

BS EN 927-3:2012



BSI Standards Publication

Paints and varnishes — Coating materials and coating systems for exterior wood

Part 3: Natural weathering test

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 927-3:2012. It supersedes BS EN 927-3:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee STI/28, Paint systems for non-metallic substrates.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2012. Published by BSI Standards Limited 2012

ISBN 978 0 580 73650 6

ICS 87.040

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2012.

Amendments issued since publication

| Date | Text affected |
|------|---------------|
|------|---------------|

EUROPEAN STANDARD

EN 927-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2012

ICS 87.040

Supersedes EN 927-3:2006

English Version

Paints and varnishes - Coating materials and coating systems for exterior wood - Part 3: Natural weathering test

Peintures et vernis - Produits de peinture et systèmes de
peinture pour bois en extérieur - Partie 3: Essais de
vieillesse naturelle

Beschichtungsstoffe - Beschichtungsstoffe und
Beschichtungssysteme für Holz im Außenbereich - Teil 3:
Freibewitterung

This European Standard was approved by CEN on 9 June 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

| | |
|---|-----------|
| Foreword..... | 4 |
| 1 Scope | 5 |
| 2 Normative references | 5 |
| 3 Principle | 6 |
| 4 Apparatus and materials | 6 |
| 5 Sampling | 6 |
| 6 Test panels | 7 |
| 6.1 Wood | 7 |
| 6.2 Preparation and selection of wood panels | 8 |
| 6.3 Preparation of coated panels | 8 |
| 6.3.1 Wood conditioning | 8 |
| 6.3.2 Preparation of panels for the test coating | 8 |
| 6.3.3 Preparation of panels for the Internal Comparison Product (ICP) | 8 |
| 6.3.4 Sealing and ageing | 8 |
| 6.3.5 Thickness of the coating | 9 |
| 7 Procedure | 10 |
| 7.1 General | 10 |
| 7.2 Examination before exposure | 10 |
| 7.3 Exposure | 10 |
| 7.4 Examination after exposure | 10 |
| 7.4.1 Examination on the exposure racks | 10 |
| 7.4.2 Laboratory examination of unwashed panels | 10 |
| 7.4.3 Laboratory examination of washed panels | 11 |
| 8 Precision data | 11 |
| 9 Expression of results and test report | 11 |
| Annex A (normative) Internal Comparison Product (ICP) alkyd stain | 12 |
| Annex B (normative) Details of test methods | 14 |
| B.1 Gloss and change of gloss | 14 |
| B.2 Colour and colour change | 14 |
| B.3 Blistering | 14 |
| B.4 Flaking | 14 |
| B.5 Mould growth | 14 |
| B.6 Cracking | 15 |
| B.7 Chalking | 15 |
| B.8 General appearance | 15 |
| B.9 Adhesion | 15 |
| B.9.1 General | 15 |
| B.9.2 Apparatus | 15 |
| B.9.3 Procedure | 15 |
| B.10 Test for abnormally porous wood | 16 |
| B.11 Test for heartwood in pine | 16 |
| Annex C (normative) Assessment requirements for panels of test coatings and ICP | 17 |
| Annex D (informative) Suggested format for a test report | 18 |
| Annex E (informative) Optional tests including variations to standard weathering test procedure to obtain additional information on coating performance | 21 |

| | | |
|---------------------|--|-----------|
| E.1 | Principle | 21 |
| E.2 | Tests on alternative wood substrates | 21 |
| E.3 | Tests with water trap | 21 |
| E.3.1 | Apparatus and materials | 21 |
| E.3.2 | Preparation | 22 |
| E.3.3 | Panel assessment | 22 |
| E.4 | Tests with back sealing of the panels | 23 |
| Annex F | (informative) Explanatory notes | 24 |
| F.1 | Natural weathering test | 24 |
| F.2 | Validity of test reports | 24 |
| F.2.1 | System | 24 |
| F.2.2 | Climate and region | 24 |
| Annex G | (informative) Precision data | 25 |
| Bibliography | | 26 |

Foreword

This document (EN 927-3:2012) has been prepared by Technical Committee CEN/TC 139 “Paints and varnishes”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2013, and conflicting national standards shall be withdrawn at the latest by January 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 927-3:2006.

The main technical changes are:

- a) Precision data were added in an informative Annex G;
- b) Using the multi-blade cutting tool for cross-cut test is allowed.

