

Continuously organic coated (coil coated) steel flat products —

Part 1. General information (definitions, materials, tolerances, test methods)

The European Standard EN 10169-1 : 1996 has the status of a
British Standard

ICS 77.140.50

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Committees responsible for this British Standard

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- British Railways Board
- British Steel Industry
- Cold Rolled Sections Association
- Society of Motor Manufacturers and Traders Limited

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- British Welded Steel Tube Association
- Coated Metals Limited
- Department of the Environment (Property Services Agency)
- International Tin Research Institute
- Metal Roof Deck Association
- National Association of Steel Stockholders
- National Centre of Tribology
- Paintmakers Association of Great Britain Ltd.
- Zinc Development Association

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National foreword

This British Standard has been prepared by Technical Committee ISE/10 and is the English language version of EN 10169-1 : 1996, *Continuously organic coated (coil coated) steel flat products — Part 1: General information (definitions, materials, tolerances, test methods)*, published by the European Committee for Standardization (CEN). It supersedes BS 6781 : 1986 which is withdrawn. Part 2 of this standard, *Performance requirements for building applications*, is in preparation.

Cross-references

Publication referred to	Corresponding British Standard
EN 10143 : 1993	BS EN 10143 : 1993 <i>Continuously hot-dip metal coated steel sheet and strip — Tolerances on dimensions and shape</i>
EN 10147 : 1991	BS EN 10147 : 1992 <i>Specification for continuously hot-dip zinc coated structural steel sheet and strip — Technical delivery conditions</i>
EN 10152 : 1993	BS EN 10152 : 1994 <i>Specification for electrolytically zinc coated cold rolled steel flat products — Technical delivery conditions</i>
EN 10204 : 1991	BS EN 10204 : 1991 <i>Metallic products — Types of inspection documents</i>
EN 10214 : 1995	BS EN 10214 : 1995 <i>Continuously hot-dipped zinc-aluminium (ZA) coated steel strip and sheet — Technical delivery conditions</i>
EN 10215 : 1995	BS EN 10215 : 1995 <i>Continuously hot-dip zinc aluminium (AZ) coated steel strip and sheet — Technical delivery conditions</i>
EURONORM 153	BS 6582 : 1985 <i>Specification for continuously hot-dip lead alloy (terne) coated cold reduced carbon steel flat rolled products</i>
EN 23270 : 1991	BS EN 23270 : 1991 <i>Specification for temperatures and humidities for conditioning and testing paints, varnishes and their raw materials</i>
EN ISO 1519 : 1995	BS EN ISO 1519 : 1995 <i>Paints and varnishes — Bend test (cylindrical mandrel)</i>
EN ISO 1520 : 1994	BS EN ISO 1520 : 1995 <i>Paints and varnishes — Cupping test</i>
EN ISO 2409 : 1994	BS EN ISO 2409 : 1995 <i>Paints and varnishes cross-cut test</i>
EN ISO 6272	BS EN ISO 6272 : 1994 <i>Paints and varnishes — Falling — Weight test</i>
EURONORM 12	BS 1639 : 1964 <i>Methods for bend testing of metals</i>
ISO 1043-1 : 1987	BS 3502 : <i>Symbols for plastics and rubber materials</i> Part 1 : 1991 <i>Schedule for symbols for plastics</i> BS 3900 : <i>Methods of test for paints</i>
ISO 1518 : 1992	Part E2 : 1992 <i>Scratch test</i>
ISO 2808 : 1991	Part C5 : 1992 <i>Determination of film thickness</i>
ISO 2813 : 1994	Part D5 : 1995 <i>Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85°</i>
ISO 2815	Part E9 : 1976 <i>Buchholz indentation test</i> Groups D: <i>Optical tests on paint films</i>
ISO 3668 : 1976	Part D1 : 1978 <i>Visual comparison of the colour of paints</i> BS 3900 : Group H : <i>Evaluation of paint and varnish defects</i>
ISO 4628-1 : 1982	Part H1 : 1983 <i>Designation of intensity, quantity and size of common types of defect: general principles and rating schemes</i>
ISO 4628-2 : 1982	Part H2 : 1983 <i>Designation of degree of blistering</i>
ISO 4628-3 : 1983	Part H3 : 1983 <i>Designation of degree of rusting</i>
ISO 4628-4	Part H4 : 1983 <i>Designation of degree of cracking</i>
ISO 4628-5 : 1982	Part H5 : 1983 <i>Designation of degree of flaking</i>

