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EN 927-3

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ICS 87.040

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: Essai de vieillissement naturel

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

This European Standard was approved by CEN on 7 July 2000.

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 Central Secretariat or to any CEN member.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 927-3:2000 E

Contents

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by January 2001, and conflicting national standards shall be withdrawn at the latest by January 2001.

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

Part 1: Classification and selection
Part 2: Performance specification
Part 3: Natural weathering test
Part 4: Assessment of the water-vapour permeability
Part 5: Assessment of liquid water permeability

Annexes A to D are a normative part of this part of EN 927.

Annexes E to G are for information only.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This part of EN 927 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 prENV 927-2:2000.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 927-1	1996	Paints and varnishes – Coating materials and coating systems for exterior wood – Part 1: Classification and selection
prENV 927-2	2000	Paints and varnishes – Coating materials and coating systems for exterior wood – Part 2: Performance specification
EN 21512	1994	Paints and varnishes – Sampling of products in liquid or paste form (ISO 1512:1991)
EN ISO 1513	1994	Paints and varnishes – Examination and preparation of samples for testing (ISO 1513:1992)
EN ISO 2409	1994	Paints and varnishes – Cross-cut test (ISO 2409:1992)
EN ISO 2431	1996	Paints and varnishes – Determination of flow time by use of flow cups (ISO 2431:1993, including Technical Corrigendum 1:1994)
ISO 554	1976	Standard atmospheres for conditioning and/or testing – Specifications
EN ISO 2808	1999	Paints and varnishes – Determination of film thickness (ISO 2808:1997)
ISO/DIS 2810	1997	Paints and varnishes – Natural weathering (Revision of ISO 2810:1974)
ISO 2813	1994	Paints and varnishes – Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°
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 4628-4	1982	Paints and varnishes – Evaluation of degradation of paint coatings – Designation of intensity, quantity and size of common types of defect – Part 4: Designation of degree of cracking
ISO 4628-5	1982	Paints and varnishes – Evaluation of degradation of paint coatings – Designation of intensity, quantity and size of common types of defect – Part 5: Designation of degree of flaking
ISO 4628-6	1990	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/DIS 7724-1	1997	Paints and varnishes – Colorimetry – Part 1: Principles (Revision of ISO 7724-1:1984)
ISO/DIS 7724-2	1997	Paints and varnishes – Colorimetry – Part 2: Colour measurement (Revision of ISO 7724-2:1984)
ISO/DIS 7724-3	1997	Paints and varnishes – Colorimetry – Part 3: Calculation of colour differences by CIELAB (Revision of ISO 7724-3:1984)

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 as "Internal Comparison Product" or "ICP") is specified in annex A.

The standard test substrate is pine sapwood with the back 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 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 prENV 927-2:2000.

4 Apparatus and materials

4.1 Exposure racks, inclined at an angle of 45° to the horizontal, and facing south in accordance with ISO/DIS 2810:1997.

4.2 Glossmeter, for the measurement of specular gloss in accordance with ISO 2813:1994, 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/DIS 7724-1:1997 to ISO/DIS 7724-3:1997.

4.4 Tape and a **cutting tool,** for the assessment of adhesion in accordance with EN ISO 2409:1994.

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 EN ISO 2808:1999, method 5A.

4.7 Self-adhesive, transparent tape, in accordance with ISO 4628-6:1990 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 EN 21512:1994.

Examine and prepare each sample for testing as described in EN ISO 1513:1994.

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 554:1976) 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 × (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 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 554:1976. 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 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/m², but may also be expressed as wet film thickness (in micrometers).

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 g/m² wet film. The dry film thickness shall be (50 ± 10) µm on pine.

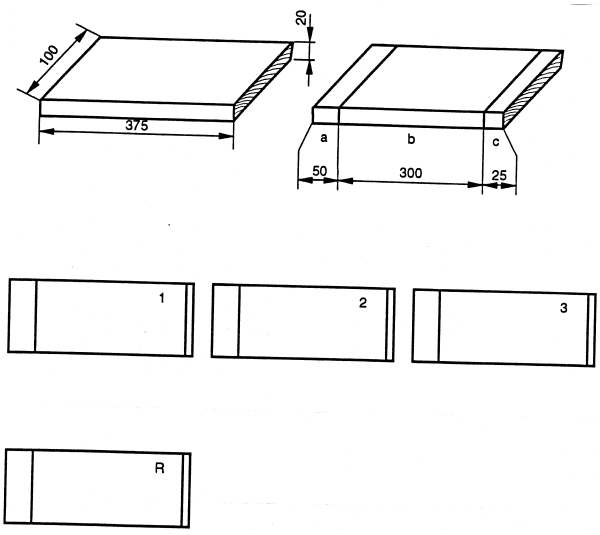
One set of ICP panels may serve as the comparison for one or more test coatings.