EN 927 consists of the following parts under the general title: *Paints and varnishes — Coating materials and coating systems for exterior wood*:

- *Part 1: Classification and selection;*
- *Part 2: Performance specification;*
- *Part 3: Natural weathering test;*
- *Part 5: Assessment of the liquid water permeability;*
- *Part 6: Exposure of wood coatings to artificial weathering using fluorescent UV lamps and water.*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European 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 in accordance with EN 927-2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 1513, *Paints and varnishes — Examination and preparation of test samples (ISO 1513)*

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

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

EN ISO 2808:2007, *Paints and varnishes — Determination of film thickness (ISO 2808:2007)*

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

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

EN ISO 4628-1:2003, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 1: General introduction and designation system (ISO 4628-1:2003)*

EN ISO 4628-2, *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 4628-2)*

EN ISO 4628-4, *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 4628-4)*

EN ISO 4628-5, *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 4628-5)*

EN ISO 4628-6, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 6: Assessment of degree of chalking by tape method (ISO 4628-6)*

EN ISO 11664-4, *Colorimetry — Part 4: CIE 1976 $L^*a^*b^*$ Colour space (ISO 11664-4)*

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

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

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 selected was *Pinus sylvestris* (European redwood or Scots pine, subsequently referred to as pine) in order to obtain relevant results more rapidly. The sapwood, which is usually present in joinery timber, was chosen for use 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 recognised and allowed for in the method by comparing the test with a reference system. The composition of the reference system (designated as "Internal Comparison Product" or "ICP") is specified in Annex A.

The standard test substrate is pine sapwood with the rear side of 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 rear side of the panels.

Optional tests are described in Annex E. It is emphasised that they can serve only to provide additional information.

4 Apparatus and materials

4.1 Exposure racks, inclined at an angle of 45° to the horizontal, on which the specimens are facing towards the equator in accordance with EN ISO 2810.

4.2 Glossmeter, for the measurement of specular gloss in accordance with EN 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 in accordance with EN ISO 11664-4.

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

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

4.6 Microscope, for measurement of film thickness in accordance with ISO 2808:2007, method 6A.

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

4.8 Climate chamber.

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 EN ISO 15528.

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

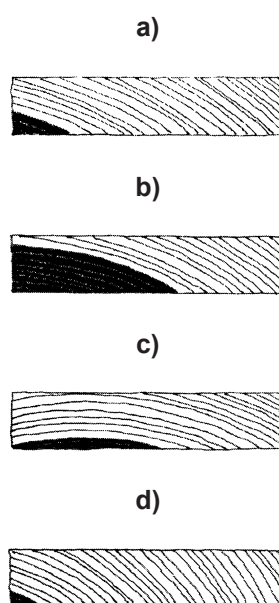
6 Test panels

6.1 Wood

The wood shall be pine that has been selected to be free from knots, cracks and resinous streaks and 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 5° to 45° (see Figure 1).

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.10).

The wood shall be conditioned at $(20 \pm 2)^\circ\text{C}$ and a relative humidity of $(65 \pm 5)\%$ (in accordance with ISO 554) to an equilibrium moisture content of $(13 \pm 2)\%$.



Key

- a) Example of a panel with no heartwood (if present) closer than 10 mm to the test surface fulfilling the requirement for growth ring orientation (5° to 45°) at the front side.
- b) This panel does not meet the specification because the heartwood is too close to the front side.
- c) This panel does not meet the specification because the growth ring orientation is not within the 5° to 45° band. The growth rings incline -10° at the left of the panel and 30° at the right. Consequently a part of the surface contains tangentially cut wood surface (growth ring inclination 0°), with considerable risk of crack formation.
- d) This panel does not meet the specification because the growth ring orientation is not within the 5° to 45° band. The growth rings incline 45° at the left of the panel and 70° at the right.

NOTE The top side of panels is the exposed side; the bottom is the rear face.

Figure 1 — Cross section of panels

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 (78 ± 3) mm and (20 ± 2) mm thick. For details of panel preparation see Figure 2. The panels shall be planed to a smooth and uniform finish. In order to avoid aged wood surface, the panels shall be hand sanded (mesh 150) immediately before coating. Rounding of edges is not permitted.

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 no closer than 10 mm from the front side. Heartwood shall be checked with the reagent described in B.11, at both ends of each panel.

Any panels showing surface splitting shall be rejected. Where the presence of some minor defects in the test area is unavoidable, their position should 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 in accordance with ISO 554. Keep the panels under the same conditions during drying of the coating system and during subsequent storage of test 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 front side of the panel is the side facing the bark of the tree. The back of the panel and 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 (± 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 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 ± 30) g/m^2 wet film. The dry film thickness shall be (50 ± 10) μm on pine.