ISO 4628-6 : 1990	Part H6 : 1991 <i>Rating of degree of chalking by tape method</i> BS 2782 : <i>Methods of testing plastics</i> Part 5: <i>Optical and colour properties, weathering</i>
ISO 4892-1 : 1994	Method 540D : 1995 <i>Methods of exposure to laboratory light sources — General guidance</i>
ISO 4892-2 : 1994	Method 540E : 1995 <i>Methods of exposure to laboratory light sources — Xenon-arc sources</i>
ISO 4892-2 : 1994	Methods 540F : 1995 <i>Methods of exposure to laboratory light sources — Fluorescent UV lamps</i>
ISO 4892-4 : 1994	Method 540G : 1995 <i>Methods of exposure to laboratory light sources — Open flame carbon-arc lamps</i> BS 3900 : <i>Methods of test for paints</i>
ISO 7253 : 1994	Part F12 : 1985 <i>Determination of resistance to neutral salt spray</i>
ISO 7724-1 : 1984	Part D8 : 1986 <i>Determination of colour and colour difference: principles</i>
ISO 7724-2 : 1984	Part D9 : 1986 <i>Determination of colour and colour difference: measurement</i>
ISO 7724-3 : 1984	Part D10 : 1986 <i>Determination of colour and colour difference: calculation</i> Group F: <i>Durability tests on paint films</i>
ISO 11341 : 1994	Part F14 : 1995 <i>Determination of resistance to artificial weathering by exposure to filtered xenon-arc radiation</i>

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the EN title page, pages 2 to 14, an inside back cover and a back cover.

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Descriptors: iron and steel products, metal plates, wide strips, strips, steel strips, organic coatings, design, materials, characteristics, tests, dimensional tolerances, inspection, marking, storage

English version

Continuously organic coated (coil coated) steel flat products Part 1: General information (definitions, materials, tolerances, test methods)

Produits plats en acier revêtus en continu de matières organiques (prélaqués)	Kontinuierlich organisch beschichtete (bandbeschichtete) Flacherzeugnisse aus Stahl
Partie 1: Généralités (définitions, matériaux, tolérances, méthodes d'essai)	Teil 1: Allgemeines (Definitionen, Werkstoffe, Grenzabweichungen, Prüfverfahren)

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 27, Surface coated flat products — Qualities, dimensions, tolerances and specific tests, the secretariat of which is held by DIN. This European Standard supersedes

EURONORM 169-1985: *Continuously organic coated steel flat products*

published by the European Coal and Steel Community. 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 February 1997, and conflicting national standards shall be withdrawn at the latest by February 1997. According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

1.1 This European Standard provides information on the selection and ordering of continuously organic coated (coil coated) steel flat products and specifies appropriate technical requirements for the products, e.g. for test methods and tolerances on coating thickness, appearance, and product dimensions and shape.

This European Standard applies to rolled steel flat products, with or without metallic coatings, that are continuously organic coated by the coil coating process.

The products covered are wide strip, sheets cut from wide strip, slit wide strip, strip rolled in widths less than 600 mm and cut lengths (from sheet or strip).

1.2 The products covered by this European Standard may be used to advantage in cases where corrosion resistance and decorative appearance are of primary importance. They have applications throughout the flat products processing industry, e.g. in the building construction, automotive, appliances, furniture and technical packaging industries.

Coil coated steel flat products may be delivered in numerous types and grades, depending on the base material used (various grades of steel with or without metallic coating), on the coating material and coating type and on the requirements for the surface appearance, the formability and general performance. The properties of the products may vary within greater or smaller limits depending on the choice and combination of the characteristics mentioned and the time of storage.

1.3 For specific applications of coil coated steel flat products additional parts are foreseen, e.g. Part 2: *Products for building exterior applications*.

1.4 This European Standard is not applicable to continuously organic coated

- tin mill flat products;
- electrical steels;
- steel strapping.

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 publications referred to applies.

2.1 Standards for the substrates

ENV 606	<i>Bar coded transport and handling labels for steel products</i>
EN 10020	<i>Definition and classification of grades of steel</i>
EN 10021	<i>General technical delivery requirements for steel and steel products</i>
EN 10025	<i>Hot rolled products of non-alloy structural steels — Technical delivery conditions</i>
EN 10027-1	<i>Designation systems for steel — Part 1: Steel names — principal symbols</i>
EN 10027-2	<i>Designation systems for steel — Part 2: Steel numbers</i>
EN 10048	<i>Hot rolled narrow steel strip — Tolerances on dimensions and shape</i>
EN 10051	<i>Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels — Tolerances on dimensions and shape</i>
EN 10079	<i>Definition of steel products</i>
EN 10111	<i>Continuously hot-rolled low carbon steel sheet and strip for cold forming — Technical delivery conditions</i>
EN 10130	<i>Cold rolled low carbon steel flat products for cold forming — Technical delivery conditions</i>
EN 10131	<i>Cold rolled uncoated low carbon and high yield strength steel flat products for cold forming — Tolerances on dimensions and shape</i>
EN 10139	<i>Cold rolled uncoated mild steel narrow strip for cold forming — Technical delivery conditions</i>
EN 10140	<i>Cold rolled narrow steel strip — Tolerances on dimensions and shape</i>
EN 10142	<i>Continuously hot-dip zinc coated low carbon steel sheet and strip for cold forming — Technical delivery conditions</i>
EN 10143	<i>Continuously hot-dip metal coated steel sheet and strip — Tolerances on dimensions and shape</i>
EN 10147	<i>Continuously hot-dip zinc-coated structural steel sheet and strip — Technical delivery conditions</i>

