BS EN 13523-3:2014

BSI Standards Publication

Coil coated metals — Test methods

Part 3: Colour difference — Instrumental comparison

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National foreword

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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 3: Colour difference - Instrumental comparison

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Contents

Page

Foreword

This document (EN 13523-3:2014) 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of an identical text or by endorsement, at the latest by December 2014, and conflicting national standards shall be withdrawn at the latest by December 2014.

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 13523-3:2001.

The main technical changes are:

a) the definitions were aligned with those in EN ISO 4618;

b) the scope and procedure were amended.

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)*

— *Part 9: Resistance to water immersion*

— *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 specifies procedures for determining the instrumental colour difference (CIELAB) of an organic coating on a metallic substrate.

Establishing a standard as well as the magnitude of an acceptable colour difference are not covered by this method.

Two methods are given in this part of EN 13523:

a) instrumental colour difference measurement using a tristimulus colorimeter;

b) instrumental colour difference measurement using a spectrophotometer or equivalent.

Care should be taken when measuring e.g.

— textured surfaces;

— fluorescent coatings;

— metameric coatings;

— multi-coloured, pearlescent, metallic or special colour effect coatings.

In order to determine whether metamerism is present, the metamerism index is determined (see EN 13523-15) and/or a visual examination (see EN 13523-22) is performed with different artificial light sources.

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)*

EN ISO 11664-4, *Colorimetry — Part 4: CIE 1976 L*a*b* Colour space (ISO 11664-4)*

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
colour
sensation resulting from the perception of light of a given spectral composition by the human eye

Note 1 to entry: The use of the German word “Farbe” alone, i.e. not in combinations of words, for coating materials is deprecated.

Note 2 to entry: A colour is characterized by hue, chroma, and lightness.

[SOURCE: FprEN ISO 4618:2014, 2.58]

3.2
embossed coating
coating which, when dried, has been mechanically impressed with a pattern

3.3
metamerism
phenomenon perceived when two specimens have the same colour under the lighting of an illuminant, but different spectral reflection and transmission curves

[SOURCE: FprEN ISO 4618:2014, 2.157]

3.4
textured coating
coating which, after drying, is characterized by a regularly structured surface

[SOURCE: FprEN ISO 4618:2014, 2.255]

4 Principle

The tristimulus values X, Y and Z (see EN ISO 11664-3) of both standard colour reference panel (called “standard” through the text) and specimen are measured. Colour differences between the two measurements are calculated from these tristimulus values.

5 Apparatus

Ordinary laboratory apparatus, together with the following:

5.1 Tristimulus colorimeter.

5.2 Recording spectrophotometer or equivalent. The instrument shall provide the possibility of obtaining the tristimulus values either for the 2°-standard colorimetric observer and source C or for the 10°-supplementary standard colorimetric observer and source D65. The latter conditions of 10° observer and D65 source are preferred.

Preferably the measured area shall have a minimum diameter of 10 mm. If a smaller diameter is used, this shall be stated in the test report.

6 Sampling

See EN 13523-0.

7 Specimens

See EN 13523-0.

The surfaces to be measured shall be at least as large as the area of the measuring aperture and shall be flat against the measuring aperture.

8 Procedure

8.1 Calibration

Use the apparatus in accordance with the manufacturer's instructions, particularly with regard to warm-up time and calibration.

8.2 Measurement

Measure the colour at ambient temperature. In cases of dispute, the test temperature shall be defined as (23 ± 2) °C and the relative humidity as (50 ± 5) %, in accordance with EN 23270. Conditioning is carried out in accordance with EN 13523-0:2014, Clause 6.

Measure in the wavelength range of at least 400 nm to 700 nm in intervals not greater than 20 nm with a half-intensity width of the monochromator less than 20 nm. In special cases, such as highly chromatic paint films with steep spectral reflectance curves measurements in 10 nm or 5 nm intervals using a monochromator with 10 nm or 5 nm half-intensity width are more accurate.

The illumination/viewing geometry shall be one of the following:

a) 45°:0° or 0°:45°;

b) integrating sphere (d:8° or 8°:d). The inclusion or exclusion of specular reflection shall be stated in the test report.

Determine first the tristimulus values of the standard or recall them from a data file. Thereafter determine the tristimulus values of the specimen to be measured.

Using these tristimulus values, calculate the colour difference and its components, using the CIELAB formula given in EN ISO 11664-4. Usually the software associated with the spectrophotometer shall give the absolute Lab values and the colour difference on each colour dimension. If a different colour equation is used, this shall be stated in the test report.

Colour differences shall not be compared when they are obtained by different colour scale system equations.

In case of dispute the test shall be carried out on the same equipment.

Textured and embossed coatings should be measured with an integrating sphere or with 45°-annular/circumferential illumination. An average result can be obtained by turning the specimens three times through 90° to obtain four measurements.

9 Expression of results

Express the value of the instrumental colour difference in terms of the relevant colour coordinates ΔL^* Δa^* Δb^* or ΔL^* ΔC^*_{ab} ΔH^*_{ab} in addition to the total colour difference ΔE^*_{ab}.

ΔL^*	positive	=	lighter than standard
ΔL^*	negative	=	darker than standard
Δa^*	positive	=	Redder/less green than standard
Δa^*	negative	=	Greener/less red than standard
Δb^*	positive	=	Yellower/less blue than standard

Δb^*	negative	=	Bluer/less yellow than standard
ΔC^*_{ab}	positive	=	specimen has more chroma (colour saturation) relative to the standard
ΔC^*_{ab}	negative	=	specimen has less chroma (colour saturation) relative to the standard
ΔH^*_{ab}	positive	=	In the CIELAB system ΔH^*_{ab} positive indicates that the hue angle (arctan b^*/a^*) deviates from the standard in an anticlock-wise direction, i.e. in the sequence red to yellow to green to blue.
ΔH^*_{ab}	negative	=	The hue angle deviates from the standard in a clockwise direction, i.e. in the sequence blue to green to yellow to red.

The total colour difference ΔE^*_{ab} is a mathematical combination of the above colour difference components. Calculate the total colour difference ΔE^*_{ab}, of textured coatings as the mean of the individual ΔE^*_{ab} measurements.

10 Accuracy

For dark colours (e.g. blues, browns, blacks) or for bright colours of high chroma (e.g. reds, yellows), the error in reflectance measurement at certain wavelengths might be sufficient to give misleading results. In these cases visual comparison is essential (see EN 13523-22).

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 13523-3);

c) the instrument used;

d) the source and observer used;

e) the geometry used;

f) the colour difference equation;

g) inclusion or exclusion of specular reflection;

h) the colour difference value (see Clause 9);

i) components of the colour difference, if required;

j) any deviation from the test method specified;

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

l) the date of the test.

Bibliography

[1] EN 1396, *Aluminium and aluminium alloys — Coil coated sheet and strip for general applications — Specifications*

[2] EN 10169:2010+A1:2012, *Continuously organic coated (coil coated) steel flat products — Technical delivery conditions*

[3] EN 13523-15, *Coil coated metals — Test methods — Part 15: Metamerism*

[4] EN 13523-22, *Coil coated metals — Test methods — Part 22: Colour difference — Visual comparison*

[5] FprEN ISO 4618:2014, *Paints and varnishes — Terms and definitions (ISO/FDIS 4618:2014)*

[6] EN ISO 11664-3, *Colorimetry — Part 3: CIE tristimulus values (ISO 11664-3)*

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