

# Electrolytically zinc coated cold rolled steel flat products for cold forming — Technical delivery conditions

The European Standard EN 10152:2003 has the status of a  
British Standard

ICS 77.140.50

## National foreword

This British Standard is the official English language version of EN 10152:2003. It supersedes BS EN 10152:1994 which is withdrawn.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.

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English version

## Electrolytically zinc coated cold rolled steel flat products for cold forming - Technical delivery conditions

Produits plats en acier, laminés à froid, revêtus de zinc par voie électrolytique pour formage à froid - Conditions techniques de livraison

Elektrolytisch verzinkte kaltgewalzte Flacherzeugnisse aus Stahl zum Kaltumformen - Technische Lieferbedingungen

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## Foreword

This document EN 10152:2003 has been prepared by Technical Committee ECISS/TC 27 "Surface coated flat products - Qualities, dimensions, tolerances and specific tests", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This document supersedes EN 10152:1993.

Annex A is normative.

This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

**1.1** This European Standard specifies requirements for continuously electrolytic zinc coated cold rolled flat products of low carbon steels suitable for cold forming according to Table 1 in rolled widths  $\geq 600$  mm and thicknesses from 0,35 mm up to and including 3 mm, delivered as strip (in coil form), sheet, slit strip or cut lengths obtained from slit strip or sheet.

**1.2** This European Standard can also be applied to continuously electrolytic zinc coated cold rolled flat products of

- a) steels according to EN 10139 (cold rolled strip in rolled widths  $< 600$  mm),
- b) other types of low carbon steel for cold forming,
- c) steels normally characterized by minimum yield strength values in addition to formability parameters, e. g.
  - steels with high yield strength and improved formability according to EN 10268, or other microalloyed steels,
  - high strength IF(without interstitial atoms) steels,
  - phosphorous alloyed steels and bake-hardening steels,
  - dual phase steels,
  - general purpose structural steels.

**1.3** By special agreement at the time of enquiry and order this European Standard can be applied to continuously electrolytic zinc coated hot-rolled steel flat products (e.g. according to EN 10025, EN 10111, EN 10149-1 to EN 10149-3, etc.).

**1.4** The coating masses, surface qualities and surface finishes are given in 6.9, 6.11 and Table 2. As the mass of the zinc coating applied is relatively small, the material is not intended to withstand outside exposure without further chemical treatment and painting.

**1.5** This European Standard is not applicable to

- hot-dip zinc coated steel strip and sheet (see EN 10142 and EN 10147);
- continuously organic coated steel flat products (see EN 10169-1, ENV 10169-2 and prEN 10169-3).

## **2 Normative references**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

EN 10020:2000, *Definition and classification of grades of steel.*

EN 10021:1993, *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 10079:1992, *Definition of steel products.*

EN 10131, *Cold rolled uncoated low carbon and high yield strength steel flat products for cold forming - Tolerances on dimensions and shape.*

EN 10204:1991, *Metallic materials - Types of inspection documents.*

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

EN ISO 7438, *Metallic materials - Bend test (ISO 7438:1985).*

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 terms and definitions given in EN 10020:2000, EN 10021:1993, EN 10079:1992 and EN 10204:1991 and the following apply.

#### 3.1

##### **electrolytic zinc coating (ZE)**

application of a zinc coating by electrolysis on a suitably prepared steel surface from an aqueous zinc salt solution by the use of an electric current

NOTE Flat products can have a zinc coating on one or both surfaces. If both surfaces are zinc coated, a different coating thickness can be applied on each side (this process being referred to as differential zinc coating).

### 4 Classification and designation

#### 4.1 Classification

The steel grades specified in this standard are classified in accordance with EN 10020 as non-alloy quality steels (DC01, DC03, DC04, DC05) and alloy quality steel (DC06) and by their increasing suitability for cold forming as follows:

DC01:	drawing quality;
DC03:	deep drawing quality;
DC04, DC05:	special deep drawing quality
DC06:	extra deep drawing quality.

#### 4.2 Designation

**4.2.1** 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.

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

- a) Type of product (e. g. strip, sheet, cut length),
- b) Number of this standard (EN 10152),
- c) Steel name or steel number and symbol for the type of electrolytical coating (see Table 1),
- d) Numbers denoting the nominal coating thickness on each surface (e. g. 50/50 = nominal coating thickness of 5,0 µm on each side, see Table 2 and 6.9.2).
- e) Letters A or B indicating the surface quality (see 6.11.2).
- f) Letters denoting the surface treatment (see 6.12 and Table 3).

