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ISO 15208

Second edition
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Continuous hot-dip zinc-coated twin-roll cast steel sheet of commercial quality

Tôles coulées entre cylindres et galvanisées en continu par immersion à chaud, en acier de qualité commerciale

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This second edition cancels and replaces the first edition (ISO 15208:2012), which has been technically revised.

The main changes are as follows:

— editorial update;

— update of Clause 3;

— modification of the title of Clause 4.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Continuous hot-dip zinc-coated twin-roll cast steel sheet of commercial quality

1 Scope

This document specifies the requirements for steel sheet, in coils and cut length, metallic-coated by the continuous hot-dip zinc-coated twin-roll cast process of commercial quality.

The steel sheet is intended for applications requiring corrosion resistance, formability and paintability.

The steel sheet is produced in a number of grades, coating masses, surface treatments and ordering conditions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 3497, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7438, *Metallic materials — Bend test*

ISO 16163, *Continuously hot-dipped coated steel sheet products — Dimensional and shape tolerances*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
commercial quality
base-metal quality intended for general fabricating purposes where sheet is used in the flat condition, or for bending or moderate forming

3.2
continuous hot-dip zinc-coated steel sheet
product in coils or cut lengths manufactured on a continuous coating line with a hot-dip zinc coating on base-metal of cold-reduced or hot-rolled descaled steel

3.3
normal spangle
finish obtained as a result of unrestricted growth of zinc crystals during normal solidification

Note 1 to entry: This coating has a metallic lustre and is the type normally furnished for a wide variety of applications. It can be furnished S (normal spangle with skin pass) or N (normal spangle, no skin pass), however, it can be variable in appearance and not suitable for decorative paintings.

3.4
minimized spangle
finish obtained by restricting normal spangle formation during the solidification of the zinc

Note 1 to entry: This product can have some lack of uniformity in surface appearance within a coil or from coil to coil.

3.5
differential coating
coating deliberately produced to have a different coating mass on each surface

3.6
skin pass
light cold rolling of the product

Note 1 to entry: The purpose of the skin passing is one or more of the following: to minimize the appearance of coil breaks, stretcher strains and fluting; to control the shape or to obtain the required surface finish.

Note 2 to entry: Some increase in hardness and some loss in ductility will result from skin passing.

3.7
twin-roll cast steel sheet
steel sheet produced by casting to near final thickness directly from the liquid metal with minimal hot-rolling to achieve the final thickness

3.8
lot
up to a specified quantity of steel sheet of the same designation rolled to the same thickness and coating condition

3.9
coating mass
total amount of zinc on both surfaces of the sheet, expressed in grams per square meter (g/m^2) of sheet

4 Dimensions

4.1 Zinc-coated commercial quality twin-roll cast steel sheet is produced in thicknesses up to 2,0 mm, inclusive, after zinc coating, and in widths up to 2 000 mm in coils and cut lengths. Zinc-coated twin-roll cast steel sheet less than 600 mm wide, slit from wide sheet, is considered as sheet.

4.2 The thickness of zinc-coated twin-roll cast steel sheet may be specified as a combination of the base-metal and metallic coating or base-metal alone. The purchaser shall indicate on the order which method of specifying thickness is required. If the purchaser does not indicate any preference, the thickness as a combination of the base-metal and coating shall be provided. Annex A describes the requirements for specifying the thickness as base-metal alone.

5 Conditions of manufacture

5.1 Steelmaking

Unless otherwise agreed by the interested parties, the processes used in making the steel and in manufacturing zinc-coated steel sheet are left to the discretion of the manufacturer. Upon request, the purchaser shall be informed of the steelmaking process being used.

5.2 Chemical composition

The chemical composition (heat analysis) shall conform to the requirements given in Tables 1 and 2.

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat shall be made by the manufacturer in order to determine conformity with the requirements given in Tables 1 and 2. On request, a report of the heat analysis shall be made available to the purchaser or the purchaser's representative. Each of the elements listed in Tables 1 and 2 shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis may be reported as "<0,02 %".

5.3.2 Product analysis

A product analysis may be made by the purchaser in order to verify the specified analysis of the product and shall take into consideration any normal heterogeneity. The product analysis tolerances shall be in accordance with Tables 2 and 3.

Table 1 — Chemical composition (heat analysis)

Mass fractions in percent

Base-metal quality		C	Mn	P	S	Si[a]
Designation	Name	max.	max.	max.	max.	
HRA	Commercial	0,15	0,70	0,045	0,035	–
[a] "–" indicates that there is no requirement, but the analysis shall be reported.						

