SLOVENSKI STANDARD
SIST EN 927-14:2023

01-maj-2023

Barve in laki - Premazi in premazni sistemi za zaščito lesa za zunanjo uporabo - 14. del: Določanje nateznih lastnostii premaznih filmov

Paints and varnishes - Coating materials and coating systems for exterior wood - Part 14: Determination of tensile properties of coating films

Beschichtungsstoffe - Beschichtungsstoffe und Beschichtungssysteme für Holz im Außenbereich - Teil 14: Bestimmung der Zugeigenschaften von Beschichtungsfilmen

Peintures et vernis - Produits de peinture et systèmes de peinture pour le bois en extérieur - Partie 14 : Détermination des propriétés en traction des films de revêtement

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ICS:

71.100.50	Kemikalije za zaščito lesa	Wood-protecting chemicals
87.040	Barve in laki	Paints and varnishes

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Paints and varnishes - Coating materials and coating systems for exterior wood - Part 14: Determination of tensile properties of coating films

Peintures et vernis - Produits de peinture et systèmes de peinture pour le bois en extérieur - Partie 14 : Détermination des propriétés en traction des films de revêtement

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Page

European foreword

This document (EN 927-14:2023) 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of an identical text or by endorsement, at the latest by July 2023, and conflicting national standards shall be withdrawn at the latest by July 2023.

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Introduction

Wood as a natural exterior construction material may be protected from rain, sunlight and microbial attack by a coating film, thus ensuring its appearance and mechanical integrity over many years. However, since most coatings are permeable to some extent to moisture from rain and air humidity, swelling of the wood and coating occurs. Consequent shrinking of the wood and coating occurs upon drying. The magnitude of swelling and shrinking depends on the amount of moisture uptake and varies depending on the wood species and on the direction of wood movement (longitudinal < radial < tangential). These cyclic expansions and contractions lead to different stresses in the surface coating over time. The coating should ideally stay intact over time and continue to protect the wood substrate. A coating material that is too rigid and brittle will crack and fail allowing increased moisture and water uptake, microbial attack, eventual complete coating failure and possible wood degradation. The tensile properties of the coatings are thus very important for the service lifetime of the coating and wood substrate.

1 Scope

This document specifies a method for determining the tensile properties of free coating films, specifically for exterior wood applications. Typical tensile properties of interest are the modulus of elasticity, the tensile strength and the elongation at break during stretching of a free coating film at constant test speed. The test methods specified in this document are applicable to coatings from which free films can be made.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 927-1:2013, *Paints and varnishes - Coating materials and coating systems for exterior wood - Part 1: Classification and selection*

EN ISO 527-1:2019, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1:2019)*

EN ISO 2808, *Paints and varnishes - Determination of film thickness (ISO 2808)*

EN ISO 4618, *Paints and varnishes - Terms and definitions (ISO 4618)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 4618 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

4 Principle

Tensile test specimens are prepared from free coating films and subjected to a tensile test under defined conditions until they fail. During this procedure, the load sustained by the specimen and the elongation behaviour are recorded.

This document is similar to EN ISO 527-3 and ISO 37 for the testing of plastic and rubber materials but focusses on the specimen preparation and specific testing of free dry coating films made from liquid paints and varnishes intended for application on exterior wooden substrates.

5 Apparatus and materials

5.1 Film application device

Coating films can be prepared by casting the liquid coating material in moulds or by applying it to a suitable non-adhering substrate by a manual procedure or an automatic film applicator; see 6.2.

NOTE Automatic application devices are preferred as they move at constant speed and deliver a more uniform final coating film.

5.2 Test apparatus

The tensile test machine shall comply with the requirements of EN ISO 527-1:2019, 5.1, where applicable. It should be equipped with selectable speed control (typical range: 10 mm/min to 200 mm/min), load and strain indicator and temperature control unit. The strain indicator can either use crosshead travel measurement or extensometer measurement. If an extensometer is used, an optical measurement device is preferred as it does not touch and influence the specimen.

5.3 Coating thickness gauge

For film thickness measurement, all devices using mechanical scanning according to EN ISO 2808 or equivalent methods are applicable.

6 Test specimens

6.1 Sampling of coating products

Take a representative specimen of the liquid coating material to be tested as specified in EN ISO 15528.

Deaerating of the coating material should be considered (e.g. in a centrifuge or in a high-speed vacuum mixer).

6.2 Preparation of test specimens

Prepare the test specimens by casting the liquid coating material into shallow (e.g. silicone rubber-based) moulds (in case of low viscosity coating materials) or by drawing the (more viscous) coating material as a wet film on a flat support (e.g. on a PTFE coated metal plate, POM or inert foil, e.g. based on untreated PP or PE) with a broad film applicator. The substrate shall be levelled horizontally before applying the coating material.

The substrate shall allow the dry film to be removed easily without the need for additional wetting or pre-stressing it. For cast films, apply the proper amount of (wet) coating material to produce the requested dry film thickness.

In the case of inert foils as substrate it is recommended to attach them to the levelled flat support (typically a glass plate) by wetting the backside with oil or water, avoiding entrapped air bubbles. The wet coating film should preferably be applied on the foil with an automatic film applicator at an appropriate speed.

The coating films to gain the final test specimens shall be prepared at controlled conditions in a standard atmosphere [(23 ± 2) °C, (50 ± 10) % relative humidity or (20 ± 2) °C, (65 ± 10) % relative humidity]. The cured coating films shall be free from cracks, bubbles or other defects.

