INTERNATIONAL STANDARD

ISO 15208

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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
ISO 15208:2012(E)

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 15208 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

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

1 Scope

This International Standard specifies the characteristics of continuous hot-dip zinc-coated twin-roll cast steel sheet of commercial quality manufactured using the twin-roll cast steel-making process.

The product is intended for applications where resistance to corrosion is of prime importance.

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

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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 16160, *Hot-rolled steel sheet products — Dimensional and shape tolerances*

ISO 16162, *Cold-rolled steel sheet products — Dimensional and shape tolerances*

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

3.1
continuous hot-dip zinc-coated steel sheet
product obtained by hot-dip coating of cold-reduced sheet coils or hot-rolled sheet coils on a continuous zinc-coating line

3.2
normal spangle
coating formed as a result of unrestricted growth of zinc or zinc iron crystals during normal solidification

NOTE Normal spangle has a metallic lustre and is the type normally furnished for a wide variety of applications. It may be furnished as coating conditions S or N (see 8.4); however, it may be variable in appearance and is not suitable for decorative painting.

3.3
minimized spangle coating
finish obtained by restricting normal spangle formation during the solidification of the zinc crystals

NOTE This product may have some lack of uniformity in surface appearance within a coil or from coil to coil.

3.4
smooth finish
surface produced by skin-passing the coated material in order to achieve an improved smooth surface condition as compared with the normal as-coated product

3.5
differential coating
layer having a specified coating-mass designation on one surface and a different coating-mass designation on the other surface

3.6
skin pass
light cold rolling of the zinc-coated steel sheet

NOTE The purpose of the skin pass is to produce a higher degree of surface smoothness and, thereby, improve the surface appearance. The skin pass also temporarily minimizes the occurrence of a surface condition known as stretcher strain (Luder's Lines) or fluting during the fabrication of finished parts. The skin pass also controls and improves flatness. Some increase in hardness and loss of ductility can 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

4 Thickness

4.1 Zinc-coated commercial quality twin-roll cast 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.

4.2 Zinc-coated twin-roll cast sheets less than 600 mm wide may be slit from wide sheets and may be considered sheets.

4.3 The thickness of zinc-coated twin-roll cast sheet steel 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. In the event that 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 Chemical composition

The chemical composition (heat analysis) shall not exceed the values given in Tables 1 and 2. On request, a report of the heat analysis shall be made to the purchaser.

A verification analysis (product analysis) may be made by the purchaser to verify the specified analysis of the semi-finished or finished steel, and shall take into consideration any normal heterogeneity. Non-killed steels, such as rimmed or capped are not technologically suited for verification analysis. The product analysis tolerances are shown in Table 3.

The processes used in making the steel and in manufacturing zinc-coated sheets of structural quality are left to the discretion of the manufacturer. Upon request, the purchaser shall be informed of the steel-making process being used.

Table 1 — Chemical composition — Heat analysis

Mass fractions in per cent maximum

Designation	Quality	C	Mn	P	S	Si
HRA	Commercial	0,15	0,70	0,045	0,035	–
NOTE In this table, "–" indicates that there is no requirement, but the analysis shall be reported.						

Table 2 — Limits on additional chemical elements

Mass fractions in per cent maximum

Element	Cu	Ni	Cr	Mo	Nb	V	Ti
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
NOTE Each of these elements listed in this table shall be included in the report of the heat analysis. Where the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis shall be reported as < 0,02 %.							

Table 3 — Product analysis tolerances

Element	Maximum of specified element %	Tolerance over the maximum specified %
Carbon	≤ 0,15	0,03
Manganese	≤ 0,70	0,05
Phosphorus	≤ 0,045	0,01
Sulfur	≤ 0,035	0,01
NOTE The maximum tolerance in this table is the allowable excess over the specified requirement and not the heat.		

5.2 Mechanical properties

Commercial quality zinc-coated twin-roll cast sheet steels do not have any specified minimum mechanical properties; however, the minimum tensile strength for commercial quality is normally expected to be 270 MPa. Where 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.

5.3 Coating

5.3.1 Coating mass

The coating mass shall conform to the limits for the coating designations shown in Table 4. The coating mass is the total amount of zinc on both surfaces of the sheet, expressed in grams per square metre (g/m^2) of sheet. The coating mass of differentially coated material shall be agreed upon between the interested parties. If a maximum coating mass is required, the manufacturer shall be notified at the time of ordering.

Table 4 — Mass of coating — Total both sides[a]

Coating Designation	Minimum check limit	
	Triple-spot test g/m^2 (of sheet)	Single-spot test g/m^2 (of sheet)
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 is no established minimum check limits for triple- and single-spot tests.

