit (R)

The reproducibility limit (R) is the value below which the absolute difference between two test results, each the mean of duplicates, can be expected to lie when this test method is used under reproducibility conditions. In this case, the test results are obtained on identical material, by operators in different laboratories using the standardized test method. In this part of ISO 2812, (R) is 8 °C ($\pm$ 4 °C), with a 95 % probability.

11 Test report

The test report shall contain at least the following information:

a) all information necessary for identification of the sample tested, including the manufacturer, trade name, batch number, etc.;

b) a reference to this International Standard (ISO 2812-5:2006);

c) details of the test panels, including:

   1) the material (including thickness) and surface pretreatment of the substrate;

   2) application method for applying the sample coating to the substrate, including the drying time and drying conditions for all layers; where applicable, ageing conditions before the test;

   3) dry film thickness of the coating in micrometres, including the measuring method as chosen in ISO 2808;

d) details of the method used, including the specification of the test substances;

e) the temperature gradient in the oven;

f) the results of the test as specified in Clause 9;

g) the name of the person who conducted the test;

h) any deviations from the procedure specified;

i) any unusual features (anomalies) observed during the test;

j) the date of the test.

Annex A
(informative)

Examples of test substances

Examples of laboratory chemicals and biological substances that can be used as test substances are given in Tables A.1 and A.2. Other test liquids may be used, by agreement between the interested parties.

The identification and/or composition of the products should be specified as given in Tables A.1 and A.2, unless otherwise agreed.

Use only analytical-grade chemicals.

Table A.1 — Laboratory chemicals

Test substance	Differing volumes of droplets (see 8.3)
Sodium hydroxide solution, with a mass fraction of 5 % sodium hydroxide	100 µl
Hydrochloric acid solution, with a mass fraction of 10 % hydrochloric acid	100 µl
Sulfurous acid solution, with a mass fraction of 6 % sulfurous acid	25 µl
Sulfuric acid solution, with a mass fraction of 10 % sulfuric acid	25 µl
Sulfuric acid solution, with a mass fraction of 36 % suluric acid	25 µl
Water, conforming to the requirements of Grade 3 of ISO 3696	100 µl

Table A.2 — Biological substances

Test substance	Comments		Differing volumes of droplets (see 8.3)
Resin	Rosin	50 % (by mass)	25 µl
	pine oil	50 % (by mass)	
Fall-out test substance	e.g. formic acid	47 % (by mass)	25 µl
	tannic acid	24 % (by mass)	
	albumin	5 % (by mass)	
	honey	24 % (by mass)	
Gum arabic	e.g. Acacia gum		25 µl
Rosin			25 µl
Simulated bird droppings	Pancreatin,[a] 1:1 diluted with water conforming to the requirements of Grade 3 of ISO 3696		50 µl

[a] Pancreatin may be ground in a mortar, if agreed between the interested parties. If the pancreatin is ground, this shall be stated in the test report.

Bibliography

[1] ISO 3696, *Water for analytical laboratory use — Specification and test methods*

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