

Continuously hot-dip aluminium-silicon (AS) coated steel strip and sheet — Technical delivery conditions

The European Standard EN 10154 : 1996 has the status of a
British Standard

ICS 77.140.50

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ISE/10, Flat rolled steel products, upon which the following bodies were represented:

- 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

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 September 1996

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The following BSI references relate to the work on this standard:
Committee reference ISE/10
Draft for comment 94/340694 DC

ISBN 0 580 25896 3

Amendments issued since publication

Amd. No.	Date	Text affected

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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 10154 : 1996, *Continuously hot-dip aluminium-silicon (AS) coated steel strip and sheet — Technical delivery condition* published by the European Committee for Standardization (CEN). It supersedes BS 6536 : 1985 which is withdrawn.

Cross-references

Publication referred to	Corresponding British Standard
EN 10002-1	BS EN 10002 <i>Tensile testing of metallic materials</i> Part 1 : 1990 <i>Method of test at ambient temperature</i>
EN 10020	BS EN 10020 : 1991 <i>Definition and classification of grades of steel</i>
EN 10021	BS EN 10021 : 1993 <i>General technical delivery requirements for steel and iron products</i>
EN 10027-1	BS EN 10027 <i>Designation systems for steel</i> Part 1 : 1992 <i>Steel names, principal symbols</i>
EN 10027-2	Part 2 : 1992 <i>Numerical system</i>
EN 10079	BS EN 10079 : 1993 <i>Definition of steel products</i>
EN 10143	BS EN 10143 : 1993 <i>Continuously hot-dip metal coated steel sheet and strip. Tolerances on dimensions and shape</i>
EN 10204	BS EN 10204 : 1991 <i>Metallic products. Types of inspection documents</i>
ENV 606	DD ENV 606 : 1993 <i>Bar coded transport and handling labels for steel products</i>
Euronorm 12	BS 1639 : 1964 <i>Methods for bend testing of metals</i>

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ICS 77.140.50

Descriptors: Iron and steel products, metal plates, steel strips, steels, hot-dip coating, continuous coating, aluminium-silicon alloys, designation, grades: quality, classifications, quality, mechanical properties, surface treatment, mass, inspection, marking

English version

Continuously hot-dip aluminium-silicon (AS) coated steel strip and sheet — Technical delivery conditions

Bandes et tôles en acier revêtues en continu par immersion à chaud d'une couche d'aluminium-silicium (AS) — Conditions techniques de livraison

Kontinuierlich schmelztauchveredeltes Band und Blech aus Stahl mit Aluminium-Silicium-Überzügen (AS) — Technische Lieferbedingungen

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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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 prepared by Technical Committee ECISS/TC 27, Surface coated steel flat products — Qualities, dimensions, tolerances and specific tests, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1996, and conflicting standards shall be withdrawn at the latest by October 1996.

The European Standard EN 10154 supersedes EURONORM 154-80, *Hot-dip aluminium-silicon coated low carbon steel flat rolled products of commercial and drawing qualities — Technical delivery conditions*.

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

This European Standard specifies requirements for continuously hot-dip aluminium-silicon alloy coated flat products made of low carbon steels for cold forming (see table 1) or of structural steels (see table 2) in thicknesses $\leq 3,0$ mm. The thickness is the final thickness of the delivered product after coating.

This European Standard applies to strip of all widths and to sheets cut from it (≥ 600 mm width) and cut lengths (< 600 mm width).

The aluminium-silicon alloy coating is obtained by immersing the products in a bath containing 8 % to 11 % Si (also referred to as type 1).

The available coating masses, coating finishes and surface qualities are given in 5.2 to 5.4 and table 3.

The products covered by this European Standard are mainly used where heat resistance and corrosion resistance are the most important factors.

This European Standard is not applicable to steel flat products with hot-dip coating of pure aluminium (normally referred to as type 2 coating).

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate points in the text and the publications are listed hereafter. Subsequent amendments to, or revisions of, any of these publications apply to this European Standard only when incorporated in it by amendment or revision. In the case of undated references the most recent edition of the publications referred to applies.

