

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

Part 2: Performance specification

ICS 87.040

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSi
British Standards

National foreword

This British Standard is the UK implementation of . It supersedes DDENV927-2:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee STL/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.

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 October 2008

© BSI 2008

ISBN 978 0 580 56014 9

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD
 NORME EUROPÉENNE
 EUROPÄISCHE NORM

EN 927-2

April 2006

ICS 87.040

Supersedes ENV 927-2:2000

English Version

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

Peintures et vernis - Produits de peinture et systèmes de
 revêtement pour le bois en extérieur - Partie 2:
 Spécifications de performance

Beschichtungsstoffe - Beschichtungsstoffe und
 Beschichtungssysteme für Holz im Außenbereich - Teil 2:
 Leistungsanforderungen

This European Standard was approved by CEN on 9 March 2006.

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.

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 Central Secretariat has the same status as the official versions.

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



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

© 2006 CEN All rights of exploitation in any form and by any means reserved
 worldwide for CEN national Members.

Ref. No. EN 927-2:2006: E

Contents

page

Foreword	3
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Performance tests	5
5 Optional tests	7
6 Expression of results and interpretation	7
Annex A (informative) Information and guidelines on interpretation	10
Bibliography	14

Foreword

This European Standard (EN 927-2:2006) 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 October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

This European Standard supersedes ENV 927-2:2000.

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*

This second edition cancels and replaces the first edition (ENV 927-2:2000), which has been technically revised. The main changes are:

- values for adhesion and maximum sum value in Table 1 were changed;
- former Annex A was deleted and the former Annex B became Annex A.

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

Introduction

This is one of a number of parts of EN 927. Part 1 addresses the issue of an unequivocal terminology for the wide variety of exterior coatings for wood that are now available. Part 1 also provides a framework for communicating information on the suitability of a coating for particular specific end-use categories. Improved communication is beneficial in the removal of technical barriers to trade. However there remains the problem of comparing products tested, or likely to be exposed, in different climatic regions. EN 927-2 addresses this latter issue and sets specific performance criteria.

1 Scope

This part of EN 927 specifies performance requirements for coating systems on exterior wood. Performance requirements are specified according to the categories of 'end use' and 'exposure conditions' (defined in EN 927-1) in terms of the results of natural weathering performance testing carried out in accordance with EN 927-3. A mandatory water permeability test in accordance with EN 927-5 is also specified. Additional optional tests are identified which may be used by suppliers to provide voluntary additional information, to a standardized format, on aspects of performance relevant to specific building components such as windows.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 927-1:1996, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 1: Classification and selection*

EN 927-3:2000, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 3: Natural weathering test*

EN 927-5, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 5: Assessment of the liquid water permeability*

prEN ISO 4618:2004, *Paints and varnishes — Terms and definitions (ISO/DIS 4618:2004)*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 927-1:1996 and prEN ISO 4618:2004 apply.

4 Performance tests

4.1 Resistance to natural weathering

4.1.1 General

The assessment of a coating material to this specification will require a natural weathering test to be carried out in accordance with EN 927-3, using a flat wood panel of pine (*Pinus silvestris*) with a planed surface. A manufacturer of a coating system that meets one or more of the performance profiles described in 4.1.2 can claim conformity to the specification, as described in Clause 6. If a coating system does not meet the performance criteria the manufacturer cannot claim full conformity but might provide information gained from one or more of the optional tests.

The external durability of the coating system under test is assessed by a number of performance criteria. Guide values enable an assessment to be made of the suitability of the system for the proposed end-use. Comparative trials have shown that conformity to the criteria outlined below (Table 1) sets a performance standard capable of verification, but they do not in themselves constitute a certification procedure. Further guidance on the interpretation of the results is given in Annex A.

The severity of the exposure conditions is determined by reference to the performance of an Internal Comparison Product (ICP), which also serves as a reference standard for the optional evaluation of mould resistance.