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 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 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 the controlled environment at (20 ± 2) °C and a relative humidity of (65 ± 5) % (in accordance with ISO 554:1976), before carrying out initial panel examinations.

Dimensions in millimeters



Key

1, 2 and 3 : Exposure panels
R : Unexposed reference panels

a) Sealed end (may be used for numbering of test panels)
b) Section for application of coating systems
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 EN ISO 2808:1999, method 5A. Make 10 measurements on each chip and calculate and record the mean value in micrometers.

The thickness is stated in micrometers 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.

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 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 ending 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 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) %.

7.3.2 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 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) a 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 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 for 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/cm^3 to 0,91 g/cm^3

Viscosity: 33,5 s, determined with a 4 mm flow cup as specified in EN ISO 2431:1996, which corresponds to a kinematic viscosity of 39 mm^2/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 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 loss of gloss

Measure the specular gloss in accordance with ISO 2813:1994 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 3 measurements on separate areas along the length of the panel. Displace the glossmeter sidewise and obtain 3 measurements on adjacent areas with the light beam incident on the panel from the opposite direction. Take the mean of the 6 measurements obtained.

Calculate the mean values for loss of gloss of the three exposed panels, LG_{ex}, and of the unexposed reference panel, LG_{ref}. Calculate the difference $LG_{ex} - LG_{ref} = LG$ and round the values to the nearest whole number.

B.2 Colour and colour change

Measure the colour in CIELAB colour coordinates with illuminant D65 in accordance with ISO/DIS 7724-2:1997 (2° observer) $R_{45/0}(\lambda)$ or by means of a spectrophotometer. Determine the value for each area as a mean of six single measurements.

Calculate and state single measurements to one decimal place and the mean value for all three panels to the nearest whole number.

B.3 Blistering

The assessment for quantity (density) is made on each exposed area separately in accordance with ISO 4628-2:1982.

Calculate and record the mean value to one decimal place.

B.4 Flaking

Assessment is made on each exposed area separately in accordance with ISO 4628-5:1982, using a microscope of 10× magnification (see 4.5).

Calculate and record the mean value to one decimal place.

B.5 Mould growth

Assessment is made on each exposed area separately, using a microscope of 10× magnification (see 4.5). For evaluation scale see the photographic rating scale given in annex C.

Calculate and record the mean value to one decimal place.

B.6 Cracking

The assessment is made on each exposed area separately in accordance with ISO 4628-4:1982.

Calculate and record the mean value to one decimal place.

B.7 Chalking

The assessment is made on each exposed area separately in accordance with the procedure described in ISO 4628-6:1990. Take care to distinguish between chalking and dust.

Calculate and record the mean value to one decimal place.

B.8 Adhesion

B.8.1 General

The assessment is made on each exposed area separately in accordance with EN ISO 2409:1994.

B.8.2 Apparatus and material

B.8.2.1 Cutting tool

Single-blade cutting tool with 20° to 30° edge and other dimensions as specified in EN ISO 2409:1994.

B.8.2.2 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 2409:1994.

B.8.3 Procedure

The surface (and substrate) shall be clean and dry before the test.

Select an area free of blemishes and minor surface imperfections.

When cutting, use a ruler and cut through the coating down to the substrate in one steady motion.

Inspect the incisions to make sure that the film has been penetrated and the substrate is not unduly affected. If the incision is not satisfactory, make another one.

Remove two complete laps of tape from the roll and discard.

Remove another length 300 mm to 400 mm long at a steady rate and place a 75 mm long part over the intersection with the tape oriented along the grain.

Smooth the tape into place at the area of the incisions and rub the tape firmly with a fingertip. The colour of the coating seen through the tape is a useful indication of overall contact. Within 5 min of applying the tape, remove it by seizing the free end pulling it off rapidly (but not jerked) back upon itself at an angle as close to 60° as possible.

Inspect the coated area for loss of coating; material attached to the tape shall be disregarded. Rate the adhesion in accordance with EN ISO 2409:1994.

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.9 Test for abnormally porous wood

Abnormally porous wood may be detected qualitatively by the rapid absorption of a drop of propan-2-ol (isopropanol) applied to a small 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 test panel.

B.10 Test for heartwood in pine

If the presence of heartwood in the selected pine cannot be detected by a difference in colour in the wood, it may be checked by the brush application of a test solution to both the end-grain and the faces of a small piece cut from the same length of the timber.

Prepare the test solution by dissolving Fast Red B salt in de-ionized water at a concentration of 5 g/l. The solution should be freshly prepared, and is immediately ready for use. Heartwood, if present, is indicated by the development of a deep red colour, which usually shows within about 10 min.

NOTE: Fast Red B has no reported mutagenic or teratogenic effects; however, it should be treated as a suspected carcinogen. Reference should be made to up-to-date, relevant health and safety data sheets.

