BS EN 13523-4:2014

BSI Standards Publication

Coil coated metals — Test methods

Part 4: Pencil hardness

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National foreword

This British Standard is the UK implementation of EN 13523-4:2014. It supersedes BS EN 13523-4:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee STI/21, Surface preparation of steel.

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

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Coil coated metals - Test methods - Part 4: Pencil hardness

Tôles prélaquées - Méthodes d'essai - Partie 4: Dureté crayon

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Foreword

This document (EN 13523-4:2014) 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of an identical text or by endorsement, at the latest by January 2015 and conflicting national standards shall be withdrawn at the latest by January 2015.

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 13523-4:2001.

The main technical changes are:

a) the definition of pencil hardness was amended;

b) the term “remove the coating” was corrected to “scratch the coating” in the description of the result of the test;

c) a remark on preconditioning was added;

d) concerning the applicability of the pencil hardness test, a reference to EN ISO 15184 was added.

EN 13523, *Coil coated metals — Test methods*, consists of the following parts:

— *Part 0: General introduction*

— *Part 1: Film thickness*

— *Part 2: Gloss*

— *Part 3: Colour difference — Instrumental comparison*

— *Part 4: Pencil hardness*

— *Part 5: Resistance to rapid deformation (impact test)*

— *Part 6: Adhesion after indentation (cupping test)*

— *Part 7: Resistance to cracking on bending (T-bend test)*

— *Part 8: Resistance to salt spray (fog)*

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— *Part 10: Resistance to fluorescent UV radiation and water condensation*

— *Part 11: Resistance to solvents (rubbing test)*

— *Part 12: Resistance to scratching*

— *Part 13: Resistance to accelerated ageing by the use of heat*

— *Part 14: Chalking (Helmen method)*

— *Part 15: Metamerism*

— *Part 16: Resistance to abrasion*

— *Part 17: Adhesion of strippable films*

— *Part 18: Resistance to staining*

— *Part 19: Panel design and method of atmospheric exposure testing*

— *Part 20: Foam adhesion*

— *Part 21: Evaluation of outdoor exposed panels*

— *Part 22: Colour difference — Visual comparison*

— *Part 23: Resistance to humid atmospheres containing sulfur dioxide*

— *Part 24: Resistance to blocking and pressure marking*

— *Part 25: Resistance to humidity*

— *Part 26: Resistance to condensation of water*

— *Part 27: Resistance to humid poultice (Cataplasm test)*

— *Part 29: Resistance to environmental soiling (Dirt pick-up and striping)*

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1 Scope

This part of EN 13523 describes the procedure to assess the relative hardness of an organic coating on a metallic substrate, by means of pencils of known hardness.

Smooth surfaces will give more accurate results but the method is also applicable for textured surfaces. The more pronounced the texture, the greater the unreliability of results.

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 13523-0:2014, *Coil coated metals — Test methods — Part 0: General introduction*

EN 23270, *Paints and varnishes and their raw materials - Temperatures and humidities for conditioning and testing (ISO 3270)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13523-0:2014 and the following apply.

3.1
pencil hardness
resistance of the coating surface to scratching when a pencil with a specified dimension, shape and hardness of the lead is pushed across the surface

4 Principle

The coating is intentionally damaged by pencils of increasing hardness. The hardest lead which does not scratch the coating for a minimum of 3 mm length determines the degree of hardness.

5 Apparatus and materials

Ordinary laboratory apparatus, together with the following:

5.1 Set of Cretacolor^{TM} or Faber Castell drawing pencils[1)] or their equivalents in the following range:

6B, 5B, 4B, 3B, 2B, B, HB, F, H, 2H, 3H, 4H, 5H, 6H

(softer) (harder)

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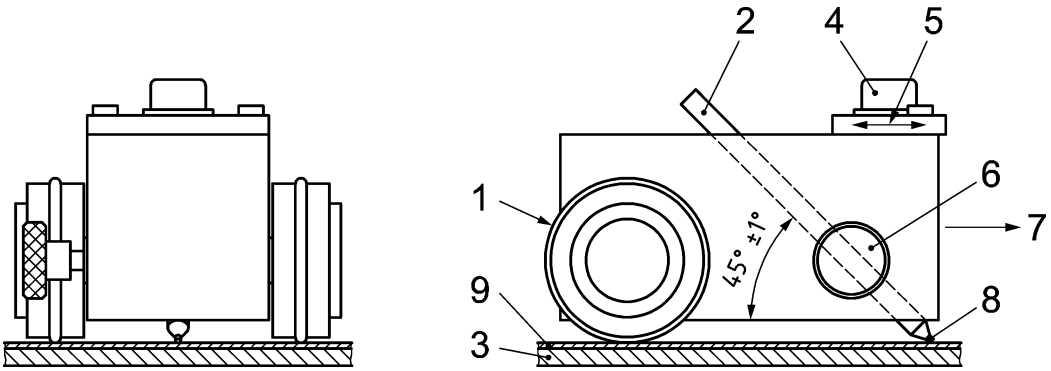
1) Cretacolor is the trade name of a product supplied by Brevillier & Co. and A. Urban & Söhne. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown to lead to the same results. Cretacolor^{TM} and Faber Castell pencils have been found to be the most uniform and the most reproducible.