5.3.2 Coating adherence

The zinc-coated twin-roll cast sheet shall be capable of being bent in any direction, in accordance with the mandrel diameter requirements for the coating designations included in 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 — Bend test mandrel diameter

Coating designation				
Quality	$e \leq 2$ mm			
Commercial	Up to Z275	Z300 Z350	Z450 Z600	Z700
	1a	1a	2a	2a

e = thickness of steel sheet, in millimetre(s)

a = bend mandrel diameter = e

5.4 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected with special attention to the heavier coatings.

5.5 Painting

Hot-dip zinc-coated steel sheet is a suitable base for paint, but the first treatment may be different from those used on mild steel. Pretreatment 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 passivated or not passivated.

5.6 Surface treatment

5.6.1 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.

5.6.2 Mill phosphating

Zinc-coated 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.

5.6.3 Oiling

The zinc-coated steel sheet as produced may be oiled to prevent marring and scratching of the soft surface during handling or shipping and to minimize wet storage stain. If the zinc-coated sheet receives a passivating treatment, oiling further minimizes the hazard of wet storage stain.

5.7 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 shall be permitted, if agreed upon between the manufacturer and the purchaser.

5.8 Dimensional and shape tolerances

5.8.1 Dimensional tolerances applicable to zinc-coated 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.

5.8.2 Where the base metal thickness is specified, the thickness tolerances of Tables 6, 7 and 8 of ISO 16163:2010, shall apply to the average product thickness, as calculated in accordance with Annex A. The tolerances for thickness of the base metal shall be as given in ISO 16160 for hot-rolled steel and ISO 16162 for cold-rolled steel.

6 Sampling

6.1 Chemical composition

Each heat shall be tested by the manufacturer to determine compliance with the requirements of Tables 1 and 2.

6.2 Tensile test

If required, one representative transverse sample shall be taken from each lot to verify conformance with the requirements of 5.2. Transverse test pieces shall be taken mid-way between the centre and the edge of the sheet as-rolled. A lot consists of 50 t, or less, of sheet of the same grade rolled to the same thickness and coating condition.

6.3 Coating tests

6.3.1 Coating mass

6.3.1.1 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.

6.3.1.2 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 the three specimens shall be 1 200 mm^2.

6.3.2 Triple-spot test

The triple-spot test result shall be the average coating mass found on the three specimens taken according to 5.3.1.

6.3.3 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.

6.3.4 Coating adherence

One representative sample for the coating bend test shall be taken from each lot of sheet for shipment. The specimens for the coated 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.

6.4 Retest

If a test does not satisfy the specified results, two more test pieces shall be taken at random from the same lot. Both retests shall conform to the requirements of this International Standard.

7 Test methods

7.1 Tensile test

The tests shall be conducted in accordance with the methods specified in ISO 6892-1. 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 average 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 complies with the requirements shown in Table 4. Commonly used methods include those specified in ISO 2178, ISO 3497 and ISO 1460. The coating mass may be determined by converting coating thickness measurements made with magnetic gauges (as specified in ISO 2178) or by X-ray spectrometry (as specified in ISO 3497) using the relationship shown in Note 2 of Table 4.

7.2.2 Coating adherence

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

8 Designation system

The designation system includes the coating type, coating mass, coating condition and surface treatment.

8.1 Coating type

The letter Z indicates a zinc coating.

8.2 Coating mass

The coating mass designations for zinc coating are: 001, 100, 180, 200, 275, 350, 450, 500, 600 and 700.

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 standard is top surface before bottom surface.

EXAMPLE An example of a differential coating designation is: Z275M120P340.

8.3 Coating finish type

The conditions of the coating are the following:

— N: normal coating (as produced);

— S: normal coating (skin passed);

— M: minimized spangle (as produced);

— E: minimized spangle (skin passed).

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.

8.4 Surface treatment

The types of surface treatment are the following:

— C: mill passivation;

— P: mill phosphating;

— O: oiling;

— CO: mill passivation and oiling.

8.5 Example of designation

The designation shall include the following components:

— zinc coating;

— coating mass;

— minimized spangle;

— mill passivation.

EXAMPLE A hot-dip zinc-coated twin-roll cast steel sheet of zinc coating Z, coating mass 275, minimized spangle M and mill passivation C shall be designated as follows:

Z275MC275

9 Resubmission

9.1 The manufacturer may resubmit for acceptance the products which have been rejected during earlier inspection because of unsatisfactory properties, after he/she has subjected them to a suitable treatment (for example selection and heat treatment), which, on request, shall be indicated to the purchaser. In this case, the tests should be carried out as if they apply to a new lot.

9.2 The manufacturer has the right to subject the rejected products to a new examination for compliance with the requirements for another quality or grade.