Annex C

(normative)

Photographic rating scale for mould growth

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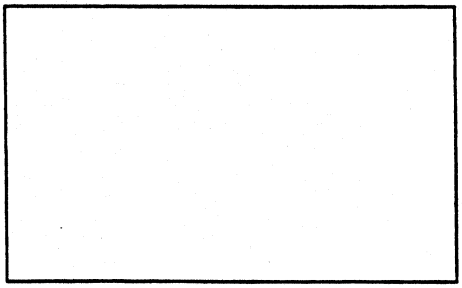

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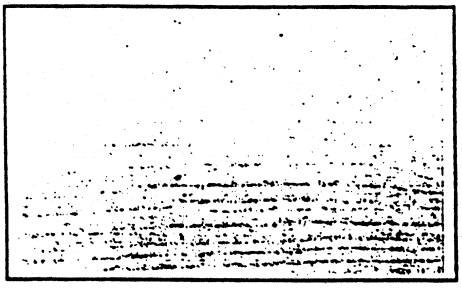

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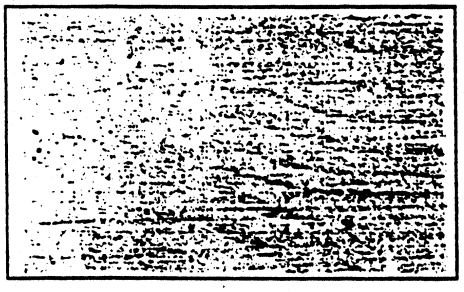

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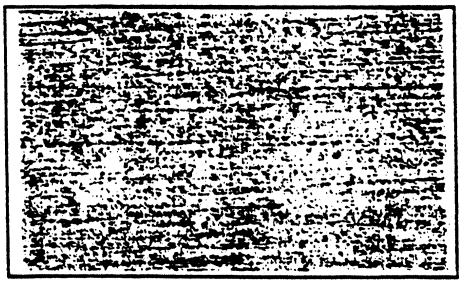

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Annex D

(normative)

Assessment requirements for panels of test coatings and ICP

Table D.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	
e) Initial defects	x	x	x	x
After exposure				
f) Blistering (on site)	x	x	x	
g) Flaking	x	x	x	
h) Cracking	x	x	x	
i) Chalking	x	x	x	
j) Mould growth	x	x	x	
After exposure and washing				
k) Mould growth	x	x	x	
l) Gloss	x	x	x	x[b)]
m) Colour	x	x	x	
n) Adhesion	x	x	x	

a) The inspections should preferably be carried out in the order indicated, a) to n).
b) The gloss measurement is repeated on the unwashed unexposed reference panel at the end of the exposure period (Annex B, B.1 Gloss and loss of gloss)

Annex E

(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.	Manufac-turer	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 6.3.5)	Test system:				
Similarly for ICP	ICP: Manufacturer, batch number, production date				
Remarks:					

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

System: Internal Comparison Product (ICP)

Result:

Property	Wood species	Evaluation scale test method	Code	Results after 12 months exposure			
				Individual values			Mean value
Loss of gloss		LG_{ex} - LG_{ref} (ISO 2813)	LG				
Change in colour		ΔE^*_{ab} (ISO 7724-3)	DE				
Blistering		0 = None 5 = Dense (ISO 4628-2)	BL				
Flaking		0 = None 5 = Dense (ISO 4628-5)	FL				
Cracking		0 = None 5 = Dense (ISO 4628-4)	CR				
Chalking		0 = None 5 = Dense (ISO 4628-6)	CH				
Mould growth		0 = None 5 = Dense (ISO 4628-5)	MG				
Adhesion		0 = Excellent 5 = Poor (EN 927-3, Annex B)	AD				

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

System: Test system

Result:

Property	Wood species	Evaluation scale test method	Code	Results after 12 months exposure			
				Individual values			Mean value
Loss of gloss		LG_{ex} - LG_{ref} (ISO 2813)	LG				
Change in colour		ΔE^*_{ab} (ISO 7724-3)	DE				
Blistering		0 = None 5 = Dense (ISO 4628-2)	BL				
Flaking		0 = None 5 = Dense (ISO 4628-5)	FL				
Cracking		0 = None 5 = Dense (ISO 4628-4)	CR				
Chalking		0 = None 5 = Dense (ISO 4628-6)	CH				
Mould growth		0 = None 5 = Dense (ISO 4628-5)	MG				
Adhesion		0 = Excellent 5 = Poor (EN 927-3, Annex B)	AD				

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 F

(informative)

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

F.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 may 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.