5.2 Special mechanical sharpener, which will remove the wood only, leaving the cylindrical pencil lead intact (see Figure 2).

5.3 Abrasive paper, No. 400 Emery paper is suitable.

5.4 Lead holder, as appropriate.

5.5 Mechanical device, consisting of a metal block, provided with two wheels on one side of the block. In the middle of the metal block there is a cylindrical hole at an angle of 45°. With the help of a clamp, pencils can be fixed in the device, always in the same manner. A level indicator on the top of the device ensures that testing is carried out horizontally. The device shall be designed so that in the horizontal position a load of (7,5 ± 0,1) N is excerted on the tip of the pencil. An example of a suitable device is shown in Figure 1.



Key

1 rubber O-ring
2 pencil
3 substrate
4 level
5 small, movable weight
6 clamp
7 direction of motion of instrument
8 pencil lead
9 paint film

Figure 1 — Schematic diagram of test instrument

6 Sampling

See EN 13523-0.

7 Test panels

See EN 13523-0.

8 Procedure

Measure the pencil hardness of the organic coating at ambient temperature. For more accurate measurements, as required for instance in case of dispute, the temperature shall be (23 ± 2) °C and the relative humidity (50 ± 5) %, in accordance with EN 23270. Conditioning is carried out in accordance with EN 13523-0:2014, Clause 6. Sharpen the pencils (5.1) so that 5 mm to 6 mm of lead, free from nicks and perfectly cylindrical in shape, extends either beyond the wood or beyond the chuck if a holder is used. Then trim the lead on the abrasive paper (5.3) to obtain a level and perfectly circular section whose diameter is

equivalent to the pencil lead and whose end is as near as possible at right angles to the axis of the pencil (see Figure 2).

Dimensions in millimetres

Figure 2 — Schematic view of pencil after sharpening

Hold the prepared pencil at 45° to the surface of the coating and push it forward with a force of 7,5 N downward pressure without breaking the lead.

For inspection purposes this test is usually performed manually but for better reproducibility and more accurate measurements a mechanical device (5.5) shall be used in which case a force of 7,5 N shall be applied to the lead.

Make successive tests until the hardest lead which does not scratch the coating for a minimum of 3 mm length is determined, the pencil or holder being rotated to present a fresh edge before each trial.

Before examination remove the lead residue from the test specimen.

9 Expression of results

Indicate as the pencil hardness the reference number of the hardest lead which does not scratch the coating for a minimum of 3 mm length. The nature of the damage, i.e. whether or not the scratch goes through the coating to the substrate, shall be reported.

10 Precision

10.1 General

Smooth surfaces will give more accurate results but the method is also applicable for textured surfaces. The more pronounced the texture, the greater the unreliability of results.

Information on the applicability of the pencil hardness test see EN ISO 15184:2012, Annex A.

10.2 Repeatability

This method demands a measure of practical experience in conducting the test in order to obtain repeatable results.

10.3 Reproducibility

The absolute results can vary widely when carried out with different devices, by different persons, or with pencils of different batches or from different manufacturers.

However, the results obtained give qualitative information only.

11 Test report

The test report shall contain at least the following information:

a) all details necessary to identify the product tested;

b) a reference to this part of EN 13523 (EN 13523-4);

c) identification of the pencils used;

d) whether a mechanical device has been used;

e) the results of the test, as indicated in Clause 9;

f) any deviation from the test method specified;

g) any unusual features (anomalies) observed during the test;

h) the date of the test.

Bibliography

EN 1396, *Aluminium and aluminium alloys - Coil coated sheet and strip for general applications - Specifications*

EN 10169, *Continuously organic coated (coil coated) steel flat products — Technical delivery conditions*

EN ISO 15184:2012, *Paints and varnishes - Determination of film hardness by pencil test (ISO 15184:2012)*

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