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

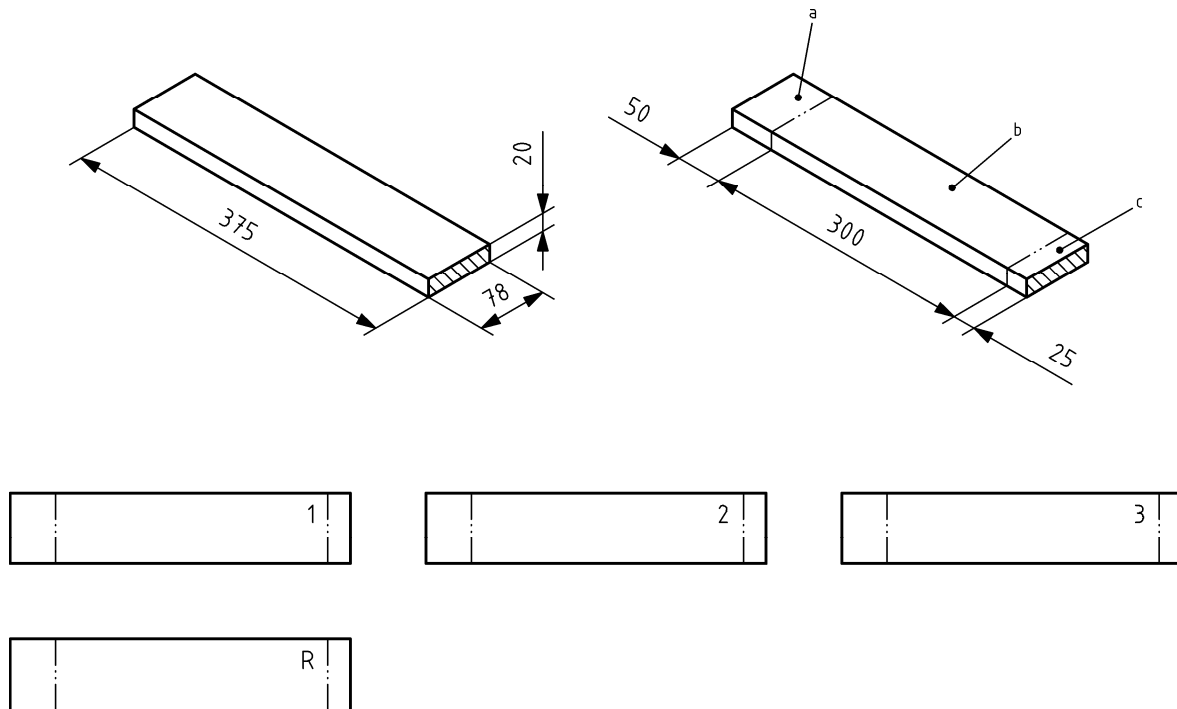
6.3.4 Sealing and ageing

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 long-oil alkyd type, and 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 2. 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 the 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.

Exposure shall start at the latest 28 days after completion of sealing.

Dimensions in millimetres



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 2 — 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 three small chips of coated wood removed from each reference panel by microscopy in accordance with EN ISO 2808:2007, method 6A. The three chips shall be removed at three different places spaced evenly across the panel width. Make five measurements on each of the three chips and calculate and record the mean value in micrometres.

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

7 Procedure

7.1 General

Carry out all examinations in accordance with Annex B and Annex C.

7.2 Examination before exposure

Before exposure, carry out the following measurements on the test panels and the ICP:

- mass of coating system applied (by weighing) (see 6.3.2);
- coating thickness (see 6.3.5);
- gloss;
- colour.

Assess the adhesion on the reference panel for the test coating and the ICP.

As wood is a natural material, unexpected defects can 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 defects shall be noted, so as to avoid any influence on the assessment after exposure.

For further details, see Annex B and Annex C.

7.3 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 ending dates.

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

7.4 Examination after exposure

7.4.1 Examination on the exposure racks

At the end of the 12 months 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) %.

7.4.2 Laboratory examination of unwashed panels

Assess the panels for the following properties:

- flaking;
- cracking;
- mould growth;
- chalking;
- general appearance.

7.4.3 Laboratory examination of washed panels

After the first examinations (7.4.1 and 7.4.2), 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 and colour.

Examine the coating on the exposed panels for mould growth, adhesion and general appearance.

8 Precision data

Further information for precision data is given in Annex G.

9 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 marks of the coating system tested, including the batch number, description of the coating system tested, method and date of application, coating thickness and colour;
- b) reference to this part of EN 927 (EN 927-3);
- c) name and address of the testing laboratory;
- d) exposure site;
- e) identification number of the test report;
- f) name and address of the organisation or the person who ordered the test;
- g) method of sampling, date and person responsible for the sampling;
- h) date of receipt of the coating system tested;
- i) exposure period (start and finishing dates);
- j) any deviations from the test methods specified;
- k) test results (see 7.2, 7.4.2 and 7.4.3);
- l) date of authorisation of the test report;
- m) type of cutting tool used for adhesion measurement (see B 9.2.1).

