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

**ДСТУ EN 10169
(EN 10169:2010 + A1:2012, IDT)**

**Прокат плоский сталевий з органічним покриттям,
нанесеним на безперервних лініях фарбування рулонного металу
(за технологією койлкоутінгу).
Технічні умови постачання**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10169:2010+A1

March 2012

ICS 25.220.60; 77.140.50

Supersedes EN 10169:2010

English Version

Continuously organic coated (coil coated) steel flat products - Technical delivery conditions

Produits plats en acier revêtus en continu de matières organiques (prélaqués) - Conditions techniques de livraison

Kontinuierlich organisch beschichtete (bandbeschichtete) Flacherzeugnisse aus Stahl - Technische Lieferbedingungen

This European Standard was approved by CEN on 7 August 2010 and includes Amendment 1 approved by CEN on 14 February 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 10169:2010+A1:2012: E

Contents

Page

Foreword

This document (EN 10169:2010+A1:2012) has been prepared by Technical Committee ECISS/TC 109 [A1] "Coated and uncoated flat products to be used for cold forming" [A1], the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

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 [A1] EN 10169:2010 [A1].

This document includes Amendment 1 approved by CEN on 2012-02-14.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1].

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements for continuously organic coated (coil coated) steel flat products. It particularly specifies the performance requirements.

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

NOTE This document is not applicable to continuously organic coated flat products made of:

— tinmill products,
— electrical steels.

2 Normative references

The following referenced documents are indispensable for the application 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 10020:2000, *Definition and classification of grades of steel*

EN 10021:2006, ▌A1⟩ *General technical delivery conditions for steel products* ⟨A1▐

EN 10025-1, *Hot-rolled products of structural steels — Part 1: General technical delivery conditions*

EN 10025-2, *Hot-rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10048, *Hot rolled narrow steel strip — Tolerances on dimensions and shape*

EN 10051, *Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels — Tolerances on dimensions and shape*

EN 10079:2007, *Definition of steel products*

EN 10111, *Continuously hot rolled low carbon steel sheet and strip for cold forming — Technical delivery conditions*

EN 10130, *Cold rolled low carbon steel flat products for cold forming — Technical delivery conditions*

EN 10131, *Cold rolled uncoated and zinc or zinc-nickel electrolytically coated low carbon and high yield strength steel flat products for cold forming —Tolerances on dimensions and shape*

EN 10139, *Cold rolled uncoated mild steel narrow strip for cold forming — Technical delivery conditions*

EN 10140, *Cold rolled narrow steel strip — Tolerances on dimensions and shape*

EN 10143, *Continuously hot-dip coated steel sheet and strip — Tolerances on dimensions and shape*

EN 10152, *Electrolytically zinc coated cold rolled steel flat products for cold forming — Technical delivery conditions*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10268, *Cold rolled steel flat products with high yield strength for cold forming — Technical delivery conditions*

prEN 10338:2007, *Hot rolled and cold rolled non-coated flat products of multiphase steels for cold forming — Technical delivery conditions*

EN 10346, *Continuously hot-dip coated steel flat products — Technical delivery conditions*

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

EN 13523-1, *Coil coated metals — Test methods — Part 1: Film thickness*

EN 13523-2, *Coil coated metals — Test methods — Part 2: Specular gloss*

EN 13523-3, *Coil coated metals — Test methods — Part 3: Colour difference — Instrumental comparison*

EN 13523-4, *Coil coated metals — Test methods — Part 4: Pencil hardness*

EN 13523-5, *Coil coated metals — Test methods — Part 5: Resistance to rapid deformation (impact test)*

EN 13523-6, *Coil coated metals — Test methods — Part 6: Adhesion after indentation (cupping test)*

EN 13523-7, *Coil coated metals — Test methods — Part 7: Resistance to cracking on bending (T-bend test)*

EN 13523-8, *Coil coated metals — Test methods — Part 8: Resistance to salt spray (fog)*

EN 13523-9, *Coil coated metals — Test methods — Part 9: Resistance to water immersion*

EN 13523-10, *Coil coated metals — Test methods — Part 10: Resistance to fluorescent UV light and water condensation*

EN 13523-11, *Coil coated metals — Test methods — Part 11: Resistance to solvents (rubbing test)*

EN 13523-12, *Coil coated metals — Test methods — Part 12: Resistance to scratching*

EN 13523-14, *Coil coated metals — Test methods – Part 14: Chalking (Helmen method)*

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

EN 13523-18, *Coil coated metals — Test methods — Part 18: Resistance to staining*

EN 13523-19, *Coil coated metals — Test methods — Part 19: Panel design and method of atmospheric exposure testing*

EN 13523-21, *Coil coated metals — Test methods — Part 21: Evaluation of outdoor exposure panels*

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

EN 13523-23, *Coil coated metals — Test methods — Part 23: Colour stability in humid atmospheres containing sulphur dioxide*

EN 13523-24, *Coil coated metals — Test methods—– Part 24: Resistance to blocking and pressure marking*

EN 13523-25, *Coil coated metals — Test methods — Part 25: Resistance to humidity*

EN 13523-26, *Coil coated metals — Test methods — Part 26*: *Resistance to condensation of water*

EN 13523-27, *Coil coated metals — Test methods — Part 27: Resistance to humid poultice (*Cataplasm *test)*

EN ISO 2815, *Paints and varnishes — Buchholz indentation test (ISO 2815:2003)*

EN ISO 4618:2006, *Paints and varnishes — Terms and definitions (ISO 4618:2006)*

EN ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering (ISO 4628-2:2003)*

EN ISO 4628-4, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking (ISO 4628-4:2003)*

EN ISO 4628-5, P*aints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 5: Assessment of the degree of flaking (ISO 4628-5:2003)*

EN ISO 8044:1999, *Corrosion of metals and alloys — Basic terms and definitions (ISO 8044:1999)*

EN ISO 9227*, Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227:2006)*

EN ISO 12944-2:1998, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments (ISO 12944-2:1998)*

ISO 4997, *Cold-reduced carbon steel sheet of structural quality*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 10020:2000, EN 10021:2006, EN 10079:2007, EN 10204:2004, EN ISO 4618:2006, EN ISO 8044:1999, EN ISO 12944-2:1998 and the following apply.

3.1
accessibility
ease of access to the steel components for the purpose of inspection and maintenance without any work over and above that concerned with routine inspection

3.2
ambience
environmental conditions which prevail in the interior of the building

NOTE 1 These conditions determine the corrosivity category of the ambience and include different parameters such as the air temperature, the relative humidity, the operating conditions in the building (e.g. use of aggressive chemical products, refrigerated areas).

NOTE 2 It should be noted that the atmosphere surrounding the building can influence the ambience.

NOTE 3 Annex A gives an example of classification of types of ambience.

3.3
building interior application
application in buildings for which the concerned construction products (i.e. components of the building fabric) are submitted to the influence of interior ambiences without significant exposure of any side of the product to the influence of exterior atmospheres

NOTE 1 Building products include, for example: liner trays, ribbed profiles for roofing and walling, curved profiles, brake-pressed profiles, interior wall panels for partitions, ceiling panels, suspended frames (for suspended ceilings), factory foamed (or mineral wool) sandwich panels for cold rooms or rooms with controlled ambience, interior door frames, interior metal doors, interior metal windows.

NOTE 2 Some coil coated products can be used for interior applications having special performance requirements, e.g. lighting. In such cases, these particular requirements should also be considered in consultation with the manufacturer.