EN 10152	<i>Electrolytically zinc coated cold rolled steel flat products — Technical delivery conditions</i>	EN ISO 6272	<i>Paints and varnishes — Falling-weight test</i>
EN 10154	<i>Continuously hot-dip aluminium-silicon (AS) coated steel strip and sheet — Technical delivery conditions</i>	EURONORM 12 ²⁾	<i>Bend test for steel sheet and strip less than 3 mm thick</i>
EN 10204	<i>Metallic products — Types of inspection documents</i>	ISO/DIS 1043-1	<i>Plastics — Symbols — Part 1: Basic polymers and their special characteristics</i>
EN 10214	<i>Continuously hot-dip zincaluminium (ZA) coated steel strip and sheet — Technical delivery conditions</i>	ISO 1518	<i>Paints and varnishes — Scratch test</i>
EN 10215	<i>Continuously hot-dip aluminium-zinc (AZ) coated steel strip and sheet — Technical delivery conditions</i>	ISO 2808	<i>Paints and varnishes — Determination of film thickness</i>
EN 10268 ¹⁾	<i>Cold-rolled flat products made of high yield strength steels for cold forming — General delivery conditions</i>	ISO 2810	<i>Paints and varnishes — Notes for guidance on the conduct of natural weathering</i>
CR 10260	<i>ECISS IC 10 Designation system for steel — Additional symbols for steel names</i>	ISO 2813	<i>Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°</i>
EURONORM 153 ²⁾	<i>Hot-dip terne (lead-alloy) coated cold-reduced carbon steel flat rolled products of commercial and drawing qualities — Technical delivery conditions</i>	ISO 2815	<i>Paints and varnishes — Buchholz indentation test</i>
ISO 4997	<i>Cold-reduced steel sheet of structural quality</i>	ISO 3668	<i>Paints and varnishes — Visual comparison of the colour of paints</i>
2.2 Standards for testing the organic coatings and for the definition of general terms		ISO 4628-1	<i>Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common defect — Part 1: General principles and rating schemes</i>
EN 971-1 ¹⁾	<i>Paints and varnishes — Terms and definitions for coating materials — Part 1: General terms</i>	ISO 4628-2	<i>Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common defect — Part 2: Designation of degree of blistering</i>
EN 23270	<i>Paints and varnishes — Temperatures and humidities for conditioning and testing</i>		<i>Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common defect — Part 3: Designation of degree of rusting</i>
EN ISO 1519	<i>Paints and varnishes — Bend test (cylindrical mandrel)</i>	ISO 4628-4	<i>Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common defect — Part 4: Designation of degree of cracking</i>
EN ISO 1520	<i>Paints and varnishes — Cupping test</i>		
EN ISO 2409	<i>Paints and varnishes — Cross-cut test</i>		

¹⁾ Draft at present stage of work.

²⁾ Until it is transformed into a European Standard, either the Euronorm cited or the corresponding national standard may be applied.

ISO 4628-5	<i>Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common defect — Part 5: Designation of degree of flaking</i>	ASTM D 4145-83 (Reapproved 1990)	<i>Standard test method for coating flexibility of prepainted sheet</i>
ISO 4628-6	<i>Paints and varnishes — Evaluation of degradation of paint coatings — Designation of intensity, quantity and size of common defect — Part 6: Rating of degree of chalking by tape method</i>	ASTM D 4214-89	<i>Standard test methods for evaluating the degree of chalking of exterior paint films</i>
ISO 4892-1	<i>Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance</i>	ASTM E 284-94a	<i>Standard terminology of appearance</i>
ISO 4892-2	<i>Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc sources</i>		
ISO 4892-3	<i>Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps</i>		
ISO 4892-4	<i>Plastics — Methods of exposure to laboratory light sources — Part 4: Open-flame carbon-arc lamps</i>		
ISO 7253	<i>Paints and varnishes — Determination of resistance to neutral salt spray</i>		
ISO 7724-1	<i>Paints and varnishes — Colorimetry — Part 1: Principles</i>		
ISO 7724-2	<i>Paints and varnishes — Colorimetry — Part 2: Colour measurement</i>		
ISO 7724-3	<i>Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences</i>		
ISO 11341	<i>Paints and varnishes — Artificial weathering of coatings and exposure of coatings to artificial radiation alone — Exposure to filtered xenon-arc radiation</i>		
ASTM D 3363-92a	<i>Standard test method for film hardness by pencil test</i>		

3 Definitions

For the purpose of this European Standard the following definitions apply in addition to the definitions in EN 971-1, EN 10020, EN 10021, EN 10079, EN 10204 and ASTM E 284-94a (see clause 2):

3.1 coil coating

A method in which an (organic) coating material is applied on rolled metal strip in a continuous process. This process includes cleaning, if necessary, and chemical pre-treatment of the metal surface and either:

- one-side or two-side, single or multiple application of (liquid) paints or coating powders which are subsequently cured; or
- laminating with plastic films.

3.2 metal substrate

Base material from rolled steel flat products, with or without metallic coating.

3.3 coating material

Material comprising organic polymers, i.e. synthetic resin or plastics, to which pigments, additives and solvents (if required) have generally been added, suitable for coil coating. These may be paints (in liquid or powder form) that when applied form an opaque film, or plastic films, providing protective, decorative and/or specific properties.