4.1.2 Performance criteria

The scores for the assessment criteria, blistering, cracking, flaking and adhesion (from EN 927-3) and the water absorption value (from EN 927-5), are interpreted as meeting, or not meeting the required standard, relative to the end-use category, according to the criteria given in Table 1. These rankings are relative to the exposure conditions as described in 4.1.3.

Interpretation of criteria:

- (1) The first four values in each column each represent the maximum allowed for the arithmetic mean (to one decimal place) of the three replicates from the natural weathering test (EN 927-3).
- (2) The 'maximum sum value' is the limit which shall not be exceeded for the sum of the 12 (4×3) individual results.
- (3) The 'maximum difference to qualify as valid test', refers to the difference between the highest and lowest score in any of the individual test panels. If this value is exceeded the test is declared invalid and shall be repeated.
- (4) The 'water absorption value' is the maximum allowed for the arithmetic mean of the five replicates as determined by the procedure described in EN 927-5.
- (5) If a coating system does not meet all of these profiles the manufacturer cannot claim full conformity in any of the three end use categories.

Table 1 — Limit values for performance criteria - Natural weathering and water absorption

	'Stable'	'Semi-stable'	'Non-stable'
Blistering	0,3	0,7	1
Cracking	0,7	1,7	3
Flaking	0,3	0,7	1,3
Adhesion	1	1	1
Maximum sum value	7	12	19
Maximum difference to qualify as valid test	2	3	4
EN 927-5, water absorption value	$\leq 175 \text{ g/m}^2$ ^a	$\leq 250 \text{ g/m}^2$ ^a	no limit
^a Non-mandatory values which will be revised/ratified in the light of ongoing work in CEN/TC 139/WG 2.			

NOTE Test precision

An estimate of the standard deviation of the weathering test method was made in a large comparative exercise carried out by members of the CEN Working Group. The findings of this exercise have been incorporated into the criteria matrix so that the underlying target values incorporate a tolerance to allow for variation in the performance of panel replicates. Attention has also been given to the expected distribution of results for a given test. Thus for example an arithmetic mean criterion of 1,3 for 'cracking' could be achieved as (1,1,2), (0,1,3) or (0,0,4). The 'Maximum difference' criteria considers the probability of such scores occurring, and rules out those which are well outside the expected distribution.

4.1.3 Exposure conditions

If the internal comparison product (ICP – see EN 927-3) meets the weathering criteria for the 'stable' end-use category the exposure conditions are rated as 'medium'. If it does not meet these criteria the conditions are rated 'severe' (see EN 927-1).

Exposure conditions during the test are recorded in the 'Expression of results' (Clause 6).

4.1.4 Water permeability

Water permeability shall be assessed in accordance with EN 927-5 and expressed as a 'water absorption value'. The criteria for each end-use category are given in Table 1.

5 Optional tests

The test methods listed in Table 2 are recommended where additional information is required from the supplier of the coating system to meet specific end-user needs. They are not required for compliance with this European Standard, nevertheless when carried out they shall be reported in the format prescribed in Clause 6.

Table 2 — Additional optional tests

Test description	Test method
Blister box test	any test method can be agreed, e.g. BS 7956:2000, Annex C
Blocking	any test method can be agreed
Stackability	EN ISO 4622
Compatibility with glazing (sealing) compounds and profiles	Overcoat following suppliers recommendations
Blue stain in service	EN 152-1 and EN 152-2
Mould resistance value	EN 927-3 and 6.2.1
Natural weathering with water trap	EN 927-3:2000, Annex F
Natural weathering with alternative substrates	EN 927-3:2000, Annex F

6 Expression of results and interpretation

6.1 Mandatory tests

The ratings achieved in the weathering and permeability tests shall be reported and expressed according to the conventions listed in Table 3 or Table 4. Manufacturers claiming conformity with this European Standard for a specified coating system shall on request supply a data sheet containing the results in this format.