NOTE 3 For interior building elements, it is important that the risk of corrosive attack on the reverse side of the element should also be considered. This can be especially important in double-skin assemblies (e.g. built up insulated cladding) where the reverse side of the interior element is not easily accessible for maintenance and/or in situations where the interior element is expected to provide long-term durability.

NOTE 4 Besides the requirements written in this document, there can be other international or national requirements or regulations regarding fire, safety, food contact etc. that should be considered at the time of enquiry and order.

3.4
building exterior application
application in buildings for which the concerned products are submitted to the influence of exterior atmospheres

NOTE 1 Building products include, for example, ribbed profiles for roofing and walling, curved profiles, brake-pressed profiles, concealed fix roofing and walling, standing seam roofing, corrugated sheeting, cladding goods, sandwich panels for roofing and walling, roof tiles, accessories (flashings, trims), rainwater goods (gutters, down pipes), metal doors and garage doors.

NOTE 2 For exterior building elements, it is important that the risk of corrosive attack on internal, i.e. reverse side surfaces, should also be considered. In particular, buildings with wet or chemically polluted internal environments can require a reverse side organic coating selected to provide enhanced corrosion protection.

This can be especially important in double-skin assemblies (e.g. built-up insulated cladding) where the reverse side of the exterior element is not easily accessible for maintenance and/or in situations where the exterior element is expected to provide long-term durability.

NOTE 3 Besides the requirements written in this document, other international or national requirements regarding reaction to fire , safety etc. can be agreed on at the time of enquiry and order.

3.5
coating flexibility
ability of a coating to follow without [A1] damaging ⟨A1⟩ the deformation [A1] *deleted text* ⟨A1⟩ of the substrate [A1] to which it is applied ⟨A1⟩

[A1] NOTE 1 The flexibility is determined during cold forming of the coated product by the T-bend test. ⟨A1⟩

[A1] NOTE 2 ⟨A1⟩ Cold forming is the process where the main forming is done without heating the working piece.

3.6
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

NOTE These may be paints (in liquid or powder form) that when applied form an opaque film or plastic film providing protective, decorative and/or specific properties.

3.7
coating systems

3.7.1
coating system, general
combination of the coatings applied on either the top side or the reverse side consisting of one or more coats of one or more coating materials, the designation of which is derived from the relevant coating material

3.7.2
multiple-coat system
system comprising a priming coat, possibly intermediate coat(s) and a top coat with particular requirements on appearance, corrosion protection, formability, etc.

3.7.3
one-coat system
single coating either with requirements on appearance (see 3.17), 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

3.8
[A1] nominal organic coating thickness [A1]
thickness of the organic coating system [A1] either [A1] on top side [A1] or [A1] on reverse side

[A1] *deleted text* [A1]

3.9
nominal thickness of a coil coated product
thickness of the metal substrate including metallic coating and excluding thickness of organic coating system

3.10
coating types

3.10.1
backing coat
coating of any type on reverse side with no particular requirements on appearance, corrosion protection, formability, etc.

NOTE In the case of particular requirements, see 3.7.2.

3.10.2
film coating, permanent
plastic film applied to the substrate to which generally an adhesive and, if appropriate, a priming coat has been applied beforehand

3.10.3
film coating, temporary
strippable plastic film applied to the coated surface in order to afford a temporary protection against mechanical damage (see also 6.1.2.3)

3.10.4
intermediate coat
coat between the priming coat and the top coat

3.10.5
priming coat
first coat of a multiple-coat system

[A1] NOTE [A1] In the case of particular requirements, see 3.7.2 and 3.7.3.

[A1] *deleted text* [A1]

3.10.6
top coat (finishing coat)
final (uppermost) coat of a multiple-coat system

3.11
coil coating
process in which an (organic) coating material is applied on rolled metal strip in a continuous process which 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/and

— laminating with permanent plastic films

NOTE 1 Curing processes include those by convective or inductive heating or by radiation.

NOTE 2 Laminating with metal strip resulting in a sandwich system is possible.

NOTE 3 A one-coat chemical pre-treatment and priming coat is possible.

3.12
colour
sensation resulting from the visual perception of radiation of a given composition (related to EN 13523-22)

NOTE 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 tristimulous values).

3.13
colour difference
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 (related to EN 13523-3)

3.14
corrosion protection (interior) category
CPI
category of coating which presents a certain level of corrosion protection, the choice of which depends on the corrosivity category, the period of protection and the accessibility

3.15
corrosion resistance (outdoor) category
RC
category of product which presents a certain level of corrosion resistance, the choice of which depends on the corrosivity category, the period of resistance and the accessibility

NOTE 1 Different categories of organic coil coated products for outdoor application classified following their level of corrosion resistance are defined. Criteria of classification are related to their level of natural and artificial outdoor corrosion resistance.

NOTE 2 These conditions determine the corrosivity category and include both meteorological and pollution parameters [EN ISO 12944-2].

NOTE 3 It should be recognized that in some local areas within a region, environmental conditions can apply which are not typical of the region as a whole, e.g. in a rural atmosphere close to a fossil fuel burning power generation plant, areas immediately down wind of the prevailing wind direction can be subjected to an environment closer to urban or even industrial atmospheres. Such special cases should be considered when organic coatings are chosen.

3.16
corrosivity category
C
category which indicates the corrosivity of the environment taking into account both atmospheric conditions prevailing around a constituent element of a structure, and micro-environmental effects and shall be used for the selection of the appropriate product (related to EN ISO 12944-2)

NOTE The relationship between corrosivity categories and types of atmospheres is given in Table 6.

3.17
gloss
optical property of a surface, characterized by its ability to reflect light (related to EN 13523-2)

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

3.18
gloss, specular
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 (related to EN 13523-2)

3.19
master coil
coil from which sheets, cut lengths or two or more smaller coils are produced

3.20
organic coating
dry paint film of the coated product or the plastic film of the film/metal laminate

3.21
period of protection
time between the first exposure of the steel component and the moment at which maintenance works need to be carried out to restore corrosion protection

NOTE The need to restore corrosion protection is deemed to arise when failure of the coating has occurred to the point where a significant amount (for example 5 %) of the component surface exhibits corrosion of the substrate.

3.22
reverse side
opposite side of the top side (see 〚A1〛 3.26 〚A1〛)

3.23
saturated colour
colour with Chroma C* $\geq$ 40

NOTE Chroma C* is defined by CIE 15:2004.

3.24
substrate
base material from rolled steel flat products, with or without metallic coating

3.25
time of wetness
period during which a coated surface is covered by a film of electrolyte that is capable of causing atmospheric corrosion (see EN ISO 12944-2)

NOTE Guidance value for time of wetness can be calculated from the temperature and humidity relative by summing the hours where the humidity relative is above 80 % and, at the same time, the temperature is above 0 °C.

3.26
top side
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

3.27
uncoated
condition in which parts of the surface of the substrate (e.g. one side of the strip) remain uncoated

3.28
UV resistance category (R_{uv})
category of coating which presents a certain level of resistance to degradation by UV radiation

NOTE Different categories of organic coil coated products for outdoor application classified following their level of UV resistance are defined. Criteria of classification are related to their level of natural and artificial outdoor UV resistance with relation to the cumulative solar energy of the outdoor exposure site.

4 Designation

4.1 For the steel substrates covered by this document (see 6.1.1), the steel names are allocated in accordance with EN 10027-1, the steel numbers are allocated in accordance with EN 10027-2.