An example for a suitable form is given in Annex D.

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

Table A.1 — Internal Comparison Product (ICP) alkyd stain

| Component | Name | Supplier | Remarks | Amount % (by mass) |
|----------------------|-------------------|-----------------------|--|-----------------------|
| Alkyd | Synolac™ 6005 WDA | Cray Valley | 70 % non volatile matter content | 49,05 |
| Solvent | Varsol™ 40 | ExxonMobil chemical | | 3,77 |
| 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 | Elementis Specialties | 10 % premix in white spirit (85 %), and ethanol (5 %) | 0,60 |
| Ca drier | Nuodex™ Ca 5 % | Rockwood Pigments | 5 % calcium, non volatile matter content about 55 % | 2,77 |
| Co drier | Nuodex™ Co 10 % | Rockwood Pigments | 10 % cobalt, non volatile matter content about 75 % | 0,37 |
| Zr drier | Nuodex™ Zr 12 % | Rockwood Pigments | 12 % zirconium, non volatile matter content about 45 % | 0,30 |
| Biocide | Preventol™ A5S | Lanxess | Powder (96 % active ingredients) | 0,72 |
| HALS ^b | Tinuvin™ 292 | BASF | | 0,45 |
| Antiskin | Exkin™ 2 | Rockwood Pigments | Methyl ethyl ketoxime | 0,20 |
| Solvent | Varsol™ 40 | ExxonMobil chemical | | 34,84 |
| Total % (by mass) | | | | 100,00 |

^a Particle size ≤ 10 µm.

^b Hindered Amine Light Stabilizer (Free radical quencher).

NOTE ICP receipt is no longer in conformity with VOC directive 1999/13/EC. It only serves to characterise the climatic conditions during exposure and it has no commercial relevance. It has only been retained for continuity until a replacement has been validated.

The following properties and values shall be controlled by the manufacturer.

Density: 0,90 g/cm³ to 0,91 g/cm³

Viscosity: 33,5 s, determined with a 4 mm flow cup as specified in EN 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 B.2. The following values are guidelines for final colour:

$L \approx 56$

$a \approx 42$

$b \approx 52$

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.

Annex B (normative)

Details of test methods

B.1 Gloss and change of gloss

Measure the specular gloss in accordance with EN ISO 2813 using a glossmeter at 60° incident light angle. Determine the value for each area along the grain, i.e. with the light beam parallel to the grain. Obtain three measurements on separate areas along the length of the panel. Displace the glossmeter sidewise and obtain three measurements on adjacent areas with the light beam incident on the panel from the opposite direction. Take the mean of the six measurements obtained.

Calculate the change of gloss of each of the three exposed panels, CG_{ex} and of the unexposed reference panel, CG_{ref} . Calculate the mean of the gloss change of the three exposed panels. State the final result to one decimal place.

B.2 Colour and colour change

Measure the colour in accordance with EN ISO 11664-4 using the measurement geometry 45/0 or $d/8$ with specular component included (sci/spin). The geometry used shall be stated in the test report. Determine the CIE 1976 colour co-ordinates (L^* , a^* , b^*) for the standard illuminant D65 and standard observer 10° for each panel as a mean of 6 single measurements.

Calculate the colour change ΔE_{ab}^* of each of the three exposed panels and of the unexposed reference panel. Calculate the mean of the colour change of the three exposed panels. State the final result to one decimal place.

B.3 Blistering

The assessment for quantity (density) and size is made on each exposed panel separately in accordance with EN ISO 4628-2.

Calculate and record the mean value for quantity and size to one decimal place.

B.4 Flaking

Assessment for quantity (density) and size is made on each exposed panel separately in accordance with EN ISO 4628-5, using a microscope with a magnification of $\times 10$ (see 4.5).

Calculate and record the mean value for quantity and size to one decimal place.

B.5 Mould growth

Assessment is made on each exposed area separately, using a microscope with a magnification of $\times 10$ (see 4.5) in accordance with EN ISO 4628-1.

B.6 Cracking

The assessment for quantity (density) and size is made on each exposed panel separately in accordance with EN ISO 4628-4. Both wood cracks and cracks in the coating are counted.

Calculate and record the mean value for quantity and size to one decimal place.

B.7 Chalking

The assessment is made on each exposed panel separately in accordance with the procedure described in EN ISO 4628-6. Take care to distinguish between chalking and dust.

Calculate and record the mean value to one decimal place.

B.8 General appearance

The assessment is made on each exposed panel separately in accordance with EN ISO 4628-1:2003, Table 3, in comparison to the unexposed reference panels.

Calculate and record the mean value to one decimal place.

