
**Paints and varnishes — Coating
materials and coating systems for
exterior wood — Natural weathering test**

*Peintures et vernis — Produits de peinture et systèmes de peinture
pour bois en extérieur — Essai de vieillissement naturel*

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ISO 16053:2004

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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 16053 was prepared by CEN (European Committee for Standardization) (as EN 927-3) and was adopted, under a special "fast-track procedure", by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

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Paints and varnishes — Coating materials and coating systems for exterior wood — Natural weathering test

1 Scope

This International Standard specifies a natural weathering test for exterior wood coating systems mainly intended for decoration and protection of planed and sawn wood.

The test provides a means of evaluating the performance of a wood coating system during outdoor exposure. It forms the basis for the performance specification given by ENV 927-2.

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

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

ISO 2409, *Paints and varnishes — Cross-cut test*

ISO 2431, *Paints and varnishes — Determination of flow time by use of flow cups*

ISO 2808:1997, *Paints and varnishes — Determination of film thickness*

ISO 2810, *Paints and varnishes — Natural weathering of coatings — Exposure and assessment*

ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°*

ISO 4628-2:2003, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

ISO 4628-4:2003, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

ISO 4628-5:2003, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 5: Assessment of degree of flaking*

ISO 4628-6, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common types of defect — Part 6: Rating of degree of chalking by tape method*

ISO 7724-1, *Paints and varnishes — Colorimetry — Part 1: Principles*

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ISO 7724-2, *Paints and varnishes — Colorimetry — Part 2: Colour measurement*

ISO 7724-3, *Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences*

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

EN 927-1, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 1: Classification and selection*

ENV 927-2, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 2: Performance specification*

3 Principle

The resistance to natural weathering of the coating system under test, applied to a wood substrate, is assessed. Durability is evaluated by determining the changes in decorative and protective properties of coatings after 12 months of exposure.

The standard test substrate has been selected to be *Pinus silvestris* (European redwood or Scots pine, subsequently referred to as pine) in order to obtain relevant results more rapidly. Moreover the sapwood, which is usually present in joinery timber, is used instead of heartwood because paint failure is more evident on the former.

Differences in quality of wood, and in the weather and site conditions, are recognized and allowed for in the method by comparing the test with a reference system. The composition of the reference system (designated the "internal comparison product" or "ICP") is specified in Annex A.

The standard test substrate is pine sapwood with the back side of the panels untreated. However, supplementary information on coating performance may be obtained by conducting optional tests on additional wood species, on pine modified or impregnated by industrial processes, by using a pine panel containing a water trap in its exposed face, or by coating the back side of the panels.

Optional tests are described in Annex F. It is emphasised that they can serve only to provide additional information. The level of performance achieved in the standard test employing a pine panel without water trap constitutes the sole basis of compliance with the requirements of the performance standard ENV 927-2.

4 Apparatus and materials

4.1 Exposure racks, inclined at an angle of 45° to the horizontal, and facing south in accordance with ISO 2810.

4.2 Glossmeter, for the measurement of specular gloss in accordance with ISO 2813, at 60° geometry.

4.3 Tristimulus colorimeter or **spectrophotometer**, for the measurement of colour and calculation of colour difference in CIELAB colour coordinates with illuminant D65 in accordance with ISO 7724-1, ISO 7724-2 and ISO 7724-3.

4.4 Tape and cutting tool, for the assessment of adhesion in accordance with ISO 2409.

4.5 Microscope, with a magnification of ×10 for the assessment of surface defects.

4.6 Microscope, for the measurement of film thickness in accordance with ISO 2808:1997, method 5A.

4.7 Self-adhesive, transparent tape, in accordance with ISO 4628-6, for the assessment of chalking.

5 Sampling

Take a representative sample of the product tested, or of each product in the case of a multi-coat system, as described in ISO 15528.

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

6 Test panels

6.1 Wood

The wood shall be pine that has been selected to be free from knots, cracks and resinous streaks, to be straight-grained and of normal growth rate (i.e. 3 to 8 annual rings per 10 mm). The inclination of the growth rings to the face shall be 0° to 45°.

The wood shall be free from blue stain and evidence of surface or bulk fungal infection. Abnormal porosity (caused by bacterial attack) shall be avoided (see Annex B, Clause B.9).

The wood shall be conditioned at (20 ± 2) °C and a relative humidity of (65 ± 5) % (in accordance with ISO 554) to an equilibrium moisture content of (13 ± 2) %.

6.2 Preparation and selection of wood panels

The panels shall be cut from boards planed all round and shall be nominally (375 ± 2) mm \times (100 ± 2) mm and (20 ± 2) mm thick. For details of panel preparation, see Figure 1. The panels shall be planed to a smooth and uniform finish and shall not be sanded.

The panels shall be selected to give a sapwood test surface on the convex side of the growth rings, with any heartwood confined to a zone not exceeding 12 mm in depth when measured from the rear face. If the presence of heartwood in the selected timber cannot be detected by difference in colour, it shall be checked using the test described in Annex B, Clause B.10.