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

a) type of product (e.g. strip, sheet or cut length, see EN 10079);

b) number of this standard (EN 10169);

c) complete designation of the substrate, i.e.:

   1) steel name or number,

   2) type and nominal mass of the metal coating,

   3) number of the standard for the substrate,

   4) dimensions and tolerances (see 6.1.1.2).

d) symbol "OC" for organic coated, when the coating material is not specified;

e) symbol for the organic coating material on the top side and, if applicable, that on the reverse side (see Table B.1);

f) nominal thickness, in µm, of the organic coating on the top side and, if applicable, 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.

g) product flexibility (see 6.3.2),

h) if applicable, corrosion protection category CPI (see Table 5) or corrosion resistance category RC (see Tables 6 and 7) of the top side followed by the one of the reverse side when required,

i) if applicable, UV resistance category R_{uv} (see Table 8) of the top side.

EXAMPLE 1
Designation of sheet for building interior applications in accordance with EN 10169, substrate made of steel grade DC03 (or 1.0347) according to EN 10130, top side organic coated with epoxide (EP) with a nominal thickness of 10 µm.

Sheet EN 10169 – DC03 EN 10130 – EP10
or
Sheet EN-10169 – 1.0347 EN 10130 – EP10

EXAMPLE 2
Designation of strip for general engineering applications in accordance with EN 10169, substrate made of electrolytically zinc coated steel of grade DC07+ZE (or 1.0898+ZE) with a nominal thickness of 10 µm (100/100) according to EN 10152 on both sides, top side organic coated with polyamide-modified polyester (SP-PA) with a nominal thickness of 25 µm.

Strip EN 10169 –DC07+ZE100/100 EN 10152 – SP-PA25
or
Strip EN 10169 –1.0898+ZE100/100 EN 10152 – SP-PA25

EXAMPLE 3
Designation of strip for building exterior applications in accordance with EN 10169, substrate made of hot-dip zinc coated steel of grade S280GD+Z (or 1.0244+Z) with a coating mass of 275 g/m² (275) according to EN 10346, top side organic coated with polyamide-modified polyester (SP-PA) with a nominal thickness of 25 μm, product flexibility 4T, corrosion resistance category 2 (RC2), UV resistance category 2 (R_{uv2}).

Strip EN 10169 – S280GD+Z275 EN 10346 –SP-PA25 – 4T– RC2 – R_{uv2}
or
Strip EN 10169 – 1.0244+Z275 EN 10346 – SP-PA25 – 4T – RC2 – R_{uv2}

EXAMPLE 4
Designation of sheet for building exterior applications in accordance with EN 10169, 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 10346, both sides coated with polyester (SP) with a nominal coating thickness of 25 μm each, product flexibility 3T, corrosion resistance category 3 (RC3) on the top side / corrosion protection category 2 (RC2) on the reverse side, UV resistance category 2 (R_{uv2}).

Sheet EN 10169 – DX53D+ZA255 – SP25/SP25 – EN 10346–3T– RC3/RC2 – R_{uv2}
or
Sheet EN 10169 – 1.0355+ZA255 – SP25/SP25 – EN 10346 – 3T – RC3/RC2 – R_{uv2}

4.3 Where appropriate, additional information to the designation as specified in 4.2 shall be given to describe clearly the delivery requirements (see 5.1).

5 Information to be supplied by the purchaser

5.1 Mandatory information

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

a) complete designation of the product (see 4.2);

b) where appropriate, details of the required decorative properties (colour, gloss, embossing, printing) and subsequent protection treatment (see 6.1.2.3);

c) nominal dimensions of the substrate;

d) quantity;

e) internal and maximum external diameter and mass limit for coils, or limit dimensions and mass limit for bundles of sheets;

f) type of test and type of inspection document (see 7.1.1 and 7.1.2);

g) requirement concerning marking (see Clause 8);

h) requirements on packing and dispatch (see Clause 9).

5.2 Options

A number of options are specified in this document and listed below. Options may be agreed at the time of enquiry and order between purchaser and manufacturer. If the purchaser does not indicate his wish to implement any of these options the products shall be supplied in accordance with the basic specification (see 5.1).

1) Use of other steel substrates (see 6.1.1.1);

2) Special requirements for strip delivered in coil form (see 6.1.2.2);

3) Tolerances on coating thicknesses ≤ 10 µm and/or specification of a plus tolerance (see 6.2.2.2);

4) Requirements for coating hardness and its testing (see 6.2.5);

5) Other coating properties, if applicable (see 6.2.6);

6) Coating flexibility (T-bend test) for the exposed face (see 6.3.2);

7) Checking the reverse side (see 6.2.3.1, 7.5.3 and 7.5.6);

8) Coating durability (see 6.3.3.1);

9) Exposure conditions for corrosivity category C5, if applicable (see 6.3.3.3.2 a));

10) Method and acceptance value for verification of colour change for saturated or other special colours (see Table 8, footnote a);

11) Deviating test method for determination of coating thickness (see 7.5.2);

12) Accelerated tests for determination of RC and R_{uv} (see 6.3.3.3.1 and 7.5.8.4);

13) Information on tests on durability (see 7.5.8.1);

14) Humidity test by an alternative method (see 7.5.8.2);

15) Cleaning conditions for natural UV radiation resistance test (see 7.5.8.3.3);

16) Use of bar coding (see 8.2).

6 Requirements

6.1 General

6.1.1 Steel substrates

6.1.1.1 The substrate for continuously organic coated flat products according to this document shall be rolled steel strip with or without metallic coating complying with one of the following standards:

EN 10025-1, EN 10025-2, EN 10111, EN 10130, EN 10139, EN 10152, EN 10268, prEN 10338:2007, EN 10346 and ISO 4997.

If so agreed at the time of enquiry and order, the products may be supplied with other steel substrates.

NOTE 1 Uncoated or electrolytically coated strip is normally not suitable as substrate for building exterior applications.

Minimum metal coating masses as specified for certain applications shall be indicated at the time of enquiry and order.

NOTE 2 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 3 The mechanical properties of the substrate material can be altered by the coil coating process. The use of substrates which can be subject to ageing will result in an increase in yield point and tensile strength, reduction in elongation and the possibility of appearance of Luders lines and the occurrence of fluting effects.

6.1.1.2 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 standards for substrates: Applicable standards are: EN 10048, EN 10051, EN 10131, EN 10140, EN 10143.

6.1.2 Organic coatings

6.1.2.1 Coating materials

The more common coating materials used for organic coated flat products, together with their coating thickness (dry film thickness) are given in Annex B.

6.1.2.2 Coil coating systems

The choice of the organic coatings and their face by face combination depends on the end-use to which the coil coated flat products are put.

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 pre-treated, being uncoated;

c) on one side, the other side (reverse side of the strip) being coated in any organic manner without special properties.

The type of coating on either side of the product shall be agreed at the time of enquiry and order to meet the purchaser's requirements of the product flexibility, the corrosion protection/corrosion resistance category of the top and reverse sides and, where necessary, the UV resistance category of the top side.

NOTE The reverse side coating should be chosen as appropriate. It is normally required to withstand handling and storage. In some circumstances, it can also be required to provide corrosion protection and/or aesthetic appearance or to be compatible with foam or adhesive bonding.

For strip supplied in coil form, the top side is normally the outside of the coil; for sheets 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 enquiry and order.