Manufacturers may at their discretion expand the table format to include information from Table 5.

Table 3 — Mandatory tests for claiming full conformity

Test description	Reporting convention
Appearance definition	Build, hiding power and gloss in accordance with EN 927-1
End use category or categories meeting full performance criteria	'Stable' and/or 'Semi-stable' and/or 'Non-stable'
Exposure conditions	'Medium' or 'severe' in accordance with 4.1.3

NOTE Some coating systems might meet more than one of the performance profiles. It is at the manufacturer's discretion whether to claim conformity with more than one end-use category.

Table 4 — Mandatory tests for claiming limited conformity

Test description	Reporting convention
Appearance definition	Build, hiding power and gloss in accordance with EN 927-1
End use category or categories meeting limited performance criteria	'Stable' and/or 'Semi-stable' and/or 'Non-stable'
Substrate for which limited conformity is claimed	Wood species, surface treatment, or machined finish
Exposure conditions	'Medium' or 'severe' in accordance with 4.1.3

6.2 Optional tests

Optional tests, which may be carried out at manufacturers' discretion, shall be reported in the expanded format to give the information listed in Table 5. Guidelines on interpretation are given in Annex A.

Table 5 — Optional tests for additional information

Test description	Reporting convention
Blister box test	Occurrence of blistering
Blocking	Degree of damage
Stackability	Degree of damage and mass loading
Compatibility of glazing compounds	Report any sticking, softening or discoloration
Blue stain in service	Depth of clear zone
Mould resistance	'Yes' or 'no', see 6.2.1
Natural weathering with water trap	'Stable' and/or 'Semi-stable' and/or 'Non-stable', see also 6.2.2

6.2.1 Criteria for mould resistance

Mould resistance is determined by the following procedure: sum the mould growth results for the ICP in the EN 927-3 exposure test (3 replicates) and add 2. Let this value = 'M'.

If the test system has a value (sum of three replicates) equal or less than M then the system is reported as "mould resistant" ('Yes').

If the test system has a value (sum of three replicates) greater than M then the system is reported as "not mould resistant" ('No').

6.2.2 Role of internal comparison product (ICP) in optional tests

The additional optional natural weathering tests use for reference purposes the same ICP on the same flat pine panel as that employed in the mandatory weathering test. If the optional tests are carried out at the same time, then one set of ICP panels is used as the reference for all mandatory and optional weathering tests exposed together. If however the additional tests are carried out at another time, then a new standard test substrate (coated with the ICP) shall be included to provide reference for exposure conditions and mould growth. Exposure of the ICP on alternative wood species, or on the water trap panel is not required, but can be carried out at the discretion of interested parties to aid qualitative interpretation of the results.

Annex A **(informative)**

Information and guidelines on interpretation

A.1 General

The performance of coatings on wood is subject to many variables, including substrate, environment and application as well as design aspects of the building units concerned. Some of these aspects have been outlined in EN 927-1:1996, Annex A. The most convincing evidence of good performance is provided by established products with demonstrable and recorded good performance over a wide range of conditions for an appropriate end-use. Users and specifiers of coating materials should take these as well as economic factors into account when making a selection. EN 927-2 supports this process by providing a set of standard tests that will aid comparison between products, and in the case of weathering provide a minimum standard of performance. This is important for both new products, and for products that might be offered in a new geographic location, thus reducing barriers to trade. The following guidelines provide some additional information to aid interpretation of the test results, the guidelines relate specifically to the mandatory and optional tests listed in Clauses 4 and 5.

A.2 Appearance

Coating materials for wood are commercially described by generic terms such as 'paint', 'varnish', 'wood stain', 'lacure', and/or a proprietary name. The definitions of appearance in EN 927-1 provide an objective means of describing coating systems in terms of their build, hiding power and gloss. The factors which control appearance will also influence performance but this will be reflected in the weathering test and should not be prejudged. However, where a given product has an extensive colour range, it might not be practical to test all the colour variants. In this case users and specifiers should apply some judgement, e.g. the response of dark colours on exposure to high levels of solar radiation (see EN 927-1:1996, Annex A).

