BRITISH STANDARD

BS EN
10154:2002

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

The European Standard EN 10154:2002 has the status of a British Standard

ICS 77.140.50

National foreword

This British Standard is the official English language version of EN 10154:2002. It supersedes BS EN 10154:1996 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/10, Flat rolled steel products, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

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EUROPEAN STANDARD

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EN 10154

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Supersedes EN 10154:1996

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

This European Standard was approved by CEN on 17 February 2002.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document EN 10154:2002 has been prepared by ECISS/TC 27 "Surface coated 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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

This European Standard supersedes EN 10154:1996.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This 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 ≤ 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 coatings, coating masses and surface qualities are given in 7.2 to 7.3 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 reference 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 draft 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 (including amendments).

EN 10002-1, *Metallic materials - Tensile testing - Part 1: Method of testing at ambient temperature.*

EN 10020, *Definition and classification of grades of steel.*

EN 10021, *General technical delivery requirements for steel and iron products*

EN 10027-1, *Designation systems for steels - Part 1: Steel names - principal symbols.*

EN 10027-2, *Designation systems for steels - Part 2: Numerical system.*

EN 10079, *Definition of steel products.*

EN 10143, *Continuously hot-dip metal coated steel sheet and strip - tolerances on dimensions and shape.*

EN 10204, *Metallic products - types of inspection documents.*

ENV 606, *Bar coded transport and handling labels for steel products.*

CR 10260, *Designation systems for steel - additional symbols.*

EURONORM 12[1)], *Bend test for steel sheet and strip less than 3 mm thick.*

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

ISO 10113, *Metallic materials - Sheet and strip - Determination of plastic strain ratio.*

ISO 10275, *Metallic materials - Sheet and strip - Determination of tensile strain hardening exponent.*

3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply in addition to the terms and 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 including the Al-Fe-Si alloy layer on both surfaces on the product (expressed in grams per square metre)

4 Classification and designation

4.1 Classification

4.1.1 The steel grades according to Table 1 of this European Standard are classified according to their increasing suitability for cold forming as follows:

DX51D+AS: bending and profiling quality,

DX52D+AS: drawing quality,

DX53D+AS: deep drawing quality,

DX54D+AS: special deep drawing quality,

DX55D+AS: deep drawing quality, heat resistance up to 800 °C,

DX56D+AS: extra deep drawing quality.

The steel grades according to Table 2 of this European Standard are classified according to their decreasing specified minimum yield strength values with the exception of DX56D.

4.1.2 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.

4.2 Designation

4.2.1 Steel names

For the steel grades covered by this European Standard, the steel names as given in Tables 1 and 2 are allocated in accordance with EN 10027-1 and CR 10260.

4.2.2 Steel numbers

For the steel grades covered by this European Standard, the steel numbers as given in Tables 1 and 2 are allocated in accordance with EN 10027-2 and CR 10260.

5 Information to be supplied by the purchaser

5.1 Mandatory information

The following information shall be supplied by the purchaser at the time of enquiry and order:

a) the quantity to be delivered;

b) the type of product (strip, sheet, cut length);

c) the number of the dimensional standard (EN 10143);

d) the nominal dimensions and the tolerances on dimensions and shape and, if applicable, letters denoting relevant special tolerances;

e) the term “steel”;

f) number of this standard (EN 10154);

g) steel name or steel number and symbol for the type of hot dip coating as given in Tables 1 and 2;

h) number designating the nominal mass of coating (e.g. 080 = 80 g/m² including both surfaces, see Table 3);

i) letter denoting the surface quality (A, B or C, see 7.3);

j) letter denoting the surface treatment (C, O, CO or U, see 7.4).