Table 2 — Limits on additional chemical elements

Mass fractions in percent

Element	Cu	Ni	Cr	Mo	Nb	V	Ti
	max.	max.	max.	max.	max.	max.	max.
Heat analysis	0,50	0,30	0,30	0,15	0,008	0,008	0,008
Product analysis	0,53	0,33	0,34	0,16	0,018	0,018	0,018

Table 3 — Product analysis tolerances

Mass fractions in percent

Element	Maximum of specified element	Tolerance over the maximum specified
C	0,15	0,03
Mn	0,70	0,05
P	0,045	0,01
NOTE The above maximum tolerance is the allowable excess over the requirements of the heat analysis specified in Table 1.		

Table 3 *(continued)*

Element	Maximum of specified element	Tolerance over the maximum specified
S	0,035	0,01
NOTE The above maximum tolerance is the allowable excess over the requirements of the heat analysis specified in Table 1.		

5.4 Mechanical properties

Zinc-coated commercial quality twin-roll cast steel sheet does not have any specified minimum mechanical properties, however, the minimum tensile strength for commercial quality is normally expected to be 270 MPa. When the minimum tensile strength is required, the value of 270 MPa may be specified. All tensile strength values are determined to the nearest 10 MPa.

5.5 Coating

5.5.1 Coating mass

The coating mass shall conform to the limits for the coating designations shown in Table 4. The interested parties shall agree upon the coating mass of differentially coated products. If a maximum coating mass is required, the manufacturer shall be notified at the time of ordering.

Table 4 — Coating mass (total both sides)

Coating mass designation	Minimum check limit	
	Triple-spot test g/m^2	Single-spot test g/m^2
Z001	no minimum[a]	no minimum[a]
Z100	100	85
Z180	180	150
Z200	200	170
Z275	275	235
Z350	350	300
Z450	450	385
Z600	600	510
Z700	700	585

NOTE 1 Because of the many variables and changing conditions that are characteristic of continuous zinc coating, the coating mass is not always evenly divided between the two surfaces of a zinc-coated sheet; neither is the coating evenly distributed from edge to edge. However, it can normally be expected that not less than 40 % of the single spot check limit will be found on either surface.

NOTE 2 The coating thickness can be estimated from the coating mass using the following relationship:

100 g/m^2 total both sides = 0,014 mm total both sides.

[a] No minimum means that there are no established minimum check limits.

5.5.2 Coating adherence

The zinc-coated twin-roll cast steel sheet shall be capable of being bent in any direction, in accordance with the mandrel diameter requirements of Table 5, without flaking of the coating on the outside of the bend. Flaking of the coating within 7 mm from the edge of the test piece shall not be cause for rejection.

Table 5 — Coating adherence

Base-metal quality	180° bend-mandrel diameter mm	
	$e \leq 2$	
	Coating mass designation	
	Up to Z350	Z450 Z600 Z700
Commercial	1a	2a
e: thickness of steel sheet, in millimetres a: thickness of bend test piece, in millimetres		

5.6 Weldability

This product is normally suitable for welding, if appropriate welding methods and procedure are used, with special attention to the heavier coatings.

5.7 Painting

Continuous hot-dip zinc-coated steel sheet is a suitable base for paint but the first treatment may be different from those used on uncoated steel. Pre-treatment primers, chemical conversion coatings (chromate, phosphate or oxide type) and some paints specially formulated for direct application to zinc surfaces are all appropriate first treatments for hot-dip zinc-coated sheet. In drawing up a painting schedule, consideration shall be given to whether the hot-dip zinc-coated sheet shall be ordered in the passivated or not passivated state.

NOTE Surfaces with certain passivation treatments (e.g. chromated) are not suitable for phosphating or the application of a pre-treatment (etch) primer.

5.8 Surface treatment

5.8.1 Mill passivation

A chemical treatment is normally applied to zinc coatings to minimize the hazard of wet storage stain (white rust) during shipment and storage. However, the inhibiting characteristics of the treatment are limited, and if a shipment is received wet, the material shall be used immediately or dried.

5.8.2 Mill phosphating

Zinc-coated twin-roll cast steel sheet may be processed chemically at the manufacturer's works to prepare all types of coatings for painting without further treatment, except normal cleaning.

5.8.3 Oiling

When specified, the zinc-coated twin-roll cast steel sheet as produced shall be oiled to prevent marring and scratching of the soft surface during handling or shipping and to minimize wet storage stain.

NOTE When the zinc-coated twin-roll cast steel sheet has received a passivating treatment, oiling further minimizes the hazard of wet storage stain.