3.4 organic coating

The dry paint film of the coated product or the plastic film of the film/metal laminate.

3.5 top side

The side of the strip with the highest decorative demand and/or corrosion protection and which, in normal production, is uppermost, respectively the exterior side of a coil, and is continuously checked by the manufacturer.

3.6 reverse side

The underside of the strip, normally coated with a backing coat, but possibly with one or the other systems (described in 3.7.2, 3.7.3 and 3.12), to fulfil special requirements.

3.7 coating systems

3.7.1 general

A coating system is the sum of the coatings applied on either the top side or the reverse side. It consists of one or more coats of one or more coating materials. The designation of the coating system derives from the relevant coating material.

3.7.2 single-coat system

A single coating either with requirements on appearance (see 3.18), formability, corrosion protection, subsequent painting, foam adhesion, etc., or as a priming coat with special properties regarding adhesion and corrosion protection for post finishing applications.

3.7.3 multiple-coat system

Comprising a priming coat, possibly intermediate coat(s) and a top coat with particular requirements on appearance, corrosion protection, formability, etc.

3.8 backing coat

A coating of any type with no particular requirements on appearance, corrosion protection, formability, etc.

NOTE. In the case of particular requirements see 3.7.2 and 3.7.3.

3.9 priming coat

The first coat of a multiple-coat system.

NOTE. In the case of particular requirements see 3.7.2 and 3.7.3.

3.10 intermediate coat

Any coat between the priming coat and the top coat.

3.11 top coat (finishing coat)

The final (uppermost) coat of a multiple-coat system.

3.12 film coating

A plastic film applied to the substrate to which generally an adhesive and, if appropriate, a priming coat has been applied beforehand.

3.13 strippable film

A plastic film applied to the coated surface in order to afford a temporary protection against mechanical damage.

3.14 uncoated

A condition in which parts of the surface of the substrate (e.g. one side of the strip) remain uncoated.

3.15 master coil

One strip, coil-coated as a single unit.

3.16 coating thickness

The total thickness of the organic coating on either side.

3.17 nominal coating thickness

Ordered or specified coating thickness.

NOTE. The nominal thickness of a coil-coated product corresponds to that of the metal substrate, the coating thickness not taken into account.

3.18 appearance

3.18.1 colour/colour difference

Colour is the sensation resulting from the visual perception of radiation of a given composition.

A colour is uniquely characterized for a defined observer and a defined light source as well as illuminating and viewing geometry by the coordinates of a point in a space (colorimetric specification with tristimulus values). Colour difference is the magnitude and character of the visually perceived, i.e. qualitative, difference between two colours under daylight and artificial light respectively, or the magnitude and direction of the (instrumentally) measured and calculated difference of two colours.

3.18.2 gloss/specular gloss

Gloss is an optical property of a surface, characterized by its ability to reflect light. Specular gloss is the ratio of the luminous flux from an object in the specular direction for a specified source and receptor angle to the luminous flux from polished black glass.

NOTE. For qualitative purposes, gloss ranges are often described by the terms 'matt', 'low gloss' or 'semimatt', 'satin', 'semi-gloss', 'gloss' and 'high gloss'.

4 Designation

4.1 For the steel substrates covered by this European Standard the steel names are allocated in accordance with EN 100271 and CR 10260; the steel numbers are allocated in accordance with EN 10027-2.

4.2 The products covered by this European Standard shall be designated as follows in the order given:

- a) type of product (e.g. strip, sheet or cut length);
- b) number of this standard (EN 101691);
- c) complete designation of the substrate according to the appropriate standard, i.e.:
 - steel name or number;
 - type and nominal mass of the metal coating, if applicable;
 - number of the standard for the substrate;
 - symbol 'OC' for organic coated, when no other symbols (see clause 4.2e) are given;
 - symbol for the organic coating material on the top side and, if need be, that on the reverse side (see table A.1);
 - nominal thickness, in μm , of the organic coating on the top side and, if need be, that on the reverse side.

NOTE 1. The information concerning the coating on the top side is separated from that relative to the reverse side by a slash mark.

NOTE 2. If the nature of the coating material on the reverse side is at the discretion of the manufacturer, it is not stated in the designation.

EXAMPLE 1:

Designation of sheet, substrate made of steel grade DC03 (or 1.0347) according to EN 10130, top side organic coated with epoxy (EP) with a nominal thickness of 10 μm .

Sheet EN 10169-1-DC03 EN 10130-EP10

or: Sheet EN 10169-1-1.0347 EN 10130-EP10

EXAMPLE 2:

Designation of strip, substrate made of hot-dip zinc coated steel of grade DX53D+Z (or 1.0355+Z) with a coating mass of 275 g/m^2 (275) according to EN 10142, top side organic coated with polyamide-modified polyester (SP-PA) with a nominal thickness of 25 μm .