B.9 Adhesion

B.9.1 General

The assessment is made on each exposed panel separately in accordance with the procedure described in EN ISO 2409.

B.9.2 Apparatus

B.9.2.1 Cutting tool

Single-blade cutting tool with 20° to 30° edge and other dimensions as specified in EN ISO 2409 or multiblade cutting tool. The single-blade cutting tool is the preferred tool. The type of cutting tool used shall be stated in the test report.

B.9.2.2 Transparent pressure-sensitive adhesive tape

(25 ± 10) mm wide, with a minimum tensile strength of 200 N per 25 mm width and an adhesion of 6 N to 10 N per 25 mm width as specified in EN ISO 2409. The tape shall be stored at (20 ± 2) °C and a relative humidity of (65 ± 5) %.

B.9.3 Procedure

Perform the test twice on each exposed panel, recording individual results without decimals. Calculate and record the mean value for each panel to one decimal place. Calculate and state the mean value for all three panels to one decimal place.

B.10 Test for abnormally porous wood

Abnormally porous wood can be detected qualitatively by the rapid absorption of a drop of propan-2-ol (isopropanol) applied to the surface; the drop should not be absorbed in less than 30 s by normal wood. The test should be carried out at not less than six places, widely separated, on the rear face of the test panel.

B.11 Test for heartwood in pine

Heartwood content shall always be checked on the end grain of both ends of each test panel using a fresh solution of for example Fast Red B salt (5 g/l in deionized water) or Solid Blue Salt B (2 % in deionized water).

NOTE Fast Red B has no reported mutagenic or teratogenic effects. However, it is important to treat it as a suspected carcinogen and make reference to up-to-date, relevant health and safety data sheets.

Annex C
(normative)

Assessment requirements for panels of test coatings and ICP

Table C.1 — Assessment requirements for panels of test coatings and ICP

| Panel designation (Test coatings and ICP) | Exposure panels | | | Unexposed reference panels |
|---|-----------------|---|---|-------------------------------|
| | 1 | 2 | 3 | R |
| Wood species | Pine | | | |
| Inspection^a | | | | |
| Before exposure | | | | |
| a) Spreading rate | x | x | x | x |
| b) Coating thickness | | | | x |
| c) Gloss | x | x | x | x ^b |
| d) Colour | x | x | x | x |
| e) Initial defects | x | x | x | x |
| After exposure | | | | |
| f) Blistering (on site) | x | x | x | x |
| g) General appearance | x | x | x | |
| h) Flaking | x | x | x | x |
| i) Cracking | x | x | x | x |
| j) Chalking | x | x | x | x |
| k) Mould growth | x | x | x | x |
| After exposure and washing | | | | |
| l) General appearance | x | x | x | |
| m) Mould growth | x | x | x | |
| n) Gloss | x | x | x | x ^b |
| o) Colour | x | x | x | x |
| p) Adhesion | x | x | x | x |
| <p>^a The inspections should preferably be carried out in the order indicated, a) to p).</p> <p>^b The gloss measurement is repeated on the unwashed unexposed reference panel at the end of the exposure period (see B.1).</p> | | | | |

Annex D
(informative)

Suggested format for a test report

Exterior wood coating system – Natural weathering test (EN 927-3)

| TEST REPORT | | | | | |
|---|--|-------------------------------------|--------------|-----------------------------|-----------------------------|
| Test system: | | | | | |
| Classification in accordance with EN 927-1: | | | | | |
| Tested on: (Substrate) | | | | | |
| Assignment: (Job No. etc.) | | | | | |
| Tested for: (Client) | | | | | |
| Tested by: (Laboratory) | | | | | |
| Exposure site: | | | | | |
| Starting date: | | | Ending date: | | |
| Coat No. | Manufacturer | Trade name (or sample reference) | Description | Application method and date | Amount applied (mean value) |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| Application interval | | | | | |
| Coat | 1-2 | | | | |
| | 2-3 | | | | |
| | 3-4 | | | | |
| Dry film thickness in μm (see EN 927-3, 6.3.5) | Test system: | | | | |
| Similarly for ICP | ICP: Manufacturer, batch number, production date | | | | |
| Remarks: | | | | | |

Exterior wood coating system – Natural weathering test (EN 927-3)

Result:

| Property Code | Wood species | Evaluation scale test method | Reference panel | Results after 12 months exposure | | | |
|-------------------------------------|--------------|------------------------------|-----------------|----------------------------------|--|--|------------|
| | | | | Individual values | | | Mean value |
| Change of gloss CG | | EN ISO 2813 | | | | | |
| Change in colour ^a DE | | EN ISO 11664-4 | | | | | |
| Blistering ^b BL | | EN ISO 4628-2 | | | | | |
| Flaking ^b FL | | EN ISO 4628-5 | | | | | |
| Cracking ^b CR | | EN ISO 4628-4 | | | | | |
| Chalking CH | | EN ISO 4628-6 | | | | | |
| Mould growth MG | | EN ISO 4628-1 | | | | | |
| Adhesion AD | | EN 927-3, Annex B | | | | | |
| General appearance GA | | EN ISO 4628-1 | | | | | |

^a Measurement geometry: (45/0 or d/8)

^b Only the quantity is considered for the performance specification in EN 927-2.