EXAMPLE 1 sheet, delivered with dimensional tolerances according to EN 10143 with a nominal thickness of 0,70 mm, ordered with special thickness tolerances (S), nominal width 1 200 mm, ordered with special width tolerances (S), nominal length 2 500 mm, ordered with special flatness tolerances (FS), made of steel S250GD+AS120-C-CO(1.0242+AS120-C-CO) according to EN 10154:

1 sheet EN 10143-0,70Sx1200Sx2500FS

steel EN 10154-S250GD+AS120-C-CO

or

1 sheet EN 10143-0,70Sx1200Sx2500FS

steel EN 10154-1.0242+AS120-C-CO

5.2 Options

A number of options are specified in this European Standard and listed below. If the purchaser does not indicate his wish to implement one of these options, the supplier shall supply in accordance with the basis specification of this European Standard (see 5.1).

a) any low carbon steel products suitable for the manufacture of a specific part (see 7.1.2);

b) any special requirements for a maximum Al-Fe-Si alloy layer mass occurring during hot-dip aluminium-silicon coating (see 7.2.2);

c) any requirement for special applications on bright appearance (type B surface, see NOTE to 7.3.3) and protection by a strippable film on one surface (see NOTE to 7.4.2);

d) any products supplied free from coil breaks (see 7.5);

e) any products supplied free from stretcher strains when cold forming (see 7.6.2);

f) any maximum or minimum value for the coating mass per product surface (see 7.7.2);

g) notification of which surface has been inspected (see 7.9.1);

h) any testing for compliance with the requirements of this standard (see 8.1.1 and 8.1.2);

i) any supply of an inspection document and type of document (see 8.1.2);

j) any requirement for packing (see 10).

6 Manufacturing process

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

7 Requirements

7.1 Mechanical properties

7.1.1 The products shall be supplied on the basis of the mechanical property requirements in Table 1 and Table 2.

7.1.2 If specially agreed at the time of enquiry and order, products made of steel grades DX52D+AS, DX 53D+AS, DX54D+AS, DX55D+AS and DX56D+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 enquiry and order.

7.1.3 If ordered in accordance with 7.1.1 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, DX55D+AS and DX56D+AS.

7.1.4 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.

7.1.5 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.

Table 1 - Grades and mechanical properties of low carbon steels for cold forming

Designation Steel grade			Yield strength R_e[a] MPa *)	Tensile strength R_m MPa *)	Elongation A_{80} % min.[b]	Plastic strain ratio r_{90} min.	Strain hardening exponent n_{90} min.
Steel name	Steel number	Symbol for the type of hot-dip coating					
DX51D	1.0226	+AS	-	270 to 500	22	-	-
DX52D	1.0350	+AS	140 to 300[c]	270 to 420	26	-	-
DX53D	1.0355	+AS	140 to 260	270 to 380	30	-	-
DX54D	1.0306	+AS	120 to 220	260 to 360	34	1,4[e,f]	0,18[f]
DX55D[d]	1.0309	+AS	140 to 240	270 to 370	30	-	-
DX56D	1.0322	+AS	120 to 180	260 to 330	39	1,7[e,f]	0,20[f]

*) 1 MPa = 1 N/mm².

a 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}).

b 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 enquiry and order.

c This value applies to skin passed products only (surface qualities B and C).

d See 4.1.2.

e For thicknesses > 1,5 mm, the r_{90}-value shall be reduced by 0,2.

f For thicknesses ≥ 0,7 mm, the r_{90}-value shall be reduced by 0,2 and the n_{90}-value shall be reduced by 0,01. For thicknesses < 0,5 mm, the r_{90}- and n_{90}-values shall be agreed at the time of enquiry and order.

Table 2 - Grades and mechanical properties of structural steels

Designation Steel grade			Yield strength R_{eH} MPa *) min.	Tensile strength R_m MPa *) min.	Elongation A_{80} % min.[a]
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 MPa = 1 N/mm².

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

7.2 Coatings

7.2.1 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.

7.2.2 During hot dip coating, a relatively pronounced Al-Fe-Si layer is formed over the base material. This shall be taken into account for further processing. If a maximum value for the mass of this layer is required, this shall be specially agreed upon at the time of enquiry and order. The test method is described in annex B.