EN 10002-1	<i>Metallic materials — Tensile testing — Part 1: Method of testing (at ambient temperature)</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 10027-1	<i>Designation systems for steels — Part 1: Steel names, principal symbols</i>
EN 10027-2	<i>Designation systems for steels — Part 2: Numerical system</i>
EN 10079	<i>Definition of steel products</i>
EN 10143	<i>Continuously hot-dip metal coated steel sheet and strip — tolerances on dimensions and shape</i>

EN 10204	<i>Metallic products — types of inspection documents</i>
ENV 606	<i>Bar coded transport and handling labels for steel products</i>
CR 10260	<i>ECISS IC 10 Designation systems for steel — additional symbols for steel names</i>
EURONORM 12 ¹⁾	<i>Bend test for steel sheet and strip less than 3 mm thick</i>

3 Definitions

For the purposes of this European Standard the following definitions apply in addition to the definitions in EN 10020, EN 10021, EN 10079 and EN 10204:

3.1 hot-dip aluminium-silicon alloy coating (AS)

Application of an aluminium-silicon coating by immersing the prepared products in a molten bath of aluminium-silicon alloy.

NOTE. In the present case, wide strip is continuously hot-dip coated in a bath the composition (type 1) of which is given in clause 1.

3.2 coating mass

Total mass of coating on both surfaces of the product (expressed in grams per square metre).

4 Designation

4.1 The steel names are allocated in accordance with EN 10027-1 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:

- type of product (e.g. strip, sheet or cut length);
- number of this standard (EN 10154);
- steel name or steel number and symbol for the type of hot-dip coating as given in table 1 or table 2;
- number denoting the nominal mass of coating (e.g. 080 = 080 g/m² including both surfaces, see table 3);
- letter denoting the surface quality (A, B or C, see 5.3);
- letter denoting the surface treatment (C, O, CO or U, see 5.4).

EXAMPLE 1. Designation of strip made of steel DX53D+AS or 1.0355+AS, coating mass 080 g/m² (080), surface quality improved surface (B); surface treatment chemical passivation (C);

or Strip EN 10154-DX53D+AS-080-B-C
Strip EN 10154-1. 0355+AS-080-B-C

¹⁾ Until it is transformed into a European Standard, either EURONORM 12 or the corresponding national standard may be applied.

EXAMPLE 2. Designation of sheet made of steel S250GD+AS or 1.0242+AS, coating mass 120 g/m² (120), surface quality best quality surface (C), surface treatment chemical passivation and oiling (CO):

or Sheet EN 10154-S250GD+AS-120-C-CO
 Sheet EN 10154-1. 0242+AS-120-C-CO

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 Classification of grades and types of delivery

5.1 Steel grades

5.1.1 The steel grades available are given in table 1 and table 2. Table 1 contains low carbon steels listed in the following order of increasing suitability for cold forming:

- DX51D+AS: bending and profiling quality;
- DX52D+AS: drawing quality;
- DX53D+AS: deep drawing quality;
- DX54D+AS: special deep drawing quality;
- DX55D+AS: special deep drawing quality, heat resistance up to 800 °C.

Table 2 contains structural steels listed in order of increasing specified minimum yield strength values.

5.1.2 Heat resistance may be assumed for temperatures up to 700 °C except for steel grade DX55D+AS for which heat resistance may be assumed for temperatures up to 800 °C.

5.2 Coatings

5.2.1 The coating masses are given in table 3. For special applications coating masses which are different from those of table 3 can be supplied by agreement between the producer and the user. Thicker coatings limit the formability and weldability of the products. Therefore, the forming and weldability requirements should be taken into account when ordering the coating mass.

5.2.2 During hot dip coating, a Fe-Al-Si alloy layer forms over the base material and its thickness depends on the chemical composition and the metallurgical properties of the base material. If a maximum value for the mass of this layer is required, this shall be specially agreed upon at the time of ordering. The test method is described in annex B.

5.3 Surface quality

5.3.1 General

The products may be supplied with one of the surface qualities described in 5.3.2 to 5.3.4 (see also 4.2e) and 6.8).

5.3.2 As coated surface (A)

Imperfections such as small pits, dark spots, stripe marks and light passivation stains are permissible. Leveller breaks or run-off marks may appear.

5.3.3 Improved surface (B)

Surface quality B is obtained by skin passing. With this surface quality, small imperfections such as stretch levelling breaks, skin pass marks, scratches, indentations, run off marks and light passivation stains are permissible. The surface has no pits.

NOTE. For special applications and by agreement between the producer and the user, the products may be supplied with a bright appearance. In that case the surface is of type 'B'.

5.3.4 Best quality surface (C)

Surface quality C is obtained by skin passing. The better surface shall not impair the uniform appearance of a high-class paint finish. The other surface shall have at least the characteristics of surface quality B (see 5.3.3).