An important aspect of durability is the rate at which appearance can change even if there is no loss of protection. Because there are so many appearance groups and technologies covering exterior wood coatings, it was not deemed practical to set tolerances for each one. However a mandatory part of the EN 927-3 weathering test on which the weathering profile is based is to record specified appearance changes over the test period, and this data can be obtained from the EN 927-3 test report.

A.3 Weathering performance profiles

Weathering performance profiles are measures of performance that take into account four important failure modes: blistering, cracking, flaking and adhesion. The profiles have been chosen to set realistic levels of practical performance. Accordingly the profile for 'stable' end-uses sets a high standard with only one or two faults permitted in each category. A range of different profiles can arise as a result of variability inherent in any test method. The mean results for each performance category have been chosen to include a tolerance to make some allowance for substrate and other variability. The 'maximum sum value' constrains the total amount of failure, and might not allow a coating system to reach the allowable maximum in all categories. The 'maximum difference' constraint restricts the spread of the failure distribution, which if too broad indicates unacceptable variance outside the established test capability. In this case the test is declared invalid and is repeated.

Despite the simplicity of the test, experience has shown it to be a meaningful indication of performance. Nevertheless a free panel test is very different from real building construction, and users might also need to pay regard to their own experience or that of the manufacturer of the coating material before making a final selection from qualifying systems. Some systems might meet more than one performance profile and the manufacturers' recommendations should be considered.

Attention is also drawn to the fact that in order to provide a common basis for comparison the weathering test piece is pine containing predominantly sapwood. Coating performance can be different on some other substrates, such as:

- other soft wood species such as spruce,
- pine heartwood,
- hardwoods and
- softwoods (including pine itself) which have been stabilized with an appropriate pre-treatment.

It is optional to test the coating over alternative substrates and where this information is available it will improve the reliability and relevance of the selection of coating systems for the alternative substrates.

A.4 Exposure conditions

As noted in EN 927-1 the exterior performance of a coating will be strongly influenced by the climate and also by the construction. Within any climatic zone there will be periods of fluctuating weather, from year to year, and within a single year. Thus while a given exposure site might on average provide extreme conditions, there will be moderate or hard periods that might fortuitously coincide with the test exposure. Knowledge of the influence of meteorological conditions on performance is not sufficiently advanced to predict the effect on relative performance. Therefore the test method uses the performance of a well-characterized product (the ICP) on a standard substrate, as indicative of the prevailing conditions during the period of test. However because the test panel is not sheltered it can only experience medium or severe, but not mild, conditions (see Table 2 in EN 927-1:1996).

Coating systems should ideally be tested in a region with exposure conditions similar and representative of where they are to be used. Where this is not practicable, users will need to make an informed judgement about the likely prevailing conditions where the tested system is to be used relative to the test exposure site. In general, a coating system which performs well under severe conditions will perform even better under medium or mild conditions. If the climate prevailing during a specific exposure test turns out to be moderate, then it is not possible to predict with confidence performance of the tested systems under severe conditions. There is no alternative but to re-test at a site where a hard or extreme climate can be expected.

A.5 Water permeability

See EN 927-5 for definition of terms and test methods.

Transport of water (liquid or vapour) through a coating will cause dimensional changes in a wooden substrate which might in turn lead to splitting of the wood. In constructed units such as windows the dimensional changes might cause the seizure of opening lights, or the working loose of sealants. It is largely for this reason that end-uses are categorized according to the need for dimensional stability (stable, semi-stable and non-stable). In addition to causing dimensional change a build up of water is a prerequisite to wood rot which can occur if the moisture content rises above 20 %. There are thus two factors to be considered in assessing the water transport properties in relation to coating selection:

- [i] rate of moisture uptake;
- [ii] average moisture content over an extended period of exposure.