Exterior wood coating system – Natural weathering test (EN 927-3)

Result:

| Property Code | Wood species | Evaluation scale test method | Reference panel | Results after 12 months exposure | | | |
|-------------------------------------|--------------|------------------------------|-----------------|----------------------------------|--|--|------------|
| | | | | Individual values | | | Mean value |
| Change of gloss CG | | EN ISO 2813 | | | | | |
| Change in colour ^a DE | | EN ISO 11664-4 | | | | | |
| Blistering ^b BL | | EN ISO 4628-2 | | | | | |
| Flaking ^b FL | | EN ISO 4628-5 | | | | | |
| Cracking ^b CR | | EN ISO 4628-4 | | | | | |
| Chalking CH | | EN ISO 4628-6 | | | | | |
| Mould growth MG | | EN ISO 4628-1 | | | | | |
| Adhesion AD | | EN 927-3, Annex B | | | | | |
| General appearance GA | | EN ISO 4628-1 | | | | | |

^a Measurement geometry: (45/0 or d/8)

^b Only the quantity is considered for the performance specification in EN 927-2.

Conclusion:

Signature:

Date:

The result of this test is only to be stated in full; extracts may only be published with the written permission from the testing laboratory.

Enclosed:

- Results in detail
- Photographs (optional)

Annex E (informative)

Optional tests including variations to standard weathering test procedure to obtain additional information on coating performance

E.1 Principle

The standard weathering test described in earlier clauses of this standard specifies that the test be conducted on a flat panel of pine with a planed surface.

This Annex describes variations to the standard test procedure which provide the means of obtaining additional information on coating performance through the use of alternative wood substrates, and also through the inclusion of a water trap in the exposed panel surface, which for some weathering characteristics might pose an additional challenge to the coated wood. The modified test panel is intended to simulate coating performance on wood components which might be at risk from water entry. From experiences in the past in different European countries, the presence of the water trap served to obtain test results on wood cracking, flaking, blistering and mould growth in a reasonable time period (12 months) compared to panels tested without water traps.

NOTE It is emphasised that these optional tests serve only to provide additional information. The level of performance achieved in the standard test employing a pine panel without back sealing and water trap constitutes the sole basis of compliance with the requirements of the performance standard.

E.2 Tests on alternative wood substrates

When information on specific wood substrates is required, the following tests may be carried out:

- alternative wood species, for example spruce (*Picea abies*) or tropical hardwoods;
- panels with a sawn finish;
- pine modified or impregnated by industrial processes.

E.3 Tests with water trap¹⁾

E.3.1 Apparatus and materials

In addition to the apparatus and materials listed in Clause 4, the following is needed:

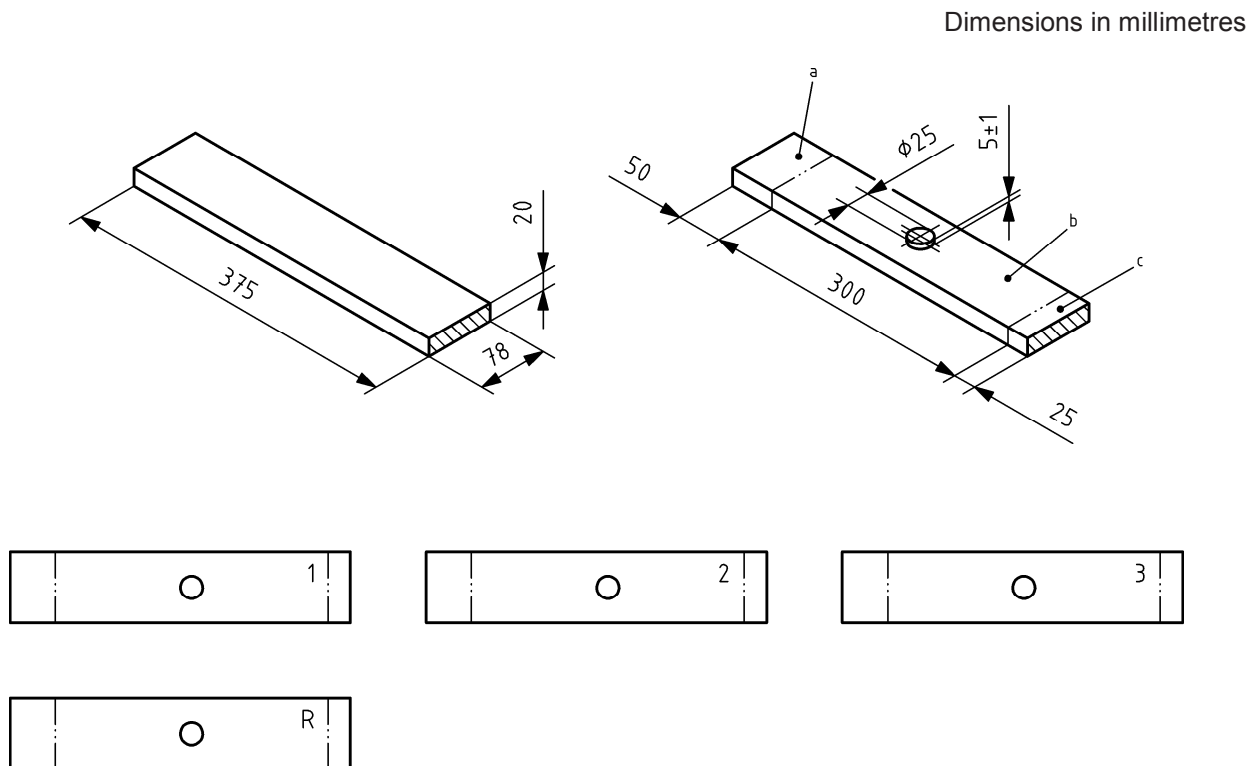
- Milling cutter, cylindrical with a diameter of 25 mm, for drilling of water traps.

1) This test is based on Nordtest Build 229, 1989, *Coating systems on exterior wood – Performance accelerated test*

E.3.2 Preparation

The preparation of panels shall be in accordance with Clause 6 except that a water trap is introduced as a final operation by the following procedure:

Machine a water trap into the centre of the face of the test and reference systems by milling a circular hole, approximately 25 mm in diameter, through the paint system and to a depth of (5 ± 1) mm into the wood, as shown in Figure E.1.



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 E.1— Details of test panels with water trap

E.3.3 Panel assessment

Panel examination shall be carried out in accordance with Clause 7.

For the evaluation of flaking, mould growth and cracking on panels containing the water trap see Tables E.1 and E.2. Flaking, mould growth and cracking on the coated areas of the panels containing the water trap are evaluated within a radius of 50 mm from the centre of the water trap excluding the actual water trap.

Table E.1— Flaking (FL) on panels containing the water trap

| Classification if both demands have been met | Affected area | |
|--|--|--|
| | Around the water trap | Remaining test area |
| 0 | 0 % | 0 % |
| 1 | Not greater than 5 % | Class 1 in accordance with EN ISO 4628-5 |
| 2 | Greater than 5 %, but not greater than 10 % | Class 2 in accordance with EN ISO 4628-5 |
| 3 | Greater than 10 %, but not greater than 20 % | Class 3 in accordance with EN ISO 4628-5 |
| 4 | Greater than 20 %, but not greater than 40 % | Class 4 in accordance with EN ISO 4628-5 |
| 5 | Greater than 40 % | Class 5 in accordance with EN ISO 4628-5 |

Table E.2— Cracking (CR) on panels containing the water trap

| Classification if both demands have been met | Affected area | |
|--|--|---|
| | Around the water trap | Remaining test area |
| 0 | No cracking | No cracking |
| 1 | Very few cracks Quantity (density) 1 in accordance with EN ISO 4628-4 | No cracking |
| 2 | A few cracks permitted Quantity (density) 2 in accordance with EN ISO 4628-4 | One single crack permitted |
| 3 | A moderate amount of cracks permitted Quantity (density) 3 in accordance with EN ISO 4628-4 | A few cracks permitted |
| 4 | A considerable amount of cracks permitted Quantity (density) 4 in accordance with EN ISO 4628-4 | A considerable amount of cracks permitted |
| 5 | Dense pattern of cracks Quantity (density) 5 in accordance with EN ISO 4628-4 | A considerable amount of cracks |

E.4 Tests with back sealing of the panels

In order to obtain additional information, the portion of the back of the exposure panels that is normally uncoated may be sealed by the following methods:

- one coat of the ICP;
- first coat of the test coating system;
- full test coating system.

Annex F (informative)

Explanatory notes

F.1 Natural weathering test

Natural weathering tests give an indication of the durability of the system tested. The closer the conditions of actual use are to the conditions of the test, the better the correspondence.

However, as conditions vary considerably, variations in performance will also occur.

In EN 927-1, systems are classified according to their appearance and end use.