7.3 Surface quality

7.3.1 General

The products may be supplied with one of the surface qualities described in 7.3.2 to 7.3.4 (see also 5.1i) and 7.9).

7.3.2 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. Coil breaks and stretcher strains may appear as well.

7.3.3 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".

7.3.4 Best quality surface (C)

Surface quality C is obtained by skin passing.

The controlled surface shall make it possible to apply a uniform high-class paint finish. The other surface shall have at least the characteristics of surface quality B (see 7.3.3).

7.4 Surface treatment (surface protection)

7.4.1 General

Hot-dip aluminium-silicon coated flat products generally receive a surface protection at the producer's plant as specified in 7.4.2 to 7.4.5 (see also 5.1j)). Surface treatment serves, among other things, as a temporary corrosion protection during storage and transportation. The period of protection afforded depends on the atmospheric and storage conditions.

7.4.2 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 coloration of the surface but is not detrimental to the general performance of the product.

NOTE Products with a bright appearance (see note to 7.3.3) which have been chemically passivated can be protected by a strippable film on one surface if agreed at the time of enquiry and order.

7.4.3 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.

7.4.4 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.

7.4.5 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).

7.5 Freedom from coil breaks

If particular requirements are made for freedom from coil breaks (fluting), it is recommended to order improved surface quality B (see 7.3.3).

7.6 Stretcher strains (low carbon steels for cold forming)

7.6.1 In order to avoid the formation of stretcher strains when cold forming, it is recommended to order improved surface quality B (see 7.3.3). 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.

7.6.2 Products with the surface condition B or C are free from stretcher strains when cold forming 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, DX55D+AS and DX56D+AS.

7.7 Coating mass

7.7.1 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 8.4.4 and 8.5.4).

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[a]	Minimum coating mass, g/m² total both surfaces[b]	
	Triple spot test[c]	Single spot test[c]
060	60	45
080	80	60
100	100	75
120	120	90
150	150	115

[a] See also 7.2.
[b] A coating mass of 100 g/m² on both sides corresponds to a coating thickness of approximately 17 µm on each surface.
[c] See 8.4.4 and 8.5.4.

7.7.2 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.

7.8 Adhesion of coating

The adhesion of the coating shall be tested using the method specified in 8.5.3. 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. Crazing and roughening are permissible.

7.9 Surface condition

7.9.1 The surface shall comply with the requirements in 7.3 and 7.4. Unless otherwise agreed at the time of enquiry and order, 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.

7.9.2 When supplying strip in coils, there is a 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.

7.10 Tolerances on dimensions and shape

The requirements of EN 10143 shall apply.

7.11 Suitability for further processing

7.11.1 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.

7.11.2 Forming

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

7.11.3 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 7.3).

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

8 Testing

8.1 General

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

8.1.2 If testing is required, the purchaser shall give the following information at the time of enquiry and order:

— type of test (specific or non-specific test, see EN 10021),

— type of inspection document (see EN 10204).

8.1.3 Specific tests shall be carried out in accordance with the requirements in 8.2 to 8.6.

8.2 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.

8.3 Number of tests

One series of tests shall be carried out per test unit as specified in 8.2 to determine

— the mechanical properties (see 8.5.1),

— the *r*- and *n*-values if specified in Table 1 (see 8.5.2),

— the adhesion of the coating (see 8.5.3), and

— the coating mass (see 8.5.4).

The number of tests for the determination of the alloy layer (see 7.2.2) shall - if required - be agreed at the time of enquiry and order.