Table 1. Grades and mechanical properties of low carbon steels for cold forming					
Designation Steel grade			Yield strength R_e max. ¹⁾²⁾ N/mm ²	Tensile strength R_m max. ²⁾ N/mm ²	Elongation A_{80} min. ³⁾ %
Steel name	Steel number	Symbol for the type of hot-dip coating			
DX51D	1.0226	+AS	—	500	22
DX52D	1.0350	+AS	300 ⁴⁾	420	26
DX53D	1.0355	+AS	260	380	30
DX54D	1.0306	+AS	220	360	34
DX55D ⁵⁾	1.0309	+AS	240	370	32

¹⁾ The yield strength values apply to the 0,2 % proof stress if the yield point is not pronounced, otherwise to the lower yield point (R_{eL}).
²⁾ For all steel grades a minimum value of 140 N/mm² for the yield strength (R_e) and of 270 N/mm² for the tensile strength (R_m) may be expected.
³⁾ For product thicknesses between 0,5 mm and 0,7 mm inclusive the minimum elongation values (A_{80}) shall be reduced by 2 units. For product thicknesses less than 0,5 mm the values are to be agreed upon at the time of ordering.
⁴⁾ This value applies to skin passed products only (surface qualities B and C).
⁵⁾ See 5.1.2.

Table 2. Grades and mechanical properties of structural steels					
Designation Steel grade			Yield strength R_{eH} min. N/mm ²	Tensile strength R_m min. N/mm ²	Elongation A_{80} min. %
Steel name	Steel number	Symbol for the type of hot-dip coating			
S250GD	1.0242	+AS	250	330	19
S280GD	1.0244	+AS	280	360	18
S320GD	1.0250	+AS	320	390	17
S350GD	1.0529	+AS	350	420	16

¹⁾ For product thickness $\leq 0,7$ mm the minimum elongation values (A_{80}) shall be reduced by 2 units.

5.4 Surface treatment (surface protection)

5.4.1 General

Hot-dip aluminium-silicon coated flat products generally receive a surface protection at the producer's plant as specified in 5.4.2 to 5.4.5 (see also 4.2f). The period of protection afforded depends on the atmospheric conditions.

5.4.2 Chemical passivation (C)

Chemical passivation may be carried out after coating to protect the surface against humidity and to reduce the risk of formation of corrosion products (white rust).

Chemical passivation may cause slight discolouration of the surface but is not detrimental to the general performance of the product.

NOTE. Products with a bright appearance (see note to 5.3.3) which have been chemically passivated may be protected by a strippable film on one surface if agreed at the time of ordering.

5.4.3 Oiling (O)

This treatment also reduces the risk of formation of corrosion products (white rust).

It shall be possible to remove the oil layer with a suitable degreasing solvent which does not adversely affect the coating.

Products supplied oiled may require additional lubrication prior to rolling or drawing.

5.4.4 Chemical passivation and oiling (CO)

Agreement may be reached on this combination of surface treatment if increased protection against the formation of corrosion products (white rust) is required.

5.4.5 Untreated (U)

Hot-dip aluminium-silicon coated flat products are only supplied without surface treatment if expressly desired by the purchaser on his own responsibility. In this case, there is increased risk of formation of corrosion products (white rust).

6 Requirements

6.1 Manufacturing process

The processes used in steelmaking and manufacture of the products are left to the discretion of the manufacturer.

6.2 Selection of properties

6.2.1 The products are generally supplied on the basis of the mechanical property requirements in table 1 and table 2.

6.2.2 If specially agreed at the time of ordering, products made of steel grades DX52D+AS, DX 53D+AS, DX 54D+AS and DX55D+AS with suitability for manufacturing a specific part may be supplied. In this case the values in table 1 do not apply. The reject tolerances arising when the material is processed shall not exceed a specific proportion to be agreed upon at the time of ordering.

6.3 Mechanical properties

6.3.1 If ordered in accordance with 6.2.1 the mechanical property values in table 1 for the low carbon steels apply for the following periods commencing from the date on which the products are made available by the works:

- 8 days for steel grades DX51D+AS and DX52D+AS
- 6 months for steel grades DX53D+AS, DX54D+AS and DX55D+AS.

6.3.2 For the structural steel flat products the mechanical properties in table 2 apply. A reduction in the formability may occur with time. It is therefore in the interest of the purchaser to use the products as soon as possible.

6.3.3 The tensile test values apply to:

- transverse test pieces for the low carbon steel grades according to table 1;
- longitudinal test pieces for the structural steel grades according to table 2.