5.9 Coated coil joining

Continuous coil coating lines use various methods to join coil ends. These methods include lap welding, butt welding and stitching. The shipment of coils containing the joined ends is permitted, if agreed upon between the purchaser and manufacturer.

5.10 Dimensional and shape tolerances

5.10.1 Dimensional and shape tolerances applicable to zinc-coated twin-roll cast steel sheet shall be as given in ISO 16163. The tolerances for thickness apply to products whose thickness is a combination of base-metal and coating thickness.

5.10.2 When the base-metal thickness is specified, the thickness tolerances of ISO 16163 shall apply to the product thickness, as calculated in accordance with Annex A.

6 Sampling

6.1 Tensile test

When required, one representative transverse sample from each lot of 50 t or less for shipment shall be taken for the tensile test to verify conformance with the requirements of 5.4. Transverse test pieces shall be taken mid-way between the centre and the edge of the sheet as-rolled.

6.2 Coating tests

6.2.1 Coating mass

6.2.1.1 The producer/manufacturer shall develop a testing plan with a frequency sufficient to adequately characterize the lot of material and ensure conformance with specification requirements.

6.2.1.2 The purchaser may conduct verification tests by securing a sample piece of approximately 300 mm in length by the as-coated width and cutting three test specimens, one from the mid-width position and one from each side not closer than 25 mm from the side edge. The minimum area of each specimen shall be 1 200 mm^2.

6.2.2 Triple-spot test

The triple-spot test result shall be the average coating mass found on the three specimens taken in accordance with 6.2.1.

6.2.3 Single-spot test

The single-spot test result shall be the minimum coating mass found on any one of the three specimens used for the triple-spot test. Material, which has been slit from wide coil, shall be subjected to a single-spot test only.

6.2.4 Coating adherence

One representative sample for the coating adherence bend test shall be taken from each lot of 50 t or less for shipment. The specimens for the coating adherence bend test shall be taken not closer than 25 mm from the side edge. The minimum width of the test specimen shall be 50 mm.

7 Test methods

7.1 Tensile test

The tests shall be conducted in accordance with the methods specified in ISO 6892-1. Transverse test pieces shall be taken mid-way between the centre and the edge of the as-coated sheet. Base-metal thickness shall be used to calculate the cross-sectional area needed for the tensile test; however, for orders specifying thickness "as base-metal only", there are two permissible methods for determining the base-metal thickness:

a) option A — determination of the actual base-metal thickness by direct measurement of the substrate of a specimen whose coating has been removed;

b) option B — calculation of the base-metal thickness by subtraction of the equivalent coating thickness for the appropriate coating designation included in Annex A from the actual coated thickness of the test specimen.

7.2 Coating properties

7.2.1 Coating mass

The manufacturer shall conduct tests using methods deemed necessary to ensure that the material conforms with the requirements shown in Table 4. Commonly used methods include those specified in ISO 2178, ISO 3497 and ISO 1460. The coating mass is determined by converting coating-thickness measurements made with magnetic gauges (see ISO 2178) or by X-ray spectrometry (see ISO 3497), using the relationship given in Table 4. Either the test method in ISO 2178 or ISO 3497 shall be used as a basis for acceptance, but not for rejection. In cases of dispute, ISO 1460 shall be used as the referee method.

7.2.2 Coating adherence

Bend tests shall be conducted in accordance with the methods specified in ISO 7438.

8 Designation system

8.1 General

The designation system includes the coating type, coating mass, coating finish condition, surface treatment and base-metal quality.

8.2 Coating type

The coating type designation for zinc coating is: Z.

8.3 Coating mass

8.3.1 The coating mass designations for zinc coating are: Z001, Z100, Z180, Z200, Z275, Z350, Z450, Z600 and Z700.

8.3.2 The coating is expressed as the total mass on both surfaces, in grams per square metre. The coating mass specified should be compatible with the desired service life, the thickness of the base-metal and the forming requirements involved.

NOTE For differential coatings, the coating mass of each surface, which is based on the agreement of the interested parties, is shown in the order of top surface and bottom surface. An example of a differential coating designation is: Z180Z100NCHSS 310 (see 8.7.2).

8.4 Coating finish condition

The coating finish condition designations are:

— N: normal spangle, no skin pass;

— S: normal spangle with skin pass;

— M: minimized spangle, no skin pass;

— E: minimized spangle with skin pass.

The “M” and “E” coating conditions are normally furnished in designations of Z180, Z275 and Z350, and in thicknesses of 0,40 mm to 2 mm, inclusive.

8.5 Surface treatment

The surface treatment designations are:

— C: mill passivation;

— P: mill phosphating;

— O: oiling;

— CO: mill passivation and oiling.