Pre-treatment, e.g. by heat, or immersion in water to ease the removal of coating films from the substrate shall not be used as it may strongly influence the mechanical film properties. Pre-treatments potentially cause thermal change of film morphology or leaching of water-soluble ingredients in an uncontrolled way.

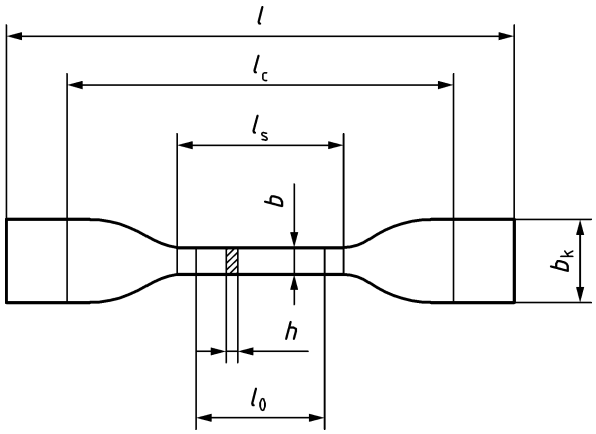
6.3 Shape and size

To determine tensile performance, two different specimen geometries are applicable and shall be agreed upon among the contracting partners.

Figure 1 shows the dimensions and tolerances of the test specimens according to geometry I. It is identical to type S2 of ISO 37. Advantages of this geometry is, that specimens are small, which makes it easy to get them defect free, and they normally break controlled in the central position. Both wider ends usually do not show any deformation as the stress will be concentrated in the middle position. This geometry type I

is commonly used in other applications like plastics, packaging foils, rubbers and elastomers and is recommended for highly flexible materials.

NOTE Specific punching devices for preparation of specimens according to geometry I are commercially available.

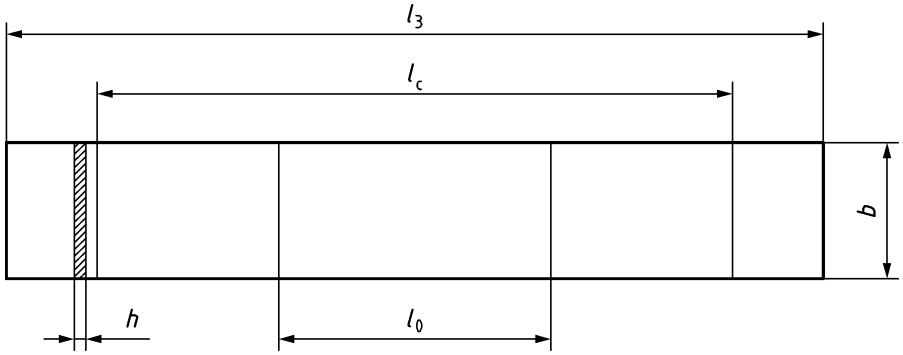


Key

b_k	width at end (for fixation):	12,5 mm
h	film thickness:	minimum 60 µm, preferred 100 µm
l	total length:	75 mm
l_s	length of bar:	25 mm
b	width of bar:	4 mm
l_0	gauge length:	20 mm
l_c	clamping length:	50 mm

Figure 1 — Dimensions of test specimen type I

Figure 2 shows the dimensions and tolerances of the test specimens according to geometry II. It is identical to specimen type 2 of EN ISO 527-3. The advantage of this geometry is that the specimens are easy to cut.



Key

h	film thickness:	minimum 60 µm
b	width:	15 mm
l_3	total length:	minimum 80 mm[a]
l_0	gauge length:	20 mm
l_c	clamping length	50 mm

[a] Total length needed depends on the tensile testing device.

Figure 2 — Dimensions of test specimen type II

6.4 Thickness

The dry film thickness shall be sufficient to ensure handling of the test specimen and repeatability of test results. It is recommended to prepare films with at least 60 µm dry layer thickness, which corresponds to high build and very high build exterior wood coatings as specified in EN 927-1:2013, 4.3.2, but also applies to low and medium build coating systems, when they are cast in a mould or applied in multiple layers.

NOTE Dry film thickness will influence the tensile properties, which are therefore normalized in the calculation (7.5 and 7.7). However, due to secondary effects, and for comparative investigations, it is better to work with free films of the same dry film thickness. Very high dry film thicknesses of 300 µm to 400 µm (corresponding to around 1 000 µm wet film thickness) are easier to handle and deliver smaller standard deviation but can lead to higher strain at break values.

6.5 Conditioning

The dried coating films should be conditioned in a standard atmosphere [(23 ± 2) °C, (50 ± 10) % relative humidity or (20 ± 2) °C, (65 ± 10) % relative humidity] for 28 days. Other conditions may be agreed upon between interested parties, but minimum drying time shall be 14 days.

6.6 Cutting of test specimens

Before cutting the specimens, the coating film shall be carefully peeled from the substrate without using water or solvents to avoid leaching of coating compounds. Before cutting the specimens, the films should be checked visually to select films free of any defects. Backlighting may help for opaque coatings.

A minimum of ten test specimens shall be cut or punched carefully with a very sharp cutting tool to avoid splitting at the edges and any other defects. The test specimens shall be cut with their longest side in the direction of the film applicator displacement. If assessment of anisotropic properties of the coating film