The values shall be related to the test piece cross-section without coating.

6.4 Freedom from coil breaks

6.4.1 Low carbon steels for cold forming

If particular requirements are made for freedom from coil breaks (fluting), it may be necessary to skin pass or stretch level the products. This treatment may limit the formability. Similar conditions exist for the appearance of coil breaks as for the appearance of stretcher strains (see 6.5).

6.4.2 Structural steels

If the products are to be delivered with freedom from coil breaks (fluting), this shall be indicated at the time of order.

6.5 Stretcher strains (low carbon steel for cold forming)

6.5.1 In order to avoid the formation of stretcher strains when cold forming, it may be necessary for the products to be skin passed at the manufacturer's works. As there is a tendency for stretcher strains to form again after some time, it is in the interest of the purchaser to use the products as soon as possible.

6.5.2 Products with the surface condition B or C are free from stretcher strains for the following periods commencing from the agreed date on which they are made available by the works:

- 1 month for steel grades DX51D+AS and DX52D+AS;
- 6 months for steel grades DX53D+AS, DX54D+AS and DX55D+AS.

6.6 Coating mass

6.6.1 The coating mass shall correspond to the data in table 3. The values apply for the total mass of the coating on both surfaces for the triple spot test and the single spot test (see 7.4.4 and 7.5.3).

The coating mass is not always equally distributed on both the product surfaces. However, it may be assumed that a coating mass of at least 40 % of the value given in table 3 for the single spot test exists on each surface of the product.

Table 3. Coating masses		
Coating designation ¹⁾	Minimum coating mass, total both surfaces ²⁾ g/m ²	
	Triple spot test ³⁾	Single spot test ³⁾
060	60	45
080	80	60
100	100	75
120	120	90
150	150	115

¹⁾ See also 5.2
²⁾ A coating mass of 100 g/m² on both sides corresponds to a coating thickness of approximately 17 µm on each surface.
³⁾ See 7.4.4 and 7.5.3.

6.6.2 A maximum or minimum value for the coating mass may be agreed upon per surface of the product (single spot test) for each coating given in table 3.

6.7 Adhesion of coating

The adhesion of the coating shall be tested using the method specified in 7.5.2. After bending, the coating shall show no signs of flaking, but an area of 6 mm from each edge of the specimen shall be disregarded in order to exclude the effect of the cutting. Crazeing and roughening are permissible.

6.8 Surface condition

6.8.1 The surface shall comply with the requirements in 5.3 and 5.4. Unless otherwise agreed at the time of ordering, only one surface shall be inspected at the manufacturer's works. If requested the supplier shall inform the purchaser whether the inspected surface is the top surface or bottom surface.

Small edge cracks which may occur in the case of uncut edges are not a justification for rejection.

6.8.2 When supplying strip in coils, there is greater risk of surface defects than if sheet and cut lengths are supplied as it is not possible for the manufacturer to eliminate all the defects in a coil. This shall be taken into account by the purchaser when evaluating the products.

6.9 Dimensions, tolerances on dimensions and shape

The requirements of EN 10143 shall apply.

6.10 Suitability for further processing

6.10.1 Welding

The products according to this European standard shall be suitable for welding using the normal welding methods. With larger coating masses, special measures shall be taken for welding, as appropriate.

6.10.2 Forming

Depending on the steel grade the products shall be suitable to be drawn, bent or profiled.

6.10.3 Organic coating

All steel grades and surface conditions shall be suitable for organic coating. The appearance after this treatment depends on the surface quality ordered (see 5.3).

NOTE. Application of organic coatings requires a corresponding pre-treatment of the surface at the processor's works.

7 Testing

7.1 General

7.1.1 The products may be supplied with or without testing for compliance with the requirements of this European Standard.

7.1.2 If testing is required, 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 7.7).

7.1.3 Specific tests shall be carried out in accordance with the requirements in 7.2 to 7.6.

7.2 Test units

The test unit consists of 20 t or a fraction of 20 t of hot-dip coated flat products of the same grade and nominal thickness, coating mass and surface condition. In the case of strip, a coil weighing more than 20 t shall be regarded as one test unit.

7.3 Number of tests

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

- the mechanical properties (see 7.5.1);
- the adhesion of the coating (see 7.5.2); and
- the coating mass (see 7.5.3).

The number of tests for the determination of the alloy layer (see 5.2.2) shall, if required, be agreed at the time of ordering.