EXAMPLE 1 Designation of strip made of steel DC03+ZE (1.0347+ZE), electrolytically zinc coated with a nominal thickness of 5,0 µm on each surface (50/50), surface quality A, surface treatment phosphated (P):

**Strip EN 10152-DC03+ZE50/50-A-P**

or

**Strip EN 10152-1.0347+ZE50/50-A-P**

## EN 10152:2003 (E)

EXAMPLE 2 Designation of sheet made of steel DC05+ZE (1.0312+ZE), electrolytically zinc coated with a nominal thickness of 7,5 µm on one surface and of 2,5 µm on the other surface (75/25), surface quality B, surface treatment phosphated and oiled (PO):

**Sheet EN 10152-DC05+ZE75/25-B-PO**

or

**Sheet EN 10152-1.0312+ZE75/25-B-PO**

**4.2.3** Where appropriate, additional information to the designation as specified in 4.2.2 shall be given to describe clearly the delivery requirements (see clause 5).

## 5 Information to be supplied by the purchaser

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

- a) complete designation (see 4.2.2);
- b) nominal dimensions (thickness, width and, in the case of sheet and cut lengths, length);
- c) quantity;
- d) limiting mass and sizes of the coils and individual bundles of sheets;
- e) properties of steels other than those covered by Table 1 (see 6.1, 6.14.2 and 7.5.3);
- f) any requirement concerning a special steelmaking or manufacturing process (see 6.2);
- g) any products suitable for making a particular part (see 6.6);
- h) any requirement relating to coating on one surface only (see 6.9.5);
- i) any requirement for a maximum value of the coating mass (see 6.9.6);
- j) any requirement concerning surface quality and surface finish (see 6.11);
- k) any requirement on surface roughness (see 6.11.3),
- l) any requirement concerning surface treatment (see 6.12 and Table 3);
- m) any requirement concerning application of a dimensional standard different from EN 10131 (see 6.14.2);
- n) if required type of testing and inspection document (see 7.1.1 and 7.7);
- o) any marking desired by branding of the product (see 8.2);
- p) any requirement for packing (see clause 9).

## 6 Requirements

### 6.1 General

The requirements according to 6.2 to 6.5 and 6.13 apply to products made of the steel grades given in Table 1.

For other steels used as substrate for electrolytically deposited coatings of zinc (see 1.2 and 1.3) the requirements shall be based on the appropriate quality standard for the non-coated steel product.



## 6.2 Steelmaking and manufacturing processes

Unless otherwise agreed at the time of enquiry and order, the steelmaking and manufacturing processes are left to the discretion of the manufacturer. The purchaser shall be informed of these processes, if he requires it.

## 6.3 Deoxidation

The method of deoxidation shall be in accordance with that specified in Table 1.

## 6.4 Chemical composition

The chemical composition based on ladle analysis shall be as given in Table 1.

## 6.5 Delivery condition

The steel substrates are normally supplied in the skin-passed condition. By agreement at the time of enquiry and order non skin-passed products may be supplied.

## 6.6 Choice of properties

The products covered by this standard shall comply with the requirements of Table 1. By agreement at the time of enquiry and order they may be delivered as suitable for making a particular part; in this case a maximum percentage of scrap may be agreed and acceptance on the basis of mechanical properties is not applicable.

## 6.7 Mechanical properties

**6.7.1** The mechanical properties are given in Table 1; they apply only to skin-passed products.

NOTE The properties in Table 1 are those specified for cold rolled non-coated low carbon steel flat products according to EN 10130 with the exception of the  $R_e$ ,  $A_{80}$  and  $n_{90}$  values for the grades DC04+ZE, DC05+ZE and DC06+ZE which have been altered with respect to the influence of the electrolytical treatment on those properties.

The mechanical properties are valid for the period specified in Table 1 from the date on which the products are made available. The date of availability shall be notified to the purchaser with reasonable prior notice compatible with the validity of the mechanical properties. Prolonged storage of products of grade DC01+ZE could result in some change in the mechanical properties leading to a reduction in formability.

