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COIL COATED METALS - TEST METHODS -

PART 6: ADHESION AFTER INDENTATION

(CUPPING TEST)

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Foreword

This document EN 13523-6:2002 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of an identical text or by endorsement, at the latest by January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This Part of EN 13523 defines terms of the procedure for determining the adhesion of an organic coating to a metallic substrate after indentation after slow deformation.

The resistance to cracking can also be evaluated.

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 13523-0:2001, *Coil coated metals - Test methods - Part 0: General introduction and list of test methods.*

EN 23270:1991, *Paints and varnishes and their raw materials - Temperatures and humidities for conditioning and testing (ISO 3270:1984).*

EN ISO 1520:2001, *Paints and varnishes - Cupping test (ISO 1520:1999).*

IEC 60454-2:1994, *Specification for pressure-sensitive adhesive tapes for electrical purposes - Part 2: Methods of test.*

3 Terms and definitions

For the purposes of this Part of EN 13523, the terms and definitions given in EN 13523-0:2001 apply.

4 Principle

The test specimen is cross-hatched with a cutting tool and is then deformed by pressing under specified conditions. After pressing, the test specimen can be artificially aged by immersion in boiling water.

5 Apparatus and materials

5.1 Cross-hatching device

A single-bladed knife, very sharp to avoid any burrs. For coatings less than 60 µm in thickness, it is also possible to use a purpose-made cutting tool, capable of making a minimum of 6 parallel cuts.

5.2 Pressing device

Apparatus in accordance with EN ISO 1520:2001, consisting essentially of:

a) a steel die, of inside diameter (27 ± 0,05) mm, its contact surface with the test specimen being flat and polished;

b) a retainer ring, having its flat and polished surface in contact with the test specimen;

c) a striker consisting of a polished steel sphere, of diameter (20 ± 0,05) mm with a maximum of 0,1 mm displacement from the axis of the die;

d) a system, preferably hydraulic, allowing movement of the striker at a speed of (12 ± 6) mm/min.

5.3 Ageing device

The ageing device shall consist of:

a) a vessel, to contain boiling water, whose dimensions allow the complete immersion of the test specimen;

b) a heating system.

5.4 Pincers, the jaws of which shall be flat, blunt and having a width of at least 5 mm.

5.5 Magnifying glass ×10.

5.6 Transparent pressure-sensitive adhesive tape, 25 mm wide, with an adhesion strength of (10 ± 1) N per 25 mm width when tested in accordance with IEC 60454-2:1994.

6 Sampling

See EN 13523-0:2001.

7 Test panels

See EN 13523-0:2001.

8 Procedure

8.1 Ambient conditions

Measure the coating adhesion 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 23270:1991.

8.2 Cross-hatching (not used for evaluation of resistance to cracking)

8.2.1 For coatings greater than or equal to 60 µm thickness (see Figure 1)

Make two parallel cuts 5 mm apart, together with two additional similar cuts at right angles to form a central 5 mm × 5 mm square.

Each cut shall just reach the metallic substrate, and each cut shall measure at least 50 mm in length.

Each cut shall be at a distance of not less than 20 mm from the edge of the test panel.

8.2.2 For coatings less than 60 µm thickness (see Figure 2)

Make at least six parallel cuts 1 mm apart, together with at least six additional similar cuts at right angles.

Each cut shall just reach the metallic substrate, and each cut shall measure at least 50 mm in length.

Each cut shall be at a distance of not less than 20 mm from the edge of the test panel.

NOTE At this stage none of the squares formed exhibit adhesion failure from the metallic substrate.

8.3 Pressing

Choose an indentation depth in millimetres, for example 80 % of the depth which ruptures the metallic substrate.

Clamp the test panel between the retainer ring and the die, the coating facing the die and the end of the striker being in contact with the test panel. The measuring device shall be in position 0. Ensure that the cross-hatching shall be centred on the dome.

Move the spherical end of the striker at constant speed of (12 ± 6) mm/min to reach the chosen depth of indentation.

8.4 Ageing (optional and only for coatings greater than or equal to 60 µm thickness)

Immerse the test panel in boiling water for at least 1 h.

If required, the test can be run for longer periods of time.

Generally, ageing shall be carried out after the deformation but in some cases it may be performed before.

8.5 Assessment of adhesion

8.5.1 For coatings greater than or equal to 60 µm thickness

Make an attempt to pull the strips of the organic coating away from the metallic substrate in each of the four directions, starting from the central square. Lift the end of the strips with the knife (5.1), then pull with the pincers (5.4) until the rupture of the strip.

Observe the extent of the peeling and express in percentage of the distance between the top and the base of the dome.

If ageing is carried out, express the adhesion as a percentage of peeling for the ageing period.

8.5.2 For coatings less than 60 µm thickness

Remove two complete laps from a reel of the adhesive tape (5.6) and discard. Remove an additional length at a steady rate and cut a piece, approximately 75 mm long.