6.1.2.3 Temporary protection treatment

Coil coated products may be supplied with the additional temporary protection of a strippable film, wax or oil. Additional temporary protection is recommended, when special requirements during transportation, storage or processing are expected. Strippable films shall be removed within 3 months at the latest.

The type of temporary protection shall be agreed upon at the time of enquiry and order. Type and thickness of the coating shall be taken into consideration when choosing protective films.

NOTE 1 The efficiency of temporary protection treatment is limited in time. The user should ensure proper stock rotation to consider this and to maintain easy removal of strippable films.

NOTE 2 Outdoor weathering exposure time of coated products protected by strippable films should be strictly limited. It is recommended to avoid exposure of products with strippable films to direct sunlight, bad weather conditions, high humidity (e.g. during storage) more than a limited period of time, for instance 2 weeks.

As the efficiency of this treatment is limited in time, the end-user shall ensure a proper stock rotation.

6.1.3 Manufacturing process

Within the context of the data on coil coating (see 6.1.2.2), the details of the manufacture of the product are at the discretion of the manufacturer.

6.2 General coating properties

6.2.1 General

Table 1 gives a summary of the main properties of coil coated flat products according to this document, which may be of importance in their processing and use. The minimum or maximum values to be achieved for the properties referred to in Table 1 shall be specified at the time of enquiry and order, taking the test methods to be used into consideration.

NOTE 1 It should be noted that some properties change during storage (see Annex E).

The properties listed in Table 1 shall be evaluated according to the specifications in 6.2.2 to 6.2.5 and 7.5.2 to 7.5.8.

Table 1 — Survey of important properties

Property	Referenced standards	For details of test methods and other comments see clause
Coating thickness and tolerances		
Coating thickness	EN 13523-1	7.5.2
Appearance (6.2.3)		
Colour/colour difference	EN 13523-3, EN 13523-15, EN 13523-22	7.5.3
Specular gloss	EN 13523-2	7.5.4
Surface condition (freedom of defects)		7.5.6
Adhesive strength/flexibility (6.2.4)		
Adhesion after cupping	EN 13523-6	7.5.5.1
Coating flexibility (T-bend test)	EN 13523-7	7.5.5.2
Adhesion and resistance to crack formation on rapid deformation (impact test)	EN 13523-5	7.5.5.3
Coating hardness (6.2.5)		
Pencil hardness	EN 13523-4	7.5.7.1
Buchholz indentation test	EN ISO 2815	7.5.7.2
Resistance to scratching	EN 13523-12	7.5.7.3
Durability (6.3.3)		
Resistance to humidity	EN 13523-26, EN ISO 4628-2, EN ISO 4628-4, EN ISO 4628-5	7.5.8.1, 7.5.8.2
Behaviour on natural weathering (outdoor exposure)	EN 13523-19, EN 13523-21	7.5.8.1, 7.5.8.3
— Resistance to outdoor corrosion	EN 13523-21, EN ISO 4628-4, EN ISO 4628-5	7.5.8.3.2
— Resistance to natural UV radiation	EN 13523-14, EN 13523-21, EN ISO 4628-4, EN ISO 4628-5	7.5.8.3.3
Behaviour on artificial weathering		7.5.8.1, 7.5.8.4
— Resistance to neutral salt spray (fog)	EN 13523-8, EN ISO 9227, EN ISO 4628-4, EN ISO 4628-5	7.5.8.4.1
— Resistance to intensified UV radiation	EN 13523-10, EN 13523-14	7.5.8.4.2
Other properties	EN 13523-9, EN 13523-11, EN 13523-18, EN 13523-23, EN 13523-24, EN 13523-25, EN 13523-26, EN 13523-27	6.2.6, 7.5.8

NOTE 2 Some methods of those listed in Table 1 can be used either as pass/fail tests or as classification test.

6.2.2 Coating thickness and tolerances

6.2.2.1 The coating thickness shall comply with the requirements specified at the time of enquiry and order (see 4.2.f)).

6.2.2.2 For the ranges of nominal coating thickness, the tolerances given in Table 2 shall apply.

Table 2 — Tolerances on nominal coating thickness

Dimensions in µm

Range of nominal thickness	> 10 ≤ 20	> 20 ≤ 25	> 25 ≤ 35	> 35 ≤ 60	> 60 ≤ 100	> 100 ≤ 150	> 150 ≤ 500	> 500 ≤ 800
Minus tolerance on the average of three measurements	3	4	6	8	15	20	30	40
Minus tolerance on single measurement	4	5	8	12	20	25	35	50

Tolerances on coating thicknesses ≤ 10 µm may be agreed at the time of enquiry and order.

NOTE 1 There are normally no requirements for the plus tolerance, but these can be agreed at the time of enquiry and order.

NOTE 2 There are no requirements for the backing coat.

6.2.3 Appearance

6.2.3.1 General

Colour and colour tolerances and specular gloss shall comply with the specified requirements, where applicable (see 5.1 b)).

Unless otherwise agreed at the time of enquiry and order, only the top side is continuously inspected.

6.2.3.2 Colour and colour difference

The appropriate colour and colour tolerances, the method of measurement and the measurement device shall be agreed at the time of enquiry and order.

NOTE Metallic structured and pearlescent paint may exhibit aspect and colour variation from one production batch to another. Metallic and pearlescent paints exhibit directionality. It is important that this directionality is maintained to ensure colour consistency.

6.2.3.3 Gloss

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

NOTE 1 Tighter tolerances may be agreed at the time of enquiry and order.

NOTE 2 For limitations see note to 7.5.4.

Table 3 — Tolerances on specular gloss
(Values in gloss units using a 60° head)

Gloss unit range	Gloss range[a]	Tolerances on nominal gloss
≤ 10	matt	± 3
> 10 ≤ 20	low gloss	± 4
> 20 ≤ 40	satin	± 6
> 40 ≤ 60	semi-gloss	± 8
> 60 < 80	gloss	± 10
≥ 80	high gloss	minimum gloss 80
[a] Informative indications.		

6.2.4 Adhesive strength after cupping or bending

For all coatings with a thickness of up to 60 μm, one of the following requirements applies; the choice is left at the discretion of the manufacturer.

a) No loss of adhesion after taping for a specified minimum indentation depth of 4 mm.

b) No loss of adhesion after a 2 T bend test (see 7.5.5.2).

For other coatings, peeling shall not exceed 75 % after the maximum indentation depth that will not rupture the substrate.

6.2.5 Coating hardness

For coating hardness, specific requirements and its testing in accordance with 7.5.7.1 and/or 7.5.7.2 and/or 7.5.7.3 may be agreed at the time of enquiry and order.

6.2.6 Other coating and performance properties

Other properties, which can be of importance depending on the intended use, such as resistance to abrasion, suitability for overpainting, ability to be printed, compatibility with foam insulating materials or adhesives, resistance to chemicals and staining, reflectance, weldability, resistance and reaction to fire, 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.

6.3 Special coating properties

6.3.1 General

A certain range of coating properties are designated as so called "performance properties" which are evaluated by performance tests.

NOTE Performance tests are carried out for the purpose to classify the coatings into categories.

6.3.2 Product flexibility

The products shall pass a T-bend test with a specified bending radius (see Table 4) for evaluation of product flexibility carried out on the exposed face in accordance with 7.5.5.2.

T-bend tests for the unexposed face may be agreed at the time of enquiry and order.