F.2 Tests on alternative wood substrates

When information on specific wood substrates is required, e.g.:

– alternative wood species, for example spruce (*Picea abies*) or tropical hardwoods;

– panels with a sawn finish;

– pine modified or impregnated by industrial processes,

tests according to this standard shall be carried out on the appropriate wood substrate.

F.3 Tests with water trap[1)]

F.3.1 Apparatus and materials

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

F.3.1.1 Milling cutter, cylindrical with a diameter of 25 mm, for drilling of water traps.

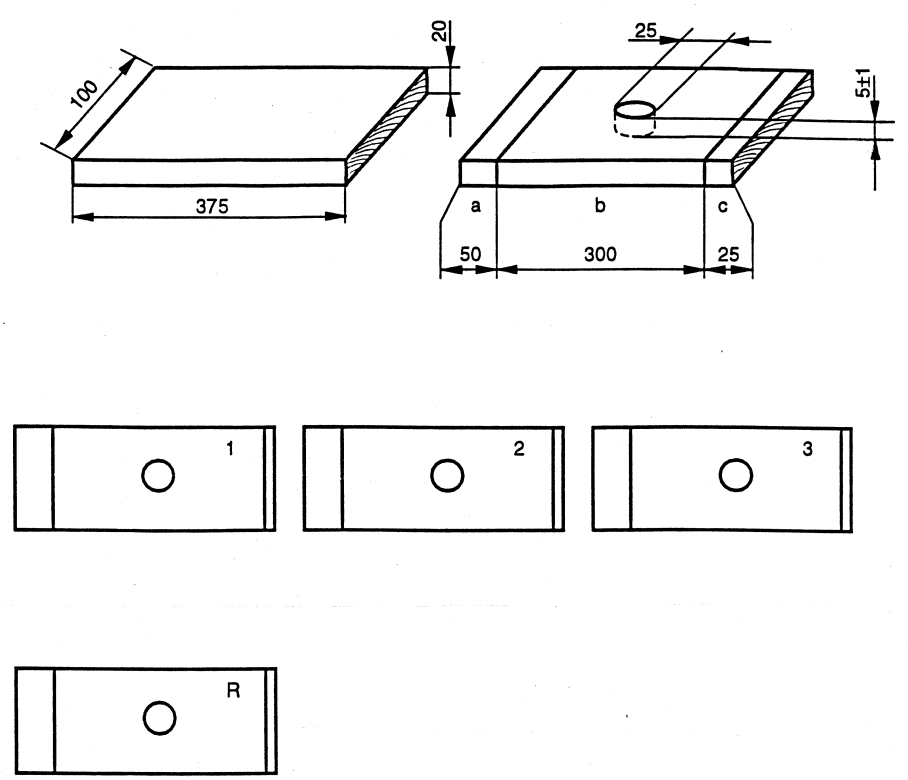
F.3.2 Preparation

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 F.1.

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

Dimensions in millimeters



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 systems
c) Sealed end

NOTE: The figure is not to scale.

Figure F.1: Details of test panels with water trap

F.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 F.1 and F.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 F.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 ISO 4628-5:1982
2	Greater than 5 %, but not greater than 10 %	Class 2 in accordance with ISO 4628-5:1982
3	Greater than 10 %, but not greater than 20 %	Class 3 in accordance with ISO 4628-5:1982
4	Greater than 20 %, but not greater than 40 %	Class 4 in accordance with ISO 4628-5:1982
5	Greater than 40 %	Class 5 in accordance with ISO 4628-5:1982

Table F.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 ISO 4628-4:1982	No cracking
2	A few cracks permitted Quantity (density) 2 in accordance with ISO 4628-4:1982	One single crack permitted
3	A moderate amount of cracks permitted Quantity (density) 3 in accordance with ISO 4628-4:1982	A few cracks permitted
4	A considerable amount of cracks permitted Quantity (density) 4 in accordance with ISO 4628-4:1982	A considerable amount of cracks permitted
5	Dense pattern of cracks Quantity (density) 5 in accordance with ISO 4628-4:1982	A considerable amount of cracks

Table F.3: Mould growth (MG) 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 ISO 4628-2:1982
2	Greater than 5 %, but not greater than 10 %	Class 2 in accordance with ISO 4628-2:1982
3	Greater than 10 %, but not greater than 20 %	Class 3 in accordance with ISO 4628-2:1982
4	Greater than 20 %, but not greater than 40 %	Class 4 in accordance with ISO 4628-2:1982
5	Greater than 40 %	Class 5 in accordance with ISO 4628-2:1982

F.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;

– the first coat of the test coating system;

– the full test coating system.

Annex G

(informative)

Explanatory notes

G.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.

G.2 Validity of test reports

G.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, may not alter the performance considerably. Prediction of the actual behavior of a system different from the one tested, however, is dependent on the manufacturers experience and is his responsibility.

G.2.2 Climate and region

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

Test reports characterize 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.