Strip EN 101691DX53D+Z275 EN 10142SPPA25

or: Strip EN 10169-1-1.0355+Z275 EN 101042-SP-PA25

EXAMPLE 3:

Designation of strip, substrate made of hot-dip zinc-aluminium coated steel of grade DX53D+ZA (or 1.0355+ZA) with a coating mass of 255 g/m² (255) according to EN 10214, two side coated with polyester (SP) with a nominal thickness of 25 µm.

Strip EN 10169-1-DX53D+ZA255 EN 10214-SP25/SP25
or: Strip EN 10169-1-1.0355+ZA255 EN 10214-SP25/SP25

If the coating material is not defined, insert + OC' (see clause 4.2d).

4.3 Where appropriate, additional information to the designation as specified in 4.2 shall be given to describe clearly the delivery requirements (see clause 12).

5 Substrates, organic coatings and manufacturing process

5.1 Steel substrates

The initial product for continuously organic coated flat products according to this European Standard shall be rolled steel strip with or without metallic coating conforming to one of the following standards (see also 2.1):

- EN 10025, EN 10111, EN 10130, EN 10139, EN 10142, EN 10147, EN 10152, EN 10154, EN 10214, EN 10215, EN 10268,
- EURONORM 153,
- ISO 4997.

If agreed at the time of ordering, the products may be supplied with other steel substrates.

Minimum metal coating masses as specified for certain applications shall be indicated when ordering.

NOTE 1. In order to preserve the decorative appearance and the formability of the coil coated steel flat product it is advised, should the occasion arise, to limit the thickness or mass of the metallic coating applied on certain substrates.

NOTE 2. It should be noted that the mechanical properties of the substrate material may be altered by the coil coating process. The use of substrates which may be subject to ageing will result in an increase in yield point and tensile strength, reduction in elongation and the possibility of Lüders lines and fluting effects.

5.2 Organic coatings

5.2.1 Coating materials

The more common coating materials used for organic coated flat products, together with their normal coating thicknesses, are given in annex A.

5.2.2 Coil coating systems

The choice of the organic coatings and to their face by face combination depends on the end use to which the coil coated flat products are put. This choice shall be made by agreement between the customer and the supplier.

Depending on the applications, the coil coated steel flat products may be delivered with a specified organic coating:

- a) on either side;
- b) on one side only, the other one, though generally pretreated, being uncoated;
- c) on one side, the other side (reverse side of the strip) being coated in any organic manner without special properties.

For strip supplied in coil form, the top side is normally the outside of the coil; for sheet and cut lengths (in stacks or bundles) the top side is normally uppermost.

If the purchaser requires an alternative arrangement this shall be expressly stated at the time of ordering.

5.2.3 Subsequent surface treatment

If severe service conditions are expected during transportation, storage or processing, the coil coated product may, on agreement, be supplied with the additional protection of a strippable film, wax or oil.

Type and thickness are to be taken into consideration when choosing strippable films.

The choice of the treatment is to be agreed upon at the time of ordering. As the efficiency of this treatment is limited in time, the end-user shall ensure a proper stock rotation.

NOTE. Strippable films can be exposed to outdoor weathering only for a limited period.

5.3 Manufacturing process

Within the context of the data on coil coating (see 5.2), the details of the manufacture of the product are at the discretion of the manufacturer.

6 Properties and test methods

6.1 General

Table 1 gives a summary of the main properties of coil coated flat products according to this European Standard, which may be of importance in their processing and use. The properties assessed are those of the finished material and relate to the application of the product.

The minimum or maximum values to be achieved for the properties given in table 1 shall be agreed at the time of ordering, taking the test methods to be used into consideration (see 8.3 and clause 12).

NOTE. It should be noted that some properties change during storage.

The properties listed in table 1 shall be evaluated according to the following indications (see also 2.2):

6.2 Coating thickness

The methods for determining the coating thickness shall be in accordance with ISO 2808.

For products in widths ≥ 600 mm, testing of the coating thickness shall be carried out at three measuring sites located perpendicular to the rolling direction, i.e. in the centre and at a distance of at least 50 mm from either edge of the product ('triple spot test').

For products in widths ≥ 600 mm, testing shall be carried out at only one site in the centre of the product ('single spot test').

6.3 Appearance

6.3.1 Colour/colour difference

The match of the colour of the coating and, where appropriate, the pattern in the case of a printed finish, with an agreed sample is established by means of a visual comparison in accordance with ISO 3668.

For a more thorough inspection, the difference in colour between the delivered product and the reference sample can be measured instrumentally.

The method for measuring and calculation of the colour difference (ΔE) between two test pieces of the same nonmetameric colour using the CIELAB formula shall be in accordance with ISO 7724, Part 1 to Part 3.

NOTE. The method does not give reliable values in the case of embossed or textured coatings, metallic or pearly pigmented coatings.