Any panels showing surface splitting shall be rejected. Where the presence of some minor defects in the test area is unavoidable, their position shall be noted and their influence excluded during assessment of coating performance.

6.3 Preparation of coated panels

6.3.1 Wood conditioning

Prior to coating, condition the panels at (20 ± 2) °C and a relative humidity of (65 ± 5) % until constant mass is reached, in accordance with ISO 554. Keep the panels under the same conditions during drying of the coating system, and during subsequent storage of the panels before exposure. Panels may be transferred for brief periods to other ambient conditions where this is required for the conduct of specific operations or assessments.

6.3.2 Preparation of panels for the test coating

For each system, select four panels on a random basis from the available supply. Three panels shall be used for exposure and the fourth shall be for unexposed reference.

Apply the coating system to the front and side faces of each panel. The back of the panel and the end-grains shall be left uncoated.

Apply the coating system using the method specified by the manufacturer to give a wet film thickness corresponding to the mean value ($\pm 20\%$) of the manufacturer's recommended spreading rate.

Record the quantity of coating applied to each test panel and subsequently calculate a mean value for the four panels. The values should be stated preferably in g/m^2 , but may also be expressed as wet film thickness (in micrometres).

6.3.3 Preparation of panels for the internal comparison product (ICP)

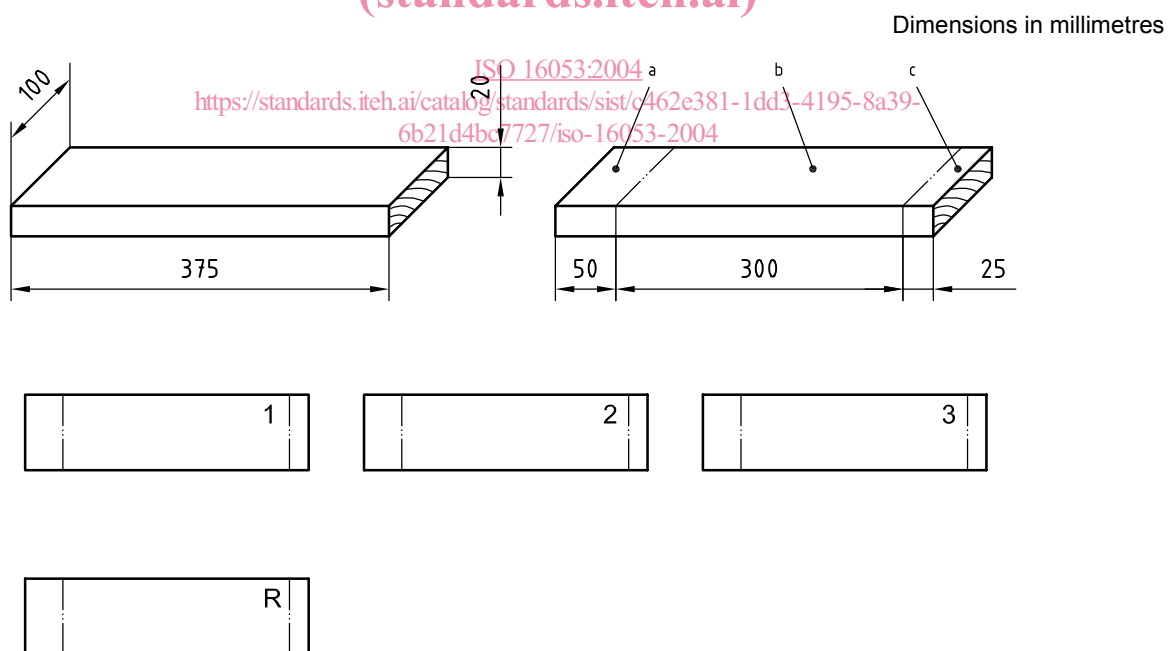
Prepare four panels by applying the ICP to the front and side faces of each panel. The back of the panel and the end-grains shall be left uncoated. Apply the ICP by brushing in three coats, allowing 16 h to 24 h drying between coats. The spreading rate shall correspond to a total of 150 g/m^2 wet film. The dry film thickness shall be $(50 \pm 10) \mu\text{m}$ on pine.

One set of ICP panels may serve as the comparison for one or more test coatings.

6.3.4 Sealing and ageing

When the test coatings and ICP have dried, seal thoroughly the ends of the panels with at least two coats of a flexible, moisture-impermeable white paint, for example of the long-oil alkyd type, capable of withstanding 2 years of natural exposure without breakdown. The sealer may be applied by brushing or dipping. The sealer shall be applied to the bands marked "a" and "c" at the ends of the panel shown in Figure 1. It is important that the sealer is applied all round, i.e. that front, sides, end grains and rear face of the bands are coated.

After sealing, age the panels for approximately 7 days in a controlled environment at $(20 \pm 2)^\circ\text{C}$ and a relative humidity of $(65 \pm 5)\%$ (in accordance with ISO 554), before carrying out initial panel examinations.



- Key**
- 1, 2 and 3 exposure panels
 - R unexposed reference panel
 - a Sealed end (may be used for numbering of test panels).
 - b Section for application of coating system.
 - c Sealed end.