**6.7.2** The tensile test values apply to transverse samples and relate to the test piece cross-section without zinc coating.

Table 1 - Chemical composition and mechanical properties of electrolytically zinc coated mild steel flat products<sup>a</sup>

Designation Steel grade			Definition and classification according to EN 10020	Desoxidation	Validity of mechanical properties	Surface appearance	Absence of stretcher strain marks	$R_e$ MPa b	$R_m$ MPa	$A_{80}$ % min. c	$r_{90}$ min. d,e	$n_{90}$ min. d	Chemical composition (ladle analysis) % max.				
Steel name	Steel number	Symbol for the type of electrolytically coating											C	P	S	Mn	Ti
DC01 <sup>f</sup>	1.0330	+ZE	Non alloy quality steel <sup>g</sup>	Manufacturer's discretion	-	A B	- 3 months	140 to 280 <sup>h</sup>	270 to 410	28	-	-	0,12	0,045	0,045	0,60	
DC03	1.0347	+ZE	Non alloy quality steel <sup>g</sup>	Fully killed	6 months	A B	6 months 6 months	140 to 240	270 to 370	34	1,3	-	0,10	0,035	0,035	0,45	
DC04	1.0338	+ZE	Non alloy quality steel <sup>g</sup>	Fully killed	6 months	A B	6 months 6 months	140 to 220	270 to 350	37	1,6	0,160	0,08	0,030	0,030	0,40	
DC05	1.0312	+ZE	Non alloy quality steel <sup>g</sup>	Fully killed	6 months	A B	6 months 6 months	140 to 190	270 to 330	39	1,9	0,190	0,06	0,025	0,025	0,35	
DC06	1.0873	+ZE	Alloy quality steel	Fully killed	6 months	A B	no limit no limit	120 to 190	270 to 350	37	1,8 <sup>i</sup>	0,200 <sup>j</sup>	0,02	0,020	0,020	0,25	0,3 <sup>i</sup>

<sup>a</sup> The mechanical properties apply only to skin-passed products.

<sup>b</sup> The values of yield strength shall be the 0,2 % proof stress ( $R_{p0,2}$ ) for products which do not present a definite yield point and the lower yield strength ( $R_{eL}$ ) for the others.

<sup>c</sup> When the thickness is less than or equal to 0,7 mm but greater than 0,5 mm the values for yield strength shall be increased by 20 MPa. For thicknesses less than or equal to 0,5 mm the values shall be increased by 40 MPa.

<sup>d</sup> When the thickness is less than or equal to 0,7 mm but greater than 0,5 mm the minimum values for elongation shall be reduced by 2 units. For thicknesses less than or equal to 0,5 mm the minimum values shall be reduced by 4 units.

<sup>e</sup> The values of  $r_{90}$  and  $n_{90}$  or  $r$  and  $n$  (see footnote j and ISO 10113 and ISO 10275) only apply to products of thickness equal to or greater than 0,5 mm.

<sup>f</sup> When the thickness is over 2 mm the value for  $r_{90}$  or  $r$  is reduced by 0,2.

<sup>g</sup> It is recommended that products in grade DC01+ZE should be formed within 6 weeks from the time of their availability.

<sup>h</sup> Unless otherwise agreed at the time of the enquiry and order DC01+ZE, DC03+ZE, DC04+ZE and DC05+ZE may be supplied as alloy steels (for example with boron or titanium).

<sup>i</sup> The upper limit of  $R_e$  of 280 MPa for grade DC01+ZE is valid only for 8 days from the time of the availability of the product.

<sup>j</sup> Titanium may be replaced by niobium. Carbon and nitrogen shall be completely bound.

<sup>k</sup>  $r$  and  $n$  respectively

## 6.8 Stretcher strain marks

All products are generally subjected to a light skin-pass after annealing and before coating at the manufacturer's works to avoid the formation of stretcher strain marks.

The tendency to form such marks reappears a certain time after the skin-pass. It is therefore in the purchaser's interest to form the products as soon as possible.

Products of grade DC06+ZE do not exhibit stretcher strain marks whether delivered skin passed or non-skin-passed.

For skin-passed products the manufacturer shall ensure the absence of stretcher strain marks:

- for 6 months after products of grades DC03+ZE, DC04+ZE and DC05+ZE are made available, for surface qualities A and B,
- for 3 months after products of DC01+ZE are made available, for surface quality B.