8.4 Sampling

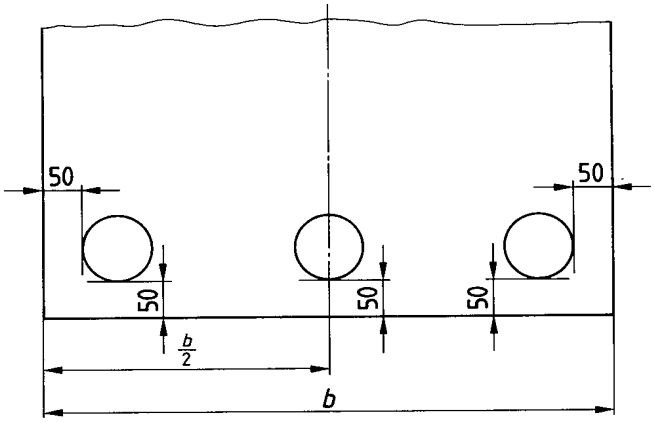
8.4.1 In the case of strip, the samples shall be taken from the beginning or the end of the coil. In the case of sheet and cut lengths, the selection of the sample shall be left to the discretion of the supplier.

8.4.2 The sample for the tensile test (see 8.5.1) shall be taken either in the transverse or in the longitudinal direction (see 7.1.5) at a distance of at least 50 mm from the edge of the product.

8.4.3 The sample for the bend test to determine the adhesion of the coating (see 8.5.3) 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.

8.4.4 The three samples for testing the coating mass (see 8.5.4) 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 5 000 mm² in area.

Dimensions in millimetres



Key

b Strip or sheet width

Figure 1 - Position of the samples for determining the coating mass of aluminium-silicon coating

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 5 000 mm². The coating mass determined from it shall comply with the requirements for the single spot test as specified in Table 3.

8.4.5 If it is agreed to determine the thickness of the alloy layer (see 7.2.2) special agreement shall be made for sampling.

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

8.5 Test methods

8.5.1 The tensile test shall be carried out as described in EN 10002-1 using type 2 test pieces (initial gauge length L_o = 80 mm, width b = 20 mm) (see also 7.1.5).

8.5.2 The determination of the plastic strain ration r and the strain hardening exponent n shall be carried out in accordance with ISO 10113 and ISO 10275.

The plastic strain ratio r and the strain hardening exponent n are determined within the strain range of 10 % to 20 %. As the determination shall be carried out in the range of homogeneous deformation, then if the uniform elongation of the tested material is lower than 20 %, values for the upper limit of the strain range of 15 % to 20 % can be applied.

8.5.3 The bend test to determine the adhesion of the coating (see also 7.9 and 8.4.3) 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 8.5.3)

Steel grade	Mandrel diameter D^a for nominal thicknesses	
	< 2,0 mm	2,0 . 3,0 mm
DX51D+AS	0	1*a*
DX52D+AS	0	1*a*
DX53D+AS	0	1*a*
DX54D+AS	0	1*a*
DX55D+AS	0	1*a*
DX56D+AS	0	1*a*
S250GD+AS	1*a*	2*a*
S280GD+AS	2*a*	3*a*
S320GD+AS	2*a*	3*a*
S350GD+AS	2*a*	3*a*
[a] *a*: Product thickness		

8.5.4 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.

8.5.5 If it is agreed to determine the thickness of the alloy layer (see 7.2.2) the method for its determination given in annex B shall be applied.

8.6 Retests

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

9 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;

— designation (consisting of 5.1b) and 5.1f) to 5.1j));

— 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.

10 Packing

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

11 Storage and transportation

11.1 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 temporary surface protection are given in 7.4. As a precaution, the products should be transported and stored dry and protected from moisture.

11.2 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.

12 Disputes

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

Annex A
(normative)

Reference method for determination of the total coating mass

A.1 Purpose

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 (ρ = 1,19 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 8.4.4.

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:

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

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 Al-Fe-Si alloy layer

B.1 Purpose

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 weighted 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 1 000 g $SnCl_2H_2O$ are dissolved in 500 ml of diluted hydrochloric acid (1 : 1). Make up to 1 000 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 8.4.4 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.

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