Table 1. Survey of important properties		
Property	Referenced standards	For details of test methods and other comments see clause
Coating thickness	ISO 2808	6.2
Appearance		6.3
Colour/colour difference	ISO 3668, ISO 7724-1 to 3	6.3.1
Specular gloss	ISO 2813	6.3.2
Coating hardness		6.4
Pencil hardness	ASTM D 3363	6.4.1
Buchholz indentation test	ISO 2815	6.4.2
Scratch test	ISO 1518	6.4.3
Adhesive strength/flexibility		6.5
Adhesive strength after cupping	EN ISO 1520, EN ISO 2409	6.5.1
Coating flexibility	EN ISO 1519, EN ISO 2409, ASTM D 4145	6.5.2
Adhesive strength and resistance to crack formation on rapid deformation	EN ISO 2409, EN ISO 6272	6.5.3
Durability		6.6
Resistance to neutral salt spray (fog)	EN ISO 2409, ISO 4628-1 to 3, ISO 7253	6.6.2
Behaviour on artificial weathering	ISO 2808, ISO 2813, ISO 3668, ISO 4628-1, 2, 4 to 6, ISO 4892-1 to 4, ISO 7724-3, ISO 11341 ASTM D 4214	6.6.3
Behaviour on natural weathering	ISO 2810, ISO 2813, ISO 4628-1 to 6, ISO 3668, ISO 7724-3, ASTM D 4214	6.6.4
Other properties		6.7
NOTE. Some methods of those listed in table 1 may be used either as pass/fail tests or as classification tests.		

6.3.2 Specular gloss

The test method for measuring specular gloss shall be as specified in ISO 2813.

NOTE. The method does not give reliable values in the case of embossed or textured coatings, metallic or pearly pigmented coatings.

6.4 Coating hardness

6.4.1 Pencil hardness

The test method for measuring pencil hardness shall be in accordance with ASTM D 3363.

NOTE. Not applicable to embossed or textured coatings.

6.4.2 Buchholz indentation test

The test method for measuring indentation resistance shall be in accordance with ISO 2815. In the case of coatings with thicknesses greater than 50 µm, a thin carbon paper laid underneath the indentation tool gives a more precise record of the original indentation.

NOTE. Not applicable to embossed or textured coatings.

6.4.3 Scratch test

The test method for measuring scratch resistance shall be in accordance with ISO 1518.

6.5 Adhesive strength/flexibility

6.5.1 Adhesive strength after cupping

The test method for adhesive derived after cupping shall be in accordance with EN ISO 1520 (apparatus and procedure) and EN ISO 2409 (taping).

6.5.2 Coating flexibility

The bend test has been basically derived from EURONORM 12. The test methods for adhesive strength and resistance to crack formation on 180° bending shall be in accordance with EN ISO 1519 using the type 2 bend test apparatus, with or without taping (see also EN ISO 2409), and ASTM D 4145 ('T-bend test'). The resistance to cracking and pick-off on 180° bending T is expressed as follows:

$$T = \frac{\text{min. bending radius}}{\text{substrate thickness}}$$

NOTE. The definition of T differs from that explained in ASTM D 4145, where values are twice as high.

6.5.3 Adhesive strength and resistance to crack formation on rapid deformation

The test method for adhesive strength and resistance to crack formation on rapid deformation by falling weight shall be in accordance with EN ISO 6272 (apparatus and procedure) and EN ISO 2409 (taping).

6.6 Durability

6.6.1 General

Durability of coil coated products involves resistance to corrosion in a variety of outdoor environments as well as behaviour on weathering. Laboratory accelerated tests cannot be expected to give direct and valid correlations with outdoor exposures because of the large number of factors of influence. They do, however, provide an accepted means of checking quality and simulation of artificial conditions which are more reproducible.

6.6.2 Resistance to neutral salt spray (fog)

The test method for resistance to neutral salt spray (fog) (apparatus and procedure) shall be in accordance ISO 7253.

Where a scratch or scribed mark is made through the coating to the substrate, i.e. to the uppermost metallic layer, where applicable, before testing, the type and location of this shall be agreed. The cutting tool to be used is that described in EN ISO 2409. Other cutting tools can be agreed on.

Unless otherwise agreed, the changes occurring are evaluated in accordance with ISO 4628 Part 1 to Part 3.

NOTE. Other methods of determining resistance to corrosion may be agreed on.

6.6.3 Behaviour on artificial weathering

The test methods for assessing the behaviour on artificial weathering (general guidance, apparatus and procedure) shall be in accordance with ISO 4892 : Part 1 to Part 4 and ISO 11341.

Details on apparatus and procedure are subject to agreement.

Unless otherwise agreed, the changes occurring are evaluated according to 6.3.1 (colour/colour difference), 6.3.2 (gloss) and ISO 4628 : Part 1 and Part 2 (blistering) and Part 4 to Part 6 (cracking, flaking and chalking).

NOTE. Other methods of evaluating the degree of chalking may be agreed on, in particular those in accordance with ASTM D 4214.

6.6.4 Behaviour on natural weathering

Outdoor exposure tests are carried out to determine exterior durability of coated products in a variety of sites representing rural, urban, marine, high-UV or industrial environments or combinations thereof. The procedure shall be in accordance with ISO 2810.

Evaluation shall be in accordance with that described for the evaluation of the behaviour on artificial weathering (see 6.6.3), supplemented by the procedure according to ISO 4628 : Part 3 (rusting).