## 6.9 Coatings

**6.9.1** Zinc coatings as given in Table 2 are applicable for equally coated products.

**6.9.2** In the designation the coating is expressed as ten times the nominal coating thickness in  $\mu\text{m}$ , indicated separately for either surface of the product (see 4.2.2 d)).

**6.9.3** The coatings shall be checked by determining the mass of zinc per square metre on each surface (see 7.4.4 and 7.5.4). Each result shall meet the requirements for the minimum coating mass according to Table 2.

**6.9.4** Differential coatings based upon a combination of the coatings mentioned in Table 2 may be available, subject to agreement between manufacturer and purchaser. They shall be designated as follows: ZE75/25 etc.

When differential coatings are supplied the manufacturer shall indicate which surface has the greater coating thickness, i.e. the top or the bottom surface of the sheets, inside or outside of the coil.

**6.9.5** Material may be supplied, subject to agreement between manufacturer and purchaser, with coating on one surface only. Such coatings shall be designated as follows: ZE25/00 etc.

Slight zinc coatings may appear at the edge areas of the uncoated surface.

**6.9.6** A maximum value (single spot test) for the coating mass per surface of the product may be agreed upon for each coating designation.

**Table 2 - Electrolytic zinc coatings (see also 6.9.4 and 6.9.5)**

Coating Designation	Nominal zinc coating values for each surface <sup>a</sup>		Minimum zinc coating values for each surface <sup>b</sup>	
	Thickness	Mass	Thickness	Mass
	$\mu\text{m}$	$\text{g}/\text{m}^2$	$\mu\text{m}$	$\text{g}/\text{m}^2$
ZE25/25	2,5	18	1,7	12
ZE50/50	5,0	36	4,1	29
ZE75/75	7,5	54	6,6	47
ZE100/100	10,0	72	9,1	65

<sup>a</sup> A coating mass of 50  $\text{g}/\text{m}^2$  corresponds to a coating thickness of approximately 7,1 $\mu\text{m}$ .  
<sup>b</sup> See 7.4.4 and 7.5.4.

## 6.10 Adhesion of coating

The adhesion of the coating shall be tested using the method specified in 7.5.3. 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. Cracking and roughening are permissible.

## 6.11 Surface characteristics

### 6.11.1 General

The surface characteristics consist of the surface quality and the surface finish.

The surface quality and finish shall be specified by the purchaser at the time of enquiry and order (see 4.2.2).

### 6.11.2 Surface quality

6.11.2.1 The products shall be supplied with either of the surface qualities A or B.

— Surface quality A:

defects such as pores, slight indentations, small marks, minor scratches and slight colouring which do not affect formability or the application of subsequent surface coatings are permitted.

— Surface quality B:

The better of the two surfaces shall be virtually free from surface imperfections liable to impair the uniform appearance of a high-quality paint finish. For one-sided coating, this requirement shall apply for the uncoated surface unless otherwise agreed. The other surface shall at least conform to surface quality A.

Unless otherwise agreed, a single surface of the sheet shall be inspected and shall comply with the requirements.

The other surface shall be such that during subsequent treatment it does not have a deleterious effect on the surface inspected.

6.11.2.2 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.

### 6.11.3 Surface finish

By agreement at the time of the enquiry and order ranges for surface roughness (*Ra* values) may be specified for specific end uses.

## 6.12 Surface treatment (surface protection)

Electrolytically zinc coated strip and sheet may be supplied in one of the surface treatment conditions listed in Table 3. Surface treatment reduces the risk of corrosion occurring during transport and storage, which is mainly due to humidity and gives rise to wet storage stain (white rust). The phosphated, chemically sealed and oiled treatment condition normally offers the best corrosion protection. Since this type of protection is, however, not permanent the transport and storage conditions shall be selected to suit the material concerned.

A surface treatment also improves the adherence and protective effect of a coating applied by the processor who is, however, to ensure that pretreatment and coating systems are compatible with each other. Chemically sealed or passivated material is not recommended for products which will subsequently be phosphated. Discoloration as a result of chemical treatment does not impair further processing.

Phosphating in conjunction with a suitable lubricating agent may improve workability.

The application of a sealed (S) surface treatment, with a transparent organic film of about 1g/m<sup>2</sup>, will offer protection against corrosion and fingerprints. It may improve the sliding characteristics during forming and can be used as a priming coat for subsequent varnishing.

Products are supplied without surface treatment (U, as given in Table 3) only if the purchaser so wishes. In such cases, corrosion damage to the product may occur even when stored for short periods or during transport. Untreated products are also susceptible to fretting corrosion and are easily scratched.

In the case of oiled surfaces, it shall be possible to remove the oil layer with suitable detergents not attacking the zinc coating. It is assumed that the processor has all the equipment necessary for degreasing the products.

**Table 3 - Surface treatment**

Symbol	Type of treatment
P	Phosphated
PC	Phosphated and chemically sealed
C	Chemically passivated
PCO	Phosphated, chemically sealed and oiled
CO	Chemically passivated and oiled
PO	Phosphated and oiled
O	Oiled
S	Sealed
U	As coated, i.e. untreated

## 6.13 Applications

### 6.13.1 Welding

The product is suitable for welding under conditions laid down for the base metal. However, precautions may be necessary to overcome the presence of the zinc and, where applied, the phosphate on the surface of the product.

### 6.13.2 Painting

Zinc coated steel is a suitable base for paint, but the first treatment may be different from those used for uncoated steel. Pre-treatment primers, chemical conversion coatings and primers specially formulated for direct application to zinc surfaces are all appropriate first treatments for electrolytically zinc coated steel.

In drawing up a surface preparation and painting schedule, consideration should be given by the purchaser as to whether the material should be supplied chemically passivated or phosphated and/or oiled (see also 6.12).

### 6.13.3 Forming

Electrolytic zinc coatings are usually tightly adherent even when used for difficult formings. However, powdering can occur if the product is overformed or "coined" during fabrication. Care should be taken to ensure that the speed of forming and the clearance of dies is carefully controlled.

## 6.14 Mass, tolerances on dimensions and shape

**6.14.1** The product mass shall be calculated taking the density of the steel as 7,85 kg/dm<sup>3</sup> and the density of the zinc coating as 7,1 kg/dm<sup>3</sup>.

**6.14.2** For the tolerances on dimensions and shape EN 10131 applies. The application of other dimensional standards shall be specially agreed at the time of enquiry and order.

## 7 Testing

### 7.1 General

**7.1.1** The purchaser shall specify at the time of the enquiry and order his requirements for

- type of testing: specific or non-specific (see EN 10021),
- type of inspection document (see EN 10204).

**7.1.2** Specific testing shall be carried out in accordance with 7.2 to 7.6.

**7.1.3** Specific testing may not be specified either for the product analysis or the surface finish. However by agreement at the time of enquiry and order the manufacturer may supply a certificate of compliance with the order.

## **7.2 Test units**

The test unit consists of 20 t or a fraction of 20 t of electrolytically zinc coated flat products of the same grade and nominal thickness, coating type and surface characteristics. In the case of strip, a coil with a mass of more than 20 t is 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  $r$ - and  $n$ -values if specified in Table 1 (see 7.5.2),
- the adhesion of the coating (see 7.5.3), and
- the coating mass (see 7.5.4).

## **7.4 Sampling**

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

**7.4.2** The sample for the tensile test (see 7.5.1) shall be taken transversely to the direction of rolling at a distance of at least 50 mm from the edges of the product.

**7.4.3** The sample for the bend test to determine the adhesion of the coating (see 7.5.3) may be taken in any direction. The distance from the product edges 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** One sample for testing the coating mass (see 7.5.4) with an area of at least 5000 mm<sup>2</sup> shall be taken at a distance of at least 50 mm from the edges of the product.

**7.4.5** 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 (original gauge length  $L_0 = 80$  mm, width  $b = 20$  mm) as described in EN 10002-1 (see also 6.7.2).

**7.5.2** The determination of the plastic strain ratio  $r$  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.

**7.5.3** The bend test to determine the adhesion of the coating (see also 6.10 and 7.4.3) shall be carried out as described in EN ISO 7438.

The diameter  $D$  of the mandrel or bending roll shall be 0 (flat on itself) for the steels covered by Table 1 and shall be by agreement between the manufacturer and the purchaser for other steel types.

The angle of bend shall be 180° in all cases.

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

**7.5.4** The coating mass shall be determined from the difference in mass of the sample before and after the coating has been removed chemically.

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 shall be used.

## 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

**8.1** 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 4.2.2),
- nominal dimensions of the product,
- identification number,
- order number,
- mass of the lot, coil or bundle.

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

**8.2** Marking of the products by branding may be agreed upon at the time of enquiry and order.

## 9 Packing

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

## 10 Storage and transportation

**10.1** Moisture, in particular condensation between the sheets, laps of the coil or other adjacent parts made of electrolytically zinc coated flat products may lead to the formation of matt grey to white deposits (white rust). The possible types of surface protection are given in 6.12. However, if there is lengthy contact with moisture, the corrosion protection may be reduced locally. As a precaution, the product should be transported and stored dry and protected from moisture.

**10.2** During transportation, dark spots may appear on the zinc 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.

## Annex A (normative)

### Reference method for determination of the zinc coating mass

#### A.1 Principle

The sample shall be at least 5000 mm<sup>2</sup> in area. Using a sample with a surface area of 5000 mm<sup>2</sup>, the loss of mass in grams when the coating is dissolved, multiplied by 200, will represent the zinc mass in grams per square metre on each surface of the product.

#### A.2 Reagent and preparation of the solution

Reagent:

- Hydrochloric acid (HCl  $\rho_{20} = 1,19 \text{ g/cm}^3$ )
- Hexamethylenetetramine (C<sub>6</sub>H<sub>12</sub>N<sub>4</sub>)

Preparation of the solution:

The hydrochloric acid is diluted with deionized or distilled water in the ratio one part pure HCl to one part water (50 % dilution). Hexamethylenetetramine is then added, stirring, in the ratio of 3,5 g per litre of dilute hydrochloric acid solution.

This prepared solution permits the execution of numerous successive dissolutions under satisfactory conditions of attack of the coating, both from the point of view of speed and accuracy.

#### A.3 Apparatus

Balance capable of weighing samples to an accuracy of 0,001 g. For the test, use a take-off device.

#### A.4 Procedure

The following operations are applied to the sample:

- a) if necessary, degrease the sample with an organic solvent which will not attack the zinc, then dry the sample;
- b) protect one surface of the sample against the attack of the solution by coating with a suitable lacquer;
- c) weigh the sample to an accuracy of 0,001 g;
- d) place the sample in the hydrochloric acid solution with hexamethylenetetramine inhibitor at ambient temperature (20 °C to 25 °C). Leave the sample immersed in the solution until the release of hydrogen ceases or only a few bubbles are released;
- e) after the attack, the tested surface of the sample is washed and brushed under running water, dried with a cloth and then by heating to around 100 °C and cooled and dried by blowing with warm air;
- f) weigh the sample again to an accuracy of 0,001 g;
- g) determine the difference between the mass of the coated sample and that of the sample without its coating. This difference, calculated in grams, represents the mass of the coating on the tested surface;
- h) remove the lacquer from the other surface (see A.4.b)) and continue as mentioned above under c) to g).



## Bibliography

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

EN 10025, *Hot-rolled products of non-alloy structural steels - Technical delivery conditions.*

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

EN 10142, *Continuously hot-dip zinc coated low carbon steels strip and sheet for cold forming - Technical delivery conditions.*

EN 10147, *Continuously hot-dip zinc coated structural steel strips and sheet - Technical delivery conditions.*

EN 10149-1, *Hot-rolled flat products made of high yield strength steels for cold forming - Part 1: General delivery conditions.*

EN 10149-2, *Hot-rolled flat products made of high yield strength steels for cold forming - Part 2: Delivery conditions for thermomechanically rolled steels.*

EN 10149-3, *Hot-rolled flat products made of high yield strength steels for cold forming - Part 3: Delivery conditions for normalized or normalized rolled steels.*

EN 10169-1, *Continuously organic coated (coil coated) steel flat products - Part 1: General information (definitions, materials, tolerances, test methods).*

ENV 10169-2, *Continuously organic coated (coil coated) steel flat products - Part 2: Products for building exterior applications.*

prEN 10169-3, *Continuously organic coated (coil coated) steel flat products - Part 3: Products for building interior applications.*

EN 10268, *Cold-rolled flat products made of high yield strength micro-alloyed steels for cold forming - General delivery conditions.*

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