Table 4 — Minimum bending radius for the T-bend test

Flexibility range	Minimum bending radius[a]
High flexibility, for severe forming conditions	0 T, 1 T
Standard flexibility	2 T, 3 T, 4 T, 5 T, 6 T
No requirement on flexibility	no test required
[a] T Nominal thickness of the product.	

6.3.3 Durability

6.3.3.1 General

Durability of coil coated products involves resistance to corrosion as well as resistance to UV weathering in a variety of environments as well as behaviour on weathering and shall be verified by appropriate tests (see 7.5.8.2 to 7.5.8.4) if so agreed at the time of enquiry and order.

6.3.3.2 Products for building interior and general engineering applications

The classification of the coatings into corrosion protection categories CPI in accordance with Table 5 shall be based on the results of tests on appropriate substrates in appropriate artificial atmospheres (see 7.5.8.2) which represent the conditions of use of the product.

NOTE For CPI 1 coatings, no tests are specified.

Table 5 — Test duration for the test of resistance to humidity

Corrosion protection (interior) category (CPI)	CPI2	CPI3	CPI4	CPI5
Test duration, h	500	1 000	1 500	1 500
NOTE For coatings of corrosion protection (interior) category CPI5, additional appropriate tests relevant to the actual corrosive environment could be settled by agreement at the time of enquiry and order.				

6.3.3.3 Products for building exterior applications

6.3.3.3.1 General

The classification of the coatings into corrosion resistance categories RC and UV resistance categories R_{uv} shall be based on the behaviour on natural weathering (see 6.3.3.3.2).

Where not possible, e.g. in the case of a new coating, accelerated tests (see 7.5.8.4) may be agreed.

6.3.3.3.2 Behaviour on natural weathering

a) Natural outdoor corrosion resistance

The products shall pass outdoor exposure tests in a variety of sites representing rural, urban, industrial, maritime, pollution and humidity and sea front environments or combinations thereof in accordance with 7.5.8.3.2.

NOTE All organic coatings gradually change their appearance when exposed to the weather. The changes that take place occur at different rates, the rate being dependent upon the aggressiveness of the environment and on the ability of the organic coatings to resist those changes.

When exposed in outdoor exposure sites according to the conditions given in Table 6 and Annex D, the type 2 and type 3 specimens (see EN 13523-19 and EN 13523-21) shall meet the requirements reported in Table 7. These requirements for the corrosion resistance categories RC2, RC3, RC4 and RC5 (see 7.5.8.3.2 for testing conditions) apply to the flat area and also specifically to the area under the canopy for type 2 specimen and to the overlapping area for type 3 specimen. For testing conditions, see 7.5.8.3.2.

The corrosion resistance categories RC1, RC2, RC3 and RC4 are related to corrosivity categories C1, C2, C3 and C4 according to Table 6. No requirement is set for RC1.

Exposure conditions for C5 shall be agreed, if applicable, as it can be industrial and/or maritime and requires additional exposure when comparing to C4. The corrosion resistance category related to C5 (both C5-I and C5-M) is conventionally named RC5 (see Tables 6 and 7).

Table 6 — Relationship between corrosion resistance categories, corrosivity categories and types of atmosphere –Typical environments in a moderate climate (see also EN ISO 12944-2)

Corrosion resistance category	Corrosivity category[a]	Types of atmosphere[b]					
		Rural	Urban	Industrial	Marine	Pollution and humidity	Sea front
RC1	C1 - very low (no requirement)						
RC2	C2 - low						
RC3	C3 - medium			Low SO_2	Low salinity		
RC4	C4 – high			Moderate SO_2	Moderate salinity		
RC5	C5 - I - very high			High SO_2			
	C5 - M - very high				High salinity		High salinity

[a] based in accordance with EN ISO 12944-2 on the behaviour of low carbon steels.

[b] See Annex C.

NOTE 1 Relationships between corrosivity categories and types of atmosphere are emphasized by shadowed boxes.

NOTE 2 Attention is drawn to the fact that the corrosivity can be higher under shelter and dependent on time of wetness.

NOTE 3 Accessibility to inspection, maintenance and/or repair work should be taken into account when establishing corrosivity category of the environment.

Table 7 — Requirements for natural outdoor corrosion resistance tests[a]

Corrosion resistance category[b]	Test duration years	Average edge delamination mm	Damage on bend	Blistering
RC2	1	≤ 10	c	2 (S4)
RC3	2	≤ 5	c	2 (S4)
RC4	2	≤ 2	d	2 (S2)
RC5	≥ 2	≤ 2	d	2 (S2)

a For duration of tests, see recommended outdoor exposures sites, see 7.5.8.3.2 and Annex D.

b For relationship with corrosivity categories and types of atmosphere, see Table 5.

c No requirement.

d It shall be checked that no bursting of the organic coating occurs and that there is no apparent corrosion product at the progressive radius bend, in an area located at a distance between 10 mm and 50 mm from the 3 T side panel edge of the specimen.

b) Resistance to natural outdoor UV radiation

The aspect of Type 1 specimens (see Annex D) shall not exhibit variations more than those reported in Table 8 for UV resistance categories R_{uv2}, R_{uv3} and R_{uv4}. See 7.5.8.3.3 for testing conditions.

NOTE 1 UV resistance category R_{uv1} corresponds to "no UV exposure" and is therefore not considered in Table 8.

NOTE 2 Examples of outdoor exposure sites representing different UV resistance categories are given in Table D.2.

Table 8 — Requirements for the UV resistance for natural and artificial testing conditions

Requirements (duration: two years for natural, 2 000 hours for artificial UV radiation).	UV resistance category				
	R_{uv2}	R_{uv3}		R_{uv4}	
Maximum colour change ΔE*[a] before and after the test (CIELab units)	5	3		3[c]	2[d]
Minimum retained gloss after the test (RG[b]), %	30	50[c]	60[d]	80	

a The ΔE* value is not applicable for saturated and other special colours such as metallics and pearlescent. In that case the colour change verification method and its acceptance value shall be agreed at the time of enquiry and order.

b The retained gloss (RG) is the ratio of the final gloss value, given in percent. The RG requirement is not applicable to textured finished coatings.

c natural UV radiation.

d artificial UV radiation.

6.3.3.3.3 Behaviour on artificial weathering

a) Resistance to neutral salt spray (fog)

The products shall be tested in accordance with 7.5.8.4.1. No blistering shall occur on the unscribed area and an average undercreep length shall not exceed 2 mm (either side) at the vertical scribed mark.

b) Resistance to artificial UV radiation

The colour change of the specimen (ΔE *) and its retained gloss (RG) at the end of the test shall meet the requirements of Table 8 for the coating system categories. Colour change shall be uniform. The tests are performed according to 7.5.8.4.2. Only resistance to UVA radiation is mandatory.

NOTE 1 to 6.3.3.3.2 b) also applies for artificial UV radiation.

6.4 Freedom of defects

〖A1〗 *deleted text* 〖A1〗 The products shall be free from external and internal defects which restrict their intended use.

〖A1〗 *deleted text* 〖A1〗 The maximum number and type of acceptable imperfections may be agreed at the time of enquiry and order.

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 should be taken into account by the purchaser when assessing the product.

7 Inspection

7.1 Types of inspection and inspection documents

7.1.1 Unless otherwise specified at the time of enquiry and order (see 7.1.2 and 7.1.3), the products shall be delivered with non-specific inspection without inspection document.

7.1.2 Specific testing in accordance with the requirements in 7.2 to 7.6 may be specified at the time of enquiry and order.