NOTE The figure is not to scale.

Figure 1 — Details of test panels

6.3.5 Thickness of the coating

Determine the dry film thickness of the ICP and the test coating using the unexposed reference panels. Examine one small chip of coated wood removed from each reference panel by microscopy in accordance with ISO 2808:1997, method 5A. Make 10 measurements on each chip and calculate and record the mean value in micrometres.

The thickness is stated in micrometres and is defined as the layer on (or above) the wood surface. Systems may penetrate the wood material to some extent, but this part is not included in the determination.

7 Procedure

Carry out all examinations in accordance with Annexes B and D.

7.1 Examination before exposure

Before exposure, carry out the following measurements:

- mass of coating system applied (by weighing);
- coating thickness (see 6.3.5);
- gloss;
- colour.

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As wood is a natural material, unexpected defects may be detected in the coated panels just before exposure, even though the wood material has been selected, inspected and prepared along the guidelines of 6.1 and 6.2. If such panels, as an exception, are exposed, the type, size and position of the defects shall be noted, so as to avoid any influence on the assessment after exposure.

For further details, see Annexes B and D.

7.2 Exposure

Expose three of the four panels with their long edge horizontal and the 50 mm band to the left of the exposed face, for a period of 12 months, using the exposure racks (4.1). Record the starting and finishing dates.

Store the reference panels indoors at a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %.

7.3 Examination after exposure

7.3.1 Examination on the exposure racks

At the end of the 12-month exposure period, examine the panels on the exposure racks and record any blistering. Remove the panels from the racks to the laboratory and condition for 7 days at a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %.

7.3.2 Laboratory examination of unwashed panels

Assess the panels for the following properties:

- flaking;
- cracking;

- mould growth;
- chalking.

7.3.3 Laboratory examination of washed panels

After the first examinations (7.3.1 and 7.3.2), wash the panels by sponging with clean lukewarm water to remove surface deposits and atmospheric pollutants, and allow to dry.

Examine the coating on the reference and exposed panels for gloss. Also examine the coating on the exposed panels for the following properties:

- mould growth;
- colour;
- adhesion.

8 Expression of results and test report

The test report shall contain at least the following information:

- a) all details necessary to identify the product tested, including name and address of the manufacturer or supplier of the coating system tested, name or other identification details of the coating system tested, including the batch number, a description of the coating system tested, the method and date of application, the coating thickness and the colour;
- b) a reference to this International Standard (ISO 16053:2004);
- c) name and address of the testing laboratory;
- d) exposure site;
- e) identification number of the test report;
- f) name and address of the organization or the person who ordered the test;
- g) method of sampling, date and person responsible for the sampling;
- h) classification of the coating system in accordance with EN 927-1;
- i) date of receipt of the coating system tested;
- j) exposure period (start and finishing dates);
- k) any deviations from the test methods specified;
- l) test results;
- m) date of authorization of the test report.

An example of a suitable form is given in Annex E.

A copy of the test report together with data sheets should be stored to comply with quality assurance requirements.

Annex A (normative)

Internal comparison product (ICP) alkyd stain

Component	Name	Supplier	Remarks	Amount % (by mass)
Alkyd	Synolac® 6005 W	Cray Valley	65 % non volatile matter content	52,82
Pigment, red	Sicoflush® L2817	BASF	40 % pigment in paste ^a	4,63
Pigment, yellow	Sicoflush® L1916	BASF	40 % pigment in paste ^a	2,30
Rheological additive	Bentone® 34	Rheox	10 % premix in white spirit (85 %), and ethanol (5 %)	0,60
Ca drier	Nuodex® Ca 5 %	Servo	5 % calcium, non volatile matter content about 55 %	2,77
Co drier	Nuodex® Co 10 %	Servo	10 % cobalt, non volatile matter content about 75 %	0,37
Zr drier	Nuodex® Zr 12 %	Servo	12 % zirconium, non volatile matter content about 45 %	0,30
Biocide	Preventol® A5	Bayer	Powder (90 % active ingredients)	0,72
HALS ^b	Tinuvin® 292	Ciba-Geigy		0,45
Antiskin	Exkin® 2	Servo	Methyl ethyl ketoxime	0,20
Solvent	Varsol® 40	Exxon		34,84
Total, % (by mass)				100,00
^a Particle size ≤ 10 µm. ^b HALS = Hindered amine light stabilizer (free-radical quencher).				

Before the product is applied, be sure that the following requirements are fulfilled:

Density: 0,90 g/cm³ to 0,91 g/cm³.

Viscosity: 33,5 s, determined with a 4 mm flow cup as specified in ISO 2431, which corresponds to a kinematic viscosity of 39 mm²/s.

Colour: Apply the ICP with a wet film thickness of 90 µm on the non-absorbing side of a Leneta® card. After 24 h of drying, determine the colour as described in Clause B.2. The following values are guidelines for the final colour:

$$L = 56$$

$$a = 42$$

$$b = 52$$

Add the ingredients in the order given and follow good manufacturing practice.

Record the date of manufacture on the containers.

Store in well-sealed containers and use within 2 years of manufacture.