Generally, the test will provide objective guidance in this respect, particularly when the evaluation is combined with considerations of local microclimatic variations and of the influence on durability exerted by the substrate and by constructional details.

F.2 Validity of test reports

F.2.1 System

Generally, test reports are only valid for systems equal to those tested.

Minor changes in composition, e.g. from one shade to another, might not alter the performance significantly. Predicting the actual behaviour of a system different from the one tested however is dependent on the manufacturer's experience and is his responsibility.

F.2.2 Climate and region

Test results reflect, among other things, the climatic conditions at an actual test site during a specific 12 months exposure period.

Test reports characterise the system tested under similar climatic conditions. These, however, vary from one place to another and from period to period. Therefore, test results should be considered more as qualified indications of the performance than as absolute values.

As variations in performance, as well as in test results, to a large extent are due to climatic differences, it should be noted in test reports within which location the test has been carried out. The date and period of exposure should also be recorded.

Annex G (informative)

Precision data

Test precision (repeatability and reproducibility) of the EN 927-3 natural weathering test was estimated in an interlaboratory study by members of the CEN/TC 139/WG 2 "Coating systems for wood" (see Round Robin IV, 2004-2006). The study consisted of three consecutive exposures of 1 year duration (in 3 months intervals) at five different exposure sites in Central Europe with sets of three replicate pine panels coated with the semi-transparent Internal Comparison Product (ICP). Test panels were produced by the five participants individually, applying a common batch of ICP. Performance assessments were carried out by different operators at the five exposure sites.

The calculated repeatability and reproducibility limits of the ICP are regarded as typical for this test method (see Table G.1) and may be used as basic estimates. However, test precision of exposures according to EN 927-3 will vary with specific exposure conditions, coating systems and assessed material properties.

Table G.1 — Repeatability and reproducibility of selected performance parameters on ICP-coated pine panels after 1 year of natural exposure according to EN 927-3

| Parameter | | General mean | Median | Repeatability (within laboratories) | | Reproducibility (between laboratories) | | |
|-------------------------|-------------------------|--------------|--------|---|------------------------------------|---|------------------------------------|------------------------------------|
| | | | | (mean) repeatability standard deviation | 95% repeatability limit | between laboratory standard deviation | reproducibility standard deviation | 95% reproducibility limit |
| | | | | s_r | $r = 196 \cdot \sqrt{2} \cdot s_r$ | s_L | $s_R = \sqrt{(s_L^2 + s_r^2)}$ | $R = 196 \cdot \sqrt{2} \cdot s_R$ |
| Blistering ^a | Quantity | 0,00 | 0,00 | | | | | |
| | Size | 0,00 | 0,00 | | | | | |
| Cracking | Quantity | 0,13 | 0,00 | 0,24 | 0,7 | 0,14 | 0,28 | 0,8 |
| | Size | 0,16 | 0,00 | 0,27 | 0,7 | 0,24 | 0,36 | 1,0 |
| Flaking ^a | Quantity | 0,00 | 0,00 | | | | | |
| | Size | 0,00 | 0,00 | | | | | |
| Chalking ^a | | 0,00 | 0,00 | | | | | |
| Mould growth | unwashed | 0,73 | 0,00 | 0,24 | 0,7 | 1,12 | 1,15 | 3,2 |
| | washed | 0,42 | 0,00 | 0,43 | 1,2 | 0,91 | 1,01 | 2,8 |
| Adhesion | | 0,51 | 0,00 | 0,58 | 1,6 | 0,41 | 0,71 | 2,0 |
| General appearance | | 0,84 | 1,00 | 0,09 | 0,2 | 0,85 | 0,85 | 2,4 |
| Gloss change | | -5,49 | -4,20 | 9,23 | 25,6 | 2,55 | 9,58 | 26,5 |
| Colour change | $\Delta E_{ab}^*_{sci}$ | 10,78 | 10,38 | 2,75 | 7,6 | 2,93 | 4,02 | 11,1 |

^a No Blistering, Flaking and Chalking were observed after 1 year of exposure. Therefore no meaningful calculation of repeatability and reproducibility was possible.

Bibliography

- [1] EN 927-1, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 1: Classification and selection*
- [2] EN 927-2, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 2: Performance specification*

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

Useful Contacts:

Customer Services

Tel: +44 845 086 9001

Email (orders): orders@bsigroup.com

Email (enquiries): cservices@bsigroup.com

Subscriptions

Tel: +44 845 086 9001

Email: subscriptions@bsigroup.com

Knowledge Centre

Tel: +44 20 8996 7004

Email: knowledgecentre@bsigroup.com

Copyright & Licensing

Tel: +44 20 8996 7070

Email: copyright@bsigroup.com



...making excellence a habit.™