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Steel sheet, zinc-coated and zinc-iron alloy-coated by the continuous hot-dip process, of structural quality

Tôles en acier au carbone revêtues de zinc et d'un alliage zinc-fer en continu par immersion à chaud, de qualité destinée à la construction

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Contents

Page

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).

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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 seventh edition cancels and replaces the sixth edition (ISO 4998:2014), which has been technically revised.

The main changes are as follows:

— update of terms and definitions;

— addition of coating mass designations.

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.

Steel sheet, zinc-coated and zinc-iron alloy-coated by the continuous hot-dip process, of structural quality

1 Scope

This document specifies the requirements for steel sheet, zinc-coated and zinc-iron alloy-coated by the continuous hot-dip process, of structural quality.

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

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

This document does not cover steel sheet designated as commercial quality, or drawing quality, which are covered in ISO 3575[1].

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

3.2
zinc-iron alloy-coated steel sheet
product obtained by processing the zinc-coated steel sheet so that the coating formed on the base-metal is composed of zinc-iron alloys

Note 1 to entry: This product, designated ZF, is not spangled, is normally dull in appearance, and, for some applications, can be suitable