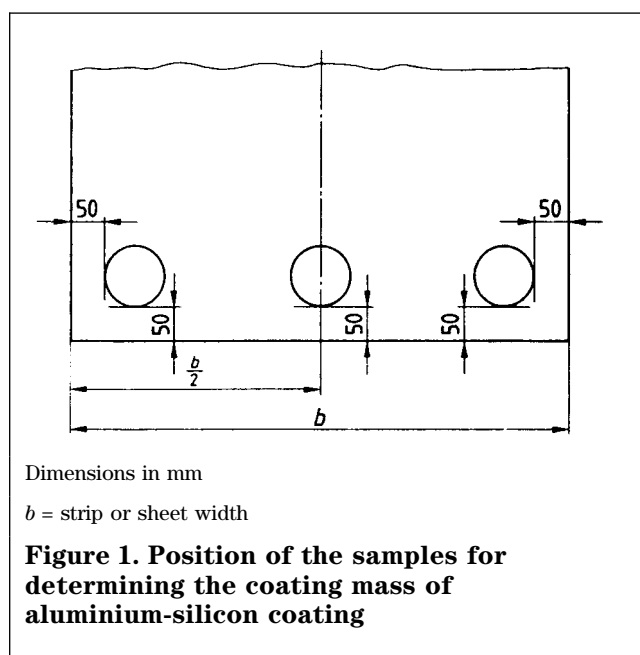
7.4 Sampling

7.4.1 In the case of strip, the samples shall be taken from the beginning or the 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.

7.4.2 The sample for the tensile test (see 7.5.1) shall be taken either in the transverse or in the longitudinal direction (see 6.3.3) at a distance of at least 50 mm from the edge of the product.

7.4.3 The sample for the bend test to determine the adhesion of the coating (see 7.5.2) may be taken in any direction. The distance from the product edge shall be at least 50 mm. The size of the sample shall be such that the length of the folded edge is at least 100 mm.

7.4.4 The three samples for testing the coating mass (see 7.5.3) shall be taken as shown in figure 1 if the product width permits. The samples may be round or square and the individual sample shall be at least 5000 mm² in area.



If sampling as shown in figure 1 is not possible because the product width is too small, only one sample shall be taken with an area of at least 5000 mm². The coating mass determined from it shall comply with the requirements for the single spot test as specified in table 3.

7.4.5 If it is agreed to determine the thickness of the alloy layer (see 5.2.2) special agreement shall be made for sampling.

7.4.6 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 The tensile test shall be carried out as described in EN 10002-1 using type 2 test pieces (initial gauge length $L_0 = 80$ mm, width $b = 20$ mm) (see also 6.3.3).

7.5.2 The bend test to determine the adhesion of the coating (see also 6.7 and 7.4.3) shall be carried out as described in EURONORM 12.

The diameters D of the mandrel or bending roll given in table 4 shall be used. The angle of bend shall be 180° in all cases.

When pressing together with the two legs of the test piece, care shall be taken that the coating is not damaged.

Table 4. Mandrel diameter for the bend test to determine the adhesion of the coating (see 7.5.2)

Steel grade	Mandrel diameter D^1 for nominal thicknesses	
	< 2,0 mm	$\geq 2,0 \leq 3,0$ mm
DX51D+AS	0	1a
DX52D+AS	0	1a
DX53D+AS	0	1a
DX54D+AS	0	1a
DX55D+AS	0	1a
S250GD+AS	1a	2a
S280GD+AS	2a	3a
S320GD+AS	2a	3a
S350GD+AS	2a	3a

¹⁾ a: Product thickness

7.5.3 The coating mass shall be determined from the difference in mass of the samples before and after the coating has been removed chemically. In the test with specimen according to figure 1, the triple spot test value is the arithmetic mean of the three test results. Each individual result shall meet the requirements of the single spot test as given in table 3.

Other methods, e.g. non-destructive tests, may be used for continuous checks at the manufacturer's works.

In cases of dispute, the method described in annex A of this European Standard shall be used.

7.5.4 If it is agreed to determine the thickness of the alloy layer (see **5.2.2**) the method for its determination given in annex B shall be applied.

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.

7.7 Inspection documents

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

8 Marking

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

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

Bar coding according to ENV 606 can supplement marking, when the above mentioned minimum information is also given in clear text.

9 Packing

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

10 Storage and transportation

10.1 Moisture, in particular condensation between the sheets, laps of the coil or other adjacent parts made of hot-dip aluminium-silicon coated flat products can lead to the formation of corrosion products (white rust).