7.1.3 The type of inspection document to be delivered in accordance with EN 10204, if requested for non-specific inspection (inspection document 2.1 or 2.2) or mandatory to be delivered for specific inspection (inspection document 3.1 or 3.2), shall be specified at the time of enquiry and order.

If an inspection certificate 3.2 is specified, the purchaser shall notify the manufacturer of the name and address of the organization or person who is to carry out the inspection and produce the inspection document. It shall also be agreed which party shall issue the certificate.

7.2 Test units

The test unit consists of maximum 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.

7.3 Type and number of tests

One series of tests shall be carried out per test unit as specified in 7.2 for verification of:

— coating thickness (see 7.5.2);

— colour and gloss (see 7.5.3 and 7.5.4);

— adhesive strength/product flexibility (see 7.5.5);

— freedom of defects (see 7.5.6).

Other tests may be agreed at the time of enquiry and order (see 6.2.5, 6.2.6, 7.5.7 and 7.5.8).

7.4 Sampling

For general information on sampling see EN 13523-0.

In the case of strip, the samples shall be taken from the beginning or end of the coil. In the case of sheets 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.

7.5 Test methods

7.5.1 General

The test methods shall comply with the relevant part of EN 13523 series and with the specific conditions reported in 7.5.2 to 7.5.8.

7.5.2 Coating thickness

The methods for determining the coating thickness shall be in accordance with EN 13523-1.

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").

NOTE Other test methods, e.g. in accordance with EN ISO 2808, may be used by agreement, for example for embossed or textured coatings and non-contact continuous-web measurement.

7.5.3 Colour and colour difference

The difference in colour between the product sample and the reference sample shall be measured instrumentally.

The inspection of the colour of the organic coating and, where appropriate, the pattern in the case of a textured finish, may also consist of a visual comparison between a sample of the delivered product and an agreed reference sample in accordance with EN 13523-22.

The method for measuring and for calculation of the colour difference (ΔE) between two test samples of the same colour shall be in accordance with EN 13523-3.

In case of metamerism, see also EN 13523-15.

NOTE 1 The methods do not give reliable values in the case of embossed or textured coatings, metallic or pearlescent pigmented coatings.

NOTE 2 Colour cards often do not define exact colours and therefore serve only as a guideline.

NOTE 3 Attention should be drawn to the fact that the measurement of a colour is much influenced by the type of the measuring instrument.

NOTE 4 This document does not give any ΔE^* CIELab value to specify colour difference since it is not possible to determine a unique ΔE^* CIELab which would be applicable for all colours and finishes. However, ΔE^* CIELab values may be specified upon agreement based on manufacturer's own data and experience.

7.5.4 Gloss

The test method for measuring specular gloss shall be as specified in EN 13523-2.

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

7.5.5 Adhesive strength/flexibility

7.5.5.1 Adhesion after cupping

The test method for verification of adhesive strength derived after cupping shall be in accordance with EN 13523-6.

7.5.5.2 Product flexibility and adhesive strength

The test methods for adhesive strength and resistance to crack formation on 180^0 bending shall be in accordance with EN 13523-7 with or without taping. The resistance to cracking and pick-off on 180^0 bending T is expressed as follows:

$$T = \frac{\text{Minimum mandrel radius}}{\text{Metal thickness}}$$

The minimum bending radius without cracking ranging from 0 T to 6 T shall be specified at the time of enquiry and order considering Table 4.

There shall be no visible cracks when the paint film is examined with a $10 \times$ magnification after test.

NOTE 1 Flexibility of the product depends on the substrate thickness, the metallic protection and the organic coating.

NOTE 2 The definition of T differs from that explained in ASTM D 4145-83 where values are twice as high.

NOTE 3 The adhesion test is made with taping and flexibility test is done without taping.

7.5.5.3 Adhesion and resistance to crack formation on rapid deformation (impact test)

The test method for adhesive strength and resistance to crack formation on rapid deformation by falling weight shall be in accordance with EN 13523-5.

7.5.6 Inspection on defects

The products shall be inspected [A1] for the detection of [A1] possible defects. Inspection methods [A1] *deleted text* [A1] may be agreed at the time of enquiry and order.

Unless otherwise agreed at the time of enquiry and order, only the top side shall be continuously inspected.

7.5.7 Coating hardness

7.5.7.1 Pencil hardness

The test method for measuring pencil hardness shall be in accordance with EN 13523-4.

[A1] NOTE This method should not be used for embossed or textured coatings; it should be agreed at time of enquiry and order. [A1]

7.5.7.2 Buchholz indentation test

The test method for measuring indentation resistance shall be in accordance with EN 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.

〚A1〛 NOTE This method should not be used for embossed or textured coatings; it should be agreed at time of enquiry and order. 〚A1〛

7.5.7.3 Resistance to scratching

The test method for measuring scratch resistance shall be in accordance with EN 13523-12.

7.5.8 Testing on durability

7.5.8.1 General

Laboratory accelerated tests cannot be expected to give direct and valid correlations with outdoor exposures because of the large number of factors of influence. However, they do provide an accepted means of checking quality under artificial conditions.

NOTE Durability tests are not part of the acceptance tests to be carried out per test unit in accordance with 7.3. For information on the results of such tests, the purchaser should contact the manufacturer.

7.5.8.2 Resistance to humidity

The resistance to humidity shall be determined according to EN 13523-26 or, if so agreed at the time of enquiry and order, by another appropriate method.

This test shall not be carried out for coatings of corrosion protection (interior) category CPI1.

For the other corrosion protection (interior) categories, blistering shall be less than category 2 (S2) of EN ISO 4628-2 after the test duration indicated in Table 5.

7.5.8.3 Behaviour on natural weathering

7.5.8.3.1 General test conditions

Outdoor exposure tests shall be carried out in accordance with EN 13523-19 on outdoor exposure sites.

Evaluation shall be in accordance with EN 13523-21.

NOTE 1 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. EN ISO 4628-4 and EN ISO 4628-5 should also be considered for the evaluation.

NOTE 2 Changes in appearance of an organic coating do not necessarily imply that the coating has lost the ability to protect the substrate.

7.5.8.3.2 Natural outdoor corrosion resistance tests

The test duration is one year for the corrosion resistance category RC2, two years for categories RC3 and RC4, at least two years for RC5.

The degree of blistering shall be evaluated in accordance with EN 13523-21, 10 mm away from any singularity (edge, bend, gripping hole).

Natural outdoor corrosion resistance tests are not applicable for coatings of corrosion resistance category RC1.

Examples of outdoor exposure sites are given in Annex D.

7.5.8.3.3 Natural outdoor UV radiation resistance tests

The exposure site shall provide at least 4 500 MJ/m²/year of cumulative solar energy measured horizontally. Specimen cleaning conditions can influence test results significantly. Colour change and retained gloss shall be evaluated on correctly cleaned specimens. The cleaning conditions may be changed upon agreement at the time of enquiry and order. Lisbon (PT) – site recommended by ECCA and Sanary-sur-Mer (FR) are examples of a UV radiation exposure. Other sites with the same minimum cumulative solar energy may be selected as well (Florida, Arizona, etc.).

The test duration is 2 years for all UV resistance categories R_{uv2}, R_{uv3} and R_{uv4}.

7.5.8.4 Behaviour on artificial weathering

7.5.8.4.1 Resistance to neutral salt spray (fog)

The tests shall be carried out in accordance with EN 13523-8 (blistering, corrosion creep), EN ISO 4628-4 (cracking) and EN ISO 4628-5 (flaking).