8.6 Base-metal quality

The base-metal quality designation is:

— HRA: commercial quality.

8.7 Examples

8.7.1 An example of a complete designation is Z275NCHRA. This designation example includes the following components:

— Z: zinc coating;

— 275: coating mass;

— N: normal spangle, no skin pass;

— C: mill passivation;

— HRA: commercial quality.

8.7.2 An example for differential coatings, the standard designation would give the top surface before the bottom surface; Z180Z100NCHRA. This designation example includes the following components:

— Z: zinc coating;

— 180: coating mass top surface;

— 100: coating mass bottom surface;

— N: normal spangle, no skin pass;

— C: mill passivation;

— HRA: commercial quality.

9 Retests

9.1 Machining and flaws

If any tensile test piece shows defective machining or develops flaws, it shall be discarded and another test piece shall be substituted.

9.2 Elongation

On any tensile test, if any part of the fracture is outside the middle half of the gauge length as scribed before the test, the test shall be discarded and a retest carried out.

9.3 Additional tests

If any test does not give the specified results, two additional tests shall be conducted on samples selected at random from the same lot. Both retests shall conform to the requirements of this document; otherwise, the lot shall be rejected.

10 Resubmission

10.1 The manufacturer may resubmit, for acceptance, the products that have been rejected during earlier inspection because of unsatisfactory properties, after the rejected products have been subjected to a suitable treatment (e.g. selection, heat treatment), which on request, will be indicated to the purchaser. In this case, tests shall be carried out as if they applied to a new lot.

10.2 The manufacturer may present the rejected products to a new examination for conformity with the requirements for another quality.

11 Workmanship

11.1 The surface condition shall be that normally obtained for a zinc-coated twin-roll cast steel sheet product.

11.2 The steel sheet in cut lengths shall be free from quantities of laminations, surface flaws and other imperfections that are detrimental to the final product or to subsequent appropriate processing.

11.3 Processing for shipment in coils does not afford the manufacturer the opportunity to observe readily or to remove non-conforming portions, as can be carried out on the cut length product. However, this does not relieve the manufacturer of responsibility to provide a product that meets the requirement for surface condition that is normally obtained on zinc-coated twin-roll cast steel sheet products.

12 Inspection and acceptance

12.1 Although not usually required for products covered by this document, when the purchaser specifies that inspection and tests for acceptance shall be observed prior to shipment from the manufacturer's works, the manufacturer shall afford the purchaser's inspector all reasonable facilities to determine that the steel is being furnished in accordance with this document.

12.2 Steel that is reported to be non-conforming after arrival at the user's works shall be set aside, properly and correctly identified and adequately protected. The manufacturer shall be notified so that the reported non-conforming material is properly investigated.

13 Coil Size

When steel sheet in accordance with this document is ordered in coils, a minimum or range of acceptable inside diameter(s) (ID) shall be specified. In addition, the maximum outside diameter (OD) and the maximum acceptable coil mass shall be specified.

14 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel sheet shall be legibly stencilled on the top of each lift or shown on a tag attached to each coil or shipping unit:

a) the manufacturer's name or identifying brand;

b) the number of this document, i.e. ISO 15208:2022;

c) the base-metal quality designation;

d) the coating designation;

e) the order number;

f) the product dimensions;

g) the mass;

h) the bundle or coil number.

15 Information supplied by the purchaser

Enquiries and orders shall include the following information:

a) a reference to this document, i.e. ISO 15208:2022;

b) the name and designation of the material, for example hot-dip zinc-coated twin-roll cast steel sheet, Z275NCHRA (see Clause 8);

c) the dimensions:

   1) for cut lengths: the thickness (combination of base-metal and coating or base-metal alone), width, length, bundle mass and the total quantity required;

   2) for coils: the thickness (combination of base-metal and coating or base-metal alone), width, minimum or range of inside diameter, outside diameter, the maximum acceptable coil mass and the quantity required.

      NOTE 1 When the base-metal alone is specified, see Annex A for details.

      NOTE 2 When the method of specifying thickness is not indicated, the combination of base-metal and coating is provided.

d) the application (name of part), if available;

   NOTE 3 Identification of the application provides the opportunity to assess the compatibility of the end use with the ordered grade and coating designation. Proper identification of the part can include a description of the part or a visual examination of a submitted part and/or part prints or any combination thereof.

e) indication of whether oiled or not (see 5.8.3);

f) indication of whether mill passivated or not (see 5.8.1);

g) indication of whether mill phosphated or not (see 5.8.2);