NOTE. In order to provide a common European reference for outdoor exposure tests, the European Coil Coating Association (ECCA)⁵⁾ has developed a series of recommendations, especially on the preparation and configuration of test panels set out in ECCA Test Method T 19. © : ECCA Recommendation for panel design and method for atmospheric exposure testing.

³⁾ Secretariat: rue Montoyer 47, B-1040 Bruxelles.

6.7 Other properties

Other properties, which may be of importance depending on the intended use, such as resistance to abrasion, suitability for overpainting, compatibility with foam insulating materials or adhesives, resistance to chemicals and staining, reflectance, metamerism, weldability, fire behaviour, heat resistance and behaviour on deep drawing, together with the appropriate test methods, shall be the subject of special agreement between the manufacturer and the purchaser.

NOTE. Testing of properties as in 6.6 and 6.7 does not constitute part of the routine test programme following the production.

7 Requirements

7.1 Tolerances

7.1.1 Dimensions and shape

The tolerances on the thickness of the substrate and the width, length, flatness, edge camber and out-of-squareness of the organic coated flat product shall be as specified in the following standards (see also 2.1):

- EN 10048, EN 10051, EN 10131, EN 10140, EN 10143.

7.1.2 Thickness of the organic coating

The following tolerances on the ordered nominal coating thickness shall apply for each of the coating thicknesses given in table 2. Tolerances on coating thicknesses $\leq 10 \mu\text{m}$ shall be agreed at the time of ordering.

NOTE 1. There are no requirements for the plus tolerance.

NOTE 2. There are no requirements for the backing coat.

7.1.3 Colour

Appropriate colour tolerances shall be agreed at the time of ordering.

7.1.4 Gloss

When required, the tolerances shall be as given in table 3.

Table 3. Tolerances on specular gloss		
Values in gloss units using a 60° head		
Gloss unit range	Gloss range ¹⁾	Tolerances on nominal gloss
≤ 10	matt	± 3
$> 10 \leq 20$	low gloss	± 4
$> 20 \leq 40$	satin	± 6
$> 40 \leq 60$	semi-gloss	± 8
$> 60 < 80$	gloss	± 10
≥ 80	high gloss	minimum 80
¹⁾ Informative indications.		

NOTE 1. Tighter tolerances may be agreed between supplier and purchaser.

NOTE 2. For limitations see note to 6.3.2.

7.2 Freedom from defects

The requirements of EN 10021 apply to external and internal defects. Unless otherwise agreed by the purchaser and supplier, only the top side is continuously inspected.

NOTE. There is a greater risk of surface defects when the product is delivered in coils than when it is delivered in sheets and cut lengths, as it is impossible to remove defects within coils. This is to be taken into account by the purchaser when assessing the product.

The inspection methods and the maximum number and type of defects may be agreed by the purchaser and supplier. If requested, the supplier shall inform the purchaser which surface has been inspected.

Table 2. Tolerances on nominal coating thickness								Dimensions in μm
Range of nominal thickness	$> 10 \leq 20$	$> 20 \leq 25$	$> 25 \leq 35$	$> 35 \leq 60$	$> 60 \leq 100$	$> 100 \leq 200$	$> 200 \leq 500$	$> 500 \leq 800$
Minus tolerance on the average of three measurements	3	4	5	8	15	20	30	40
Minus tolerance on single measurement	4	5	7	12	20	25	35	50

8 Testing

8.1 General

8.1.1 The purchaser shall give the following information at the time of ordering:

- type of test (specific or non-specific test, see EN 10021);
- type of inspection document (see 8.7).

8.1.2 Specific tests shall be carried out in accordance with 8.2 to 8.6.

8.2 Test units

The test unit consists of 20 t or a fraction of 20 t of organic coated steel flat products corresponding to a substrate stemming from the same master coil and an organic coating of the same nature, appearance and thickness. In the case of strip, a coil with a mass of more than 20 t is regarded as one test unit.

8.3 Number of tests and type of test method

No requirements are given in this European Standard on the number of tests per test unit and the test methods used. They are to be agreed between the purchaser and supplier and should conform to the indications given in clause 6 (see table 1 and clause 12).

8.4 Sampling

In the case of strip, the samples shall be taken from the beginning or end of the coil. In the case of sheet and cut lengths, the selection of the sample shall be left to the discretion of the inspector carrying out the tests.

All the samples shall be taken and machined, if necessary, in such a way that the results of the tests are not affected.

8.5 Test methods

The test methods for each property of the coated product are described in clause 6.

Apart from test methods concerning durability (see 6.6), temperatures and humidities for conditioning and testing shall be in accordance with EN 23270.

8.6 Retests

The requirements of EN 10021 shall apply. In the case of coils, the retest specimens shall be taken from a distance of at least one lap away, but with a maximum of 20 m from the end of the coil.

8.7 Inspection documents

If agreed at the time of ordering, one of the inspection documents specified in EN 10204 shall be supplied.

9 Marking

9.1 A label shall be attached to each coil or bundle containing the following information:

- name or mark of the manufacturer's works;
- full designation (see 4.2);
- colour;
- nominal dimensions of the product;
- identification number;
- order number;
- mass of the lot, coil or bundle.