10 Workmanship

The zinc-coated steel sheet in cut lengths shall be free from amounts of laminations, surface flaws and other imperfections, which are detrimental to subsequent appropriate processing. Processing for shipment in coils does not afford the manufacturer the opportunity to observe readily or to remove defective portions as can be carried out for cut-length product; however, surface quality of coils shall be approved by the manufacturer.

10.1 Inspection and acceptance

10.1.1 While not usually required for products covered by this International Standard, the purchaser may specify that inspection and tests for acceptance be observed prior to shipment from the manufacturer's works. In these cases, the manufacturer shall afford the purchaser's inspector all reasonable facilities to determine that the steel is being furnished in accordance with this International Standard.

10.2.2 Steel that is reported to be defective after arrival at the user's works shall be set aside, properly and correctly identified, and adequately protected.

11 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel 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) a reference to this International Standard, i.e. ISO 15208:2012;

c) the grade designation;

d) the heat number;

e) the bundle/coil number;

f) the coating designation;

g) the order number;

h) the product dimensions;

i) the lot number;

j) the mass;

k) the production date (for skin-passed sheet).

12 Information to be supplied by the purchaser

To specify requirements adequately according to this International Standard, inquiries and orders shall include the following information:

a) a reference to this International Standard, i.e. ISO 15208:2012;

b) the name and designation of the material, for example hot-dip twin-roll cast zinc-coated steel sheet, Z275NC275 (see Clause 8);

c) the dimensions:

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

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

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

NOTE 2 Where 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 5.6.3);

f) indication of whether mill passivated or not (see 5.6.1);

g) indication of whether mill phosphated or not (see 5.6.2);

h) the report of the mechanical properties and/or heat analysis, if required;

i) inspection and tests for acceptance prior to shipment from the manufacturer's works, if required (see Clause 11);

j) indication of whether skin passing is required;

k) indication of whether mill chromated or not.

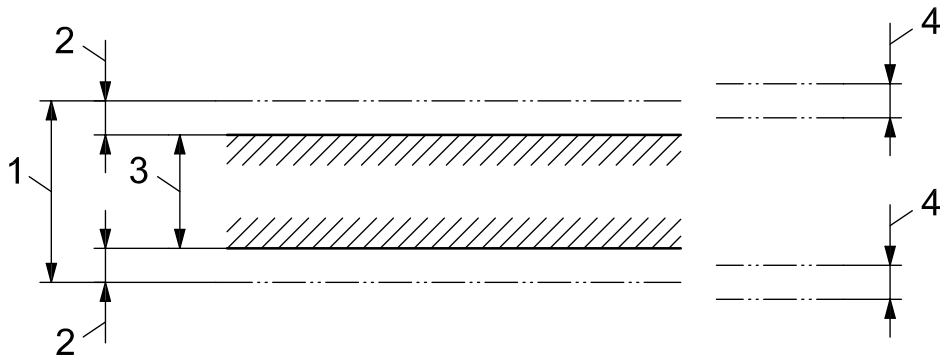
EXAMPLE The following is a typical ordering description:

International Standard ISO 12508:2012, hot-dip zinc-coated twin-roll cast steel sheet, Z180NCO275, 0,46 mm (base metal and coating) × 1 200 × 2 400 mm, 20 000 kg, to fabricate drawn shells, part 7201, mill passivation and oiled, maximum lift 4 000 kg.

Annex A
(normative)

Orders requiring base-metal thickness

A.1 Where specified by the purchaser, the ordered thickness shall be the base-metal thickness. In these cases, the average coated product thickness shall be calculated as the base-metal thickness plus the average thickness for each surface (see Table A.1) of the coating mass, as indicated in Figure A.1. Thickness tolerance tables apply to the average coated product thickness.



Key

1 average coated product thickness, $\bar{a}_p$
2 average coating thickness, $\bar{a}_c$
3 base-metal thickness, a_b
4 thickness tolerance, Δa

Figure A.1 — Calculation of the average coated product thickness

Table A.1 — Average thickness for coating mass — Total both sides

Coating designation	Average coating thickness[a] for calculation mm
Z180	0,034
Z275	0,054
Z350	0,064
Z450	0,080
Z600	0,102

a Coating mass data derived from actual production results.

Bibliography

[1] ASTM A 1063/A1063M, *Standard Specification for Steel, Sheet, Twin-Roll Cast, Zinc-Coated (Galvanized) by the Hot-Dip Process*[1)]

1) This document is recognized by ISO/TC 17/SC 12 to cover a subject similar to that of this International Standard. This information is given for the convenience of users of this International Standard and constitutes neither an endorsement of the document by TC 17/SC 12 or ISO, nor a statement regarding its degree of equivalence with this International Standard.

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