The possible types of surface protection are given in **5.4**. However if there is lengthy contact with moisture the protection may be reduced locally. As a precaution, the products should be transported and stored dry and protected from moisture.

10.2 During transportation, dark spots may appear in the coated surfaces as a result of friction. Generally, they only impair the appearance. Friction is reduced by oiling the products. However, the following precautionary measures should be taken: secure packing, laid flat, no local pressure spots.

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 of this standard:

- a) product type (strip, sheet, cut length);
- b) nominal dimensions (thickness, width and, in the case of sheet and cut lengths, length);
- c) quantity;
- d) complete designation (see **4.2**);
- e) limiting mass and sizes of the coils and individual bundles of sheets;
- f) details of any special requirements for a maximum alloy layer mass (see **5.2.2**);
- g) any low carbon steel products suitable for the manufacture of a specific part (see **6.2.2**);
- h) any products supplied free from coil breaks (see **6.4**);
- i) any maximum or minimum value for the coating mass per product surface (see **6.6.2**);
- j) notification of which surface has been inspected (see **6.8.1**);
- k) any testing for compliance with the requirements of this standard (see **7.1.1** and **7.1.2**);
- l) any supply of an inspection document and type of document (see **7.7**);
- m) any requirements for packing (see clause **9**).

Annex A (normative)

Reference method for determination of the coating mass

A.1 Scope

The method described below is used for determining the coating mass of hot-dip aluminium-silicon coated flat products. The samples are weighed before and after the coating is removed.

A.2 Reagents

- hydrochloric acid ($\rho = 1,19 \text{ g/ml}$);
- 20 % sodium hydroxide solution made by dissolving 20 g sodium hydroxide in 80 ml of water.

A.3 Procedure

A.3.1 Samples

The samples are taken from the product in accordance with 7.4.4.

The samples shall be clean. If necessary, they are to be washed firstly with suitable solvents, which will not attack the coating, then secondly in alcohol. Finally, they are thoroughly dried.

A.3.2 Method

After washing as specified in A.3.1, the samples are weighed and then placed in the hot sodium hydroxide solution until the reaction ceases. Then the test samples are taken out of this solution, rubbed under water, roughly dried off with a cloth and placed in cold hydrochloric acid for 2 s to 3 s.

The samples are then rinsed under water and again immersed in the sodium hydroxide solution until no further reaction can be established. This process is to be repeated until no reaction is visible when the sample is dipped into the sodium hydroxide solution. The samples are then washed, dried and re-weighed.

A.4 Evaluation

The coating mass in grams per square metre of the product (on both sides) is obtained from the formula:

$$\frac{(m_0 - m_1) \cdot 10^6}{A}$$

where

- m_0 is the mass of the sample before the coating is stripped off (in grams);
- m_1 is the mass of the sample after the coating has been removed (in grams);
- A is the area of the sample used (in square millimetres).

Annex B (normative)

Method for determination of the mass of the alloy layer

B.1 Scope

The method described below is used for determining the mass of the alloy layer on samples of hot-dip aluminium-silicon coated flat products. Firstly, the so-called non-alloy layer and secondly the alloy layer are removed, according to the method in annex A. The method is based on the reaction of tin (II) chloride solution with aluminium to form metallic tin (sponge); this solution does not react with the alloy or with the iron base material. The samples are weighed before and after removal of the alloy layer.

B.2 Reagents

B.2.1 Tin (II) chloride solution

B.2.1.1 To produce the stock solution 1000 g $\text{SnCl}_2 \cdot \text{H}_2\text{O}$ are dissolved in 500 ml of diluted hydrochloric acid (1 : 1). Make up to 1000 ml adding 5 g to 10 g metallic tin. Heat until the solution is clear.

B.2.1.2 To produce the test solution 20 ml of stock solution are added to 200 ml H_2O immediately prior to use.

B.3 Procedure

B.3.1 Removal of the non-alloy layer

The samples, taken in accordance with 7.4.4 are cleaned with petroleum ether and immersed in 200 ml of test solution (see B.2.1.2) until the reaction ceases.

Once the test samples have been removed from the solution, the sponge tin is scraped off with a small spatula. The process is repeated until no further reaction takes place. The samples are then washed and dried.

B.3.2 Determination of alloy layer

The test samples prepared in accordance with B.3.1 are treated as described in A.3.2.

B.4 Evaluation

The mass of the alloy layer is calculated using the formula in A.4, from the difference in mass of the samples before and after the test.

List of references

See national foreword.

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