9.2 By agreement between the purchaser and supplier, bar coding according to ENV 606 may be used.

9.3 Marking of the products by branding may be agreed on at the time of ordering.

10 Packing and dispatch

The packing requirements for the product shall be agreed at the time of ordering.

Coils shall be dispatched with their cores either in a vertical or a horizontal position. The orientation shall be specified at the time of ordering.

11 Disputes

EN 10021 is applicable to disputes after delivery and their settlement.

12 Information to be supplied by the purchaser

The following information is required from the purchaser so that the manufacturer may supply the products to conform with the requirements:

- a) complete designation (see 4.2);
- b) where appropriate, details on the required decorative properties (colour, gloss, embossing, printing) and required subsequent surface treatment (see 5.2.3);
- c) other requirements on the characteristics of the products (see 4.3);
- d) nominal dimensions of the product related to the substrate;
- e) quantity;
- f) internal and maximum external diameter and mass limit for coils, or limit dimensions and mass limit for the bundles of sheets;
- g) any testing at the manufacturer's work, type of test and type of inspection document (see 8.1.1 and 8.1.2);
- h) selection of the test methods and specification of the minimum or maximum values for the relevant properties;
- i) any marking required by bar coding (see 9.2);
- j) any marking required by branding of the product (see 9.3);
- k) requirements on packing and dispatch (see clause 10).

Annex A (informative)
List of more common coating materials
and related thickness ranges

Table A.1 List of more common coating materials and related thickness ranges			
Coating material	Symbol ¹⁾	Usual range of coating thickness μm ²⁾	Normal coating thickness μm ^{2) 3)}
1. Liquid paints⁴⁾			
Acrylic	AY	5 to 25	25
Epoxy	EP	3 to 20	—
Polyester ⁵⁾	SP	5 to 60	25 ⁶⁾
Polyamide-modified polyester	SP-PA	15 to 50	25
Silicone-modified polyester	SP-SI	15 to 40	25
Silicone-modified acrylic	AY-SI	25	25
Polyurethane	PUR	10 to 60	25
Polyamide-modified polyurethane	PUR-PA	10 to 50	25
Polyvinylidene fluoride	PVDF	20 to 60 ⁷⁾	25
Polyvinyl chloride organosol	PVC (O)	25 to 60	40
Polyvinyl chloride plastisol	PVC (P)	40 to 200 ⁶⁾	100; 200
Special adhesive ⁸⁾	SA	5 to 15	—
Heat resistant non-stick system	HRNS	5 to 15	—
Weldable zinc-rich primer	ZP	5 to 20	—
Weldable primer with conductive pigments other than zinc	CP	1 to 10	—
2. Coating powders			
Epoxy	EP (PO)	30 to 100	—
Polyester	SP (PO)	30 to 100	—
3. Films			
Polyvinyl chloride ⁹⁾	PVC (F)	50 to 800 ⁶⁾	—
Polyvinyl fluoride	PVF (F)	38 ¹⁰⁾	38
Polyethylene	PE (F)	50 to 300	—
Condensed water absorbing system	CA (F)	—	e.g. 370
¹⁾ The symbols correspond to the characteristic resin and plastic (following ISO/DIS 1043-1), where applicable, or to the key functional property. A reference is added in brackets by way of supplement, where applicable, in order to distinguish between paints, coating powders (PO) and films (F), on the one hand, and between organosol (O) and plastisol (P), on the other hand. ²⁾ Irrespective of any strippable film. ³⁾ Commonly applied nominal thicknesses, unless otherwise specified on ordering. ⁴⁾ Coatings having a thickness of 15 μm and over are generally applied as a two-coat system (priming coat plus top coat), the type and composition of which can be different. ⁵⁾ Also available in textured form. ⁶⁾ Referring to the thickness (measured by a micrometer gauge) in the case of embossed or textured coatings. ⁷⁾ Consisting of a primary coat and normally a top coat (intermediate coats are available). ⁸⁾ For example, for adhesive strength promoting systems suitable for bonding metal with rubber, plastics or other materials in subsequent processes. ⁹⁾ Available in plain or printed forms, also embossed. ¹⁰⁾ Excluding adhesive film thickness of approx. 10 μm.			

Annex B (informative)

Storage

If possible, storage should be in dry or air-conditioned buildings. Generally, the products should be protected from damp and transported in a dry condition.

When packs are stacked, the height of the stack should be limited to prevent pressure marking of the coating.

Coils should never be placed or stored on bare ground, but should be supported on wooden blocks or protective mats (e.g. felt).

Any unevenness in solid matter on the surface of the storage areas that could produce pressure points or dents in the sheet should be avoided as, under certain circumstances, they could make the outer laps unusable. Coils with horizontal axes should not be stored on top of each other.

Sheets should be removed from the packing by careful lifting, not by sliding, so as to avoid scratches caused by burrs (often invisible) or by dust and dirt (e.g. pneumatic or magnetic sheet lifters, rubber suction pads, etc., should be used).

List of references

See national foreword.

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