An alternative flat test specimen without any bending or hole, and only one vertical scribed mark, parallel to the longer side (see also EN ISO 9227), may be agreed at the time of enquiry and order.

In addition to the requirements of EN 13523-8, the following provisions are applicable to the neutral salt spray test:

— type of scribed mark in accordance with EN 13523-8,

— scribing tool: Clemen or equivalent to achieve a scribed mark with a maximum width of 1 mm.

The test duration shall be 360 hours.

NOTE 1 For coatings of corrosion resistance categories RC5 additional appropriate tests relevant to actual corrosive environment could be settled by agreement.

NOTE 2 There is seldom a direct relationship between the resistance of organic coatings to the action of salt spray and resistance to corrosion in other environments. This is because the effect of each of the several factors influencing the progress of corrosion, such as the formation of protective layers, varies greatly with the conditions encountered.

The results obtained in this test should not therefore be regarded as a direct guide to the corrosion resistance of the tested coatings in all environments where these coatings may be used. Also, performance of different coatings in the test should not be taken as a direct guide to the relative corrosion resistance of these coatings in service, even under the severe conditions of marine exposure. Nevertheless, the method described gives a means of checking that the quality of a paint or paint system is being maintained.

NOTE 3 There are materials and coating systems that are exceptionally sensitive to the very aggressive environment used in accelerated tests like the neutral salt spray, but behave excellent in normal outdoor environment. Such a system should be evaluated and controlled by other tests, agreed upon at the time of enquiry and order.

NOTE 4 Other methods of determining resistance to corrosion may be agreed at the time of enquiry and order.

7.5.8.4.2 Resistance to accelerated UV radiation

UV radiation resistance tests shall be carried out in accordance with EN 13523-10.

UV resistance tests shall not be carried out on coatings of UV resistance category R_{uv1}.

The artificial ageing test under combined action of both UV radiation and condensation is carried out for coating system categories R_{uv2}, R_{uv3} and R_{uv4} by using UV-A 340 lamps. The test duration is 2 000 hours (250 cycles).

NOTE 1 Other test methods may be agreed at the time of enquiry and order.

NOTE 2 Artificial weathering or exposure to artificial radiation of coatings in fluorescent UV-condensation type machines is carried out in order to establish, after a certain radiation exposure or mutually agreed total number of operation hours, the degree of a change of a property or properties. The properties of the exposed coatings are compared with those of unexposed coatings, prepared from the same coating materials under identical conditions or with coatings whose degradation properties are known. These properties are evaluated by criteria agreed in advance between the interested parties, these criteria usually being of a subjective nature.

NOTE 3 During natural weathering, global radiation and wet conditions are considered essential for the ageing of coatings. Therefore, the use of the artificial weathering apparatus specified in this standard is to simulate exposure to UV light and moisture.

NOTE 4 The results obtained by the use of this method do not necessarily relate directly with results obtained under natural exposure conditions. The relationship between these results needs to be established before the method can be used to predict performance.

7.6 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 Marking

8.1 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.

8.2 By agreement at the time of enquiry and order, bar coding according to EN 606 may be used.

8.3 A special marking, e.g. [A1] branding [A1] or ink jet, may be agreed upon at the time of enquiry and order.

9 Packing and dispatch

The packing requirements for the product shall be agreed at the time of enquiry and order.

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

10 Storage

Recommendations concerning storage are given in Annex E.

Annex A
(informative)

Types of ambience

A.1 General

The ambience in buildings may be classified in different categories according to the corrosivity.

The following corrosion conditions should be taken into account to establish such a classification (see A.3):

a) the aggressivity of the ambience including when applicable, the conditions for cleaning the interior walls of the building, e.g. frequency of cleaning, aggressivity of the cleaning solutions and use of disinfecting treatments;

b) the risk of condensation, i.e. risk of occasional condensation, frequent condensation, permanent condensation.

A.2 Aggressivity criteria

A.2.1 General

The aggressivity of the ambience may be classified by reference to sub-classes described in A.2.2 to A.2.6.

A.2.2 Non-aggressive ambience

Ambience for which each of the following conditions is fulfilled:

a) no chemical aggressivity;

b) periodicity of cleaning operations with neutral cleaning products: not more than once a month.

A.2.3 Low-aggressive ambience

Ambience for which each of the following conditions is fulfilled:

a) no chemical aggressivity;

b) periodicity of cleaning operations with neutral cleaning products: not more than once a week.

A.2.4 Medium-aggressive ambience

Ambience for which one of the following conditions is fulfilled:

a) low chemical aggressivity;

b) periodicity of cleaning operations with cleaning products of pH between 5 and 9: not more than once a week

A.2.5 Aggressive ambience

Ambience for which one of the following conditions is fulfilled:

a) chemical aggressivity or risk of moulds;

b) periodicity of cleaning operations with cleaning products of pH between 5 and 9: not more than once per day.

A.2.6 Very aggressive ambience

Ambience for which each of the following conditions is fulfilled:

a) high chemical aggressivity or high risk of moulds;

b) periodicity of cleaning operations with cleaning products of pH between 5 and 9: ▌A1⟩ minimum once ⟨A1▌ per day ▌A1⟩ and shall be agreed at the time of enquiry and order ⟨A1▌.

A.3 Classification of types of ambience

Taking into account the corrosion conditions related to aggressivity and risk of condensation, types of ambience may be globally classified into five categories A1 to A5 as indicated in Table A.1.

Table A.1 — Category of ambience depending on the corrosion conditions

Aggressivity of the ambience	Risk of condensation		
	Occasional condensation	Frequent condensation[a]	Permanent condensation
Non aggressive	A1	A2	A5
Low aggressive	A2	A3	A5
Medium aggressive	A3	A4	A5
Aggressive	A4	A5	A5
Very aggressive	A5	A5	A5
NOTE Table A.2 gives a way to get the category of ambience depending on the corrosion conditions			

[a] Condensation is considered as frequent when it can be detected on interior surfaces daily but the time of wetness is generally short (< 2 h).

Table A.2 — A1 Examples of typical indoor ambiences[a] A1

Ambience category	A1 Examples of typical indoor ambiences A1
A1	– Office buildings – Schools – Residential (except kitchens and bathrooms) – Dry storage buildings
A2	– Sport halls – Cinemas, theatres – Cold stores – Supermarkets
A3	– Kitchens and bathrooms – Food processing – Industrial buildings with dry processes
A4	– Swimming pools – Factory buildings with wet processes (e.g. breweries, wine cellars)
A5	– Mushroom culture – Intensive livestock buildings – Dairies – Sea food processing – Paper mills

[a] The examples given are for general guidance only since some building types and applications may be associated with several categories of ambiance e.g. cold stores.