The permeability test provides an indication of likely moisture uptake which directly links with the required level of stability. However, moisture transport is subject to many variables including age and history of the coating and numerous design details, and at present no prediction can be made about average moisture content. Therefore maximum, but not minimum, levels of liquid water absorption are set in Table 1.

A.6 Blocking

Where two coated surfaces are pressed into contact, as in a window or door jamb, there is a potential risk that the coatings will adhere and cause damage on parting. This phenomenon is known as blocking. The test indicates whether this is likely to be a problem.

A.7 Stackability

This test relates to the blocking that might occur if coated units are stacked without protection, it applies specifically to industrial coating and gives an indication of the likelihood to damage at different mass loadings.

A.8 Compatibility with glazing compounds and profiles

This test evaluates compatibility of coatings with both sealing compounds and sealing profiles. Testing should cover sticking, re-softening and discoloration.

A.9 Blue stain in service

Blue stain in service arises from colonization during or after manufacture as opposed to the growth of blue stain fungi already present in the timber. It is particularly associated with *Aureobasidium pullulans* and is a potential problem for transparent and semi-transparent coatings, though it can also disfigure the surface of opaque coatings. It can be controlled by fungicides. The test will confirm fungicidal effectiveness of the total system tested.

A.10 Blister box test

This test gives early warning of any propensity towards blistering and is recommended for new products which do not have an established track record of performance.

A.11 Mould growth

This test indicates whether the product has some resistance to surface mould. Mould growth is very dependent on local conditions, formulation factors, and can occur to some degree even in the presence of fungicidal protection. For this reason the test is relative to the performance of the ICP. The latter contains a well characterized biocide which is known to provide a realistic benchmark. The test procedure includes a margin to allow for test repeatability. Biocides also have potential health risks and might require additional warning labels. They might also be subject to national regulations. For this reason some manufacturers might choose not to use biocides and users should balance the need for mould protection against any environmental legislation or health concerns when selecting products.

A.12 Natural weathering with water trap

This test is an additional option of the standard weathering test (EN 927-3) and differs in that the test panel has an additional challenge in the form of a circular water trap cut through the coating. It can be employed to obtain extra information on the performance of a coating system on wood components which might be at risk from water entry.

A.13 Natural weathering – Alternative substrates

As noted in the discussion under A.3, the natural weathering test EN 927-3 requires the use of pine to claim full conformity, but also allows for optional testing on alternative wood species, machine finish or preservative pre-treatment. This enables a manufacturer to determine the level of performance (relative to pine) that can be achieved on other substrates and provides a route for users to request and compare information on specified substrates.

Bibliography

- [1] EN 152-1, *Test methods for wood preservatives — Laboratory method for determining the preventive effectiveness of a preservative treatment against blue stain in service — Part 1: Brushing procedure*
- [2] EN 152-2, *Test methods for wood preservatives — Laboratory method for determining the preventive effectiveness of a preservative treatment against blue stain in service — Part 2: Application by methods other than brushing*
- [3] EN ISO 4622, *Paints and varnishes — Pressure test for stackability (ISO 4622:1992)*
- [4] BS 7956:2000, *Specification for primers for woodwork*

This page has been intentionally left blank

BS EN
927-2:2006

BSI Group
Headquarters 389
Chiswick High Road,
London, W4 4AL, UK
Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
[www.bsigroup.com/
standards](http://www.bsigroup.com/standards)

BSI - British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001 Email: orders@bsigroup.com You may also buy directly using a debit/credit card from the BSI Shop on the Website <http://www.bsigroup.com/shop>

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact Information Centre. Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048 Email: info@bsigroup.com

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001 Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsigroup.com/BSOL>

Further information about BSI is available on the BSI website at <http://www.bsigroup.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. 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.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright and Licensing Manager. Tel: +44 (0)20 8996 7070 Email: copyright@bsigroup.com