Annex B
(informative)

Coating materials

Table B.1 — List of common coating materials and related thickness ranges

Coating material	Symbol[a]	Usual (range of) coating thickness µm[b, c]
Liquid paints		
Acrylic	AY	5 to 25
Epoxide	EP	3 to 20
Polyester[d]	SP	5 to 30[f]
Polyamide-modified polyester[d]	SP-PA	15 to 50
High build polyester[d]	HBP	30 to 60
High durable polyester[d]	HDP	25 to 60
Polyamide-modified high durable polyester[d]	HDP-PA	15 to 50
Silicon modified polyester	SP-SI	15 to 60
Polyurethane[d]	PUR	10 to 60
Polyfluoro-ethylene/vinyl ether	FEVE	20 to 60
Polyamide-modified polyurethane[d]	PUR-PA	10 to 50
Polyvinylidene fluoride[d]	PVDF	20 to 60[e]
Polyvinyl chloride plastisol	PVC (P)	40 to 200[f]
Special adhesive[g]	SA	5 to 15
Heat resistant non-stick system	HRNS	5 to 15
Weldable zinc-rich primer	ZP	2 to 7
Weldable primer with conductive pigments other than zinc	CP	1 to 15
Coating powders		
Polyester	SP (PO)	30 to 100
Films		
Polyvinyl chloride[h]	PVC (F)	50 to 800[f]
Polyvinyl fluoride	PVF (F)	38[i]
Polyethylene	PE (F)	50 to 300
Polyethylene terephthalate	PET (F)	15 to 150
Polypropylene	PP (F)	30 to 200
Condensed water absorbing fleece	CA (F)	≥ 300

[a] The symbols correspond to the characteristic resin and plastic (following EN ISO 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), films (F) and plastisol (P), on the other hand.

[b] Irrespective of any strippable film.

[c] The coatings having a thickness of 15 µm and over are generally applied as two-coat system (priming coat plus top coat), the type and composition of which can be different.

[d] Also available in textured form.

[e] Consisting of a priming coat and normally a top coat (intermediate coats are available).

[f] Referring to the thickness (measured by a micrometer gauge) in the case of embossed or textured coatings.

[g] E. g. for adhesive strength promoting systems suitable for bonding metal with rubber, plastics and other materials in subsequent processes.

[h] Available in plain or printed forms, also embossed.

[i] Excluding adhesive film thickness of approximately 10 µm.

Annex C
(informative)

Types of atmosphere (see also EN ISO 12944-2)

C.1 Rural atmosphere

The atmosphere prevailing in rural areas and small towns, without significant contamination by corrosive agents such as sulphur dioxide and/or chlorides.

C.2 Urban atmosphere

The contaminated atmosphere prevailing in densely populated areas without significant industry. It has moderate concentrations of pollutants such as sulphur dioxide and/or chlorides.

C.3 Industrial atmosphere

The atmosphere contaminated by corrosive pollutants from local and regional industry (mainly sulphur dioxide).

C.4 Marine atmosphere

The atmosphere over and near the sea.

NOTE 1 A marine atmosphere will extend along a certain distance inland, depending on topography and prevailing wind direction. It has a high content of sea-salt aerosols (mainly chlorides).

NOTE 2 The following explanations may be used for guidance:

— Low salinity is typical of areas located between 10 km and 20 km from the seashore.

— Moderate salinity is typical of areas located between 3 km and 10 km from the seashore.

— High salinity is typical of areas located from the seashore to 3 km inland.

NOTE 3 A distinction should be made between seashore and seafront. Seafront is defined as the place which is submitted to direct attack by seawater and sea-salt aerosols.

C.5 Industrial and marine atmosphere

Atmosphere which combines C.3 and C.4 conditions.

NOTE In a given type of atmospheric environment, various corrosivity categories can be registered depending on the location, i.e:

— open air: both climatic influences and corrosive agents can act on metallic materials,

— under shelter: except rain, sunlight irradiation and solar gain, other climatic influences and corrosive agents can act on metallic materials.

Annex D
(informative)

Outdoor exposure sites

D.1 General

Recommended exposure sites are listed in Table D.1. Other sites complying with EN ISO 12944-2 may be selected. Type 1, 2 and 3 of specimens are specified in EN 13523-19 and the method for their evaluation in EN 13523-21.

D.2 Natural outdoor corrosion sites

Type 2 and 3 specimens are exposed on a corrosion site whose corrosivity is related to the corrosion resistance category intended to obtain for a certain product.

NOTE The ECCA[1)] site of Brest (western France) is an example of marine C5M site. The site of Bohus Malmön Kvarnvik (Sweden) is an example of C4 and C5M depending on the exposure orientation. The site of ECCA Hoek van Holland (the Netherlands) is an example of marine-industrial (low SO_2 and low salinity) and that of ECCA Geleen (southern Netherlands) is an example of continental-industrial (low SO_2).

Table D.1 — Recommended outdoor exposure sites for corrosion resistance categories RC2 to [A1] RC5-M [A1]

Corrosion resistance category[a]	Outdoor exposure site[b]
RC2	ECCA Geleen
RC3	ECCA Hoek van Holland
RC4	Bohus Malmön Kvarnvik[c]
[A1] RC5-I [A1]	[A1] There is no RC5-I exposure site in Europe [A1]
[A1] RC5-M [A1]	[A1] ECCA Brest / Bohus Malmön Kvarnvik [c] [A1]

[a] For relationship with corrosivity categories and types of atmosphere, see Table 6.

[b] Other sites which comply with EN ISO 12944-2 may be selected

[c] The corrosivity of Bohus Malmön Kvarnvik strongly varies from one exposure rack to another.

D.3 Natural outdoor UV radiation sites

Relationship between UV categories indicating the level of UV radiation in the environment and geographical areas is given in Table D.2 for guidance.

Type 1 specimens are exposed in a site providing at least 4 500 MJ/m²/year of cumulative solar energy measured horizontally.

1) European Coil Coating Association (ECCA), 19-21, rue du Luxembourg, BE-1000, Bruxelles

NOTE The sites located in Lisbon (Portugal) and Sanary-sur-Mer (France) meet the requirements of this specification.

Table D.2 — Examples of exposures for the different UV resistance categories

UV resistance category	Example
R_{uv1}	Reverse coating of exterior elements
R_{uv2}	Regions located north of about latitude 45 °N, with an altitude not greater than 900 m
R_{uv3}	Regions located south of about latitude 45 °N and north of about latitude 37° N, with an altitude not greater than 900 m.
R_{uv4}	Regions located south of about latitude 37 °N. Every region with an altitude greater than 900 m.
NOTE 1 Examples given are of general guidance since local conditions in relation with sunshine hours and UV-radiation can vary considerably even in a small geographical area (see also NOTE 1 to Table 6). NOTE 2 For buildings located next to the sea or large lakes or areas covered with snow, UV-radiation can be increased due to reflection from the corresponding surfaces.	

Annex E
(informative)

Storage

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

Coils with horizontal axes should not be stored on top of each other (stacked). When packs of sheets 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. Additionally, secure packing should be taken as precautionary measure during transport.

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).

Bibliography

[1] EN 606, *Bar coding — Transport and handling labels for steel products*

[2] EN 10027-1, *Designation systems for steels — Part 1: Steel names*

[3] EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

[4] EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

[5] EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

[6] EN 10088-4, *Stainless steels — Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes*

[7] EN ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1:2001)*

[8] EN ISO 2409, *Paints and varnishes — Cross-cut test (ISO 2409:2007)*

[9] EN ISO 2808, *Paints and varnishes — Determination of film thickness (ISO 2808:2007)*

[10] EN ISO 2810, *Paints and varnishes —Natural weathering of coatings —Exposure and assessment (ISO 2810:2004)*

[11] EN ISO 11997-1, *Paints and varnishes — Determination of resistance to cyclic corrosion conditions — Part 1: Wet (salt fog)/ dry / humidity (ISO 11997-1:2005)*

[12] ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification*

[13] ASTM D 4145-83 (2002)*, Standard Test Method for Coating Flexibility of Prepainted Sheet*

[14] CIE 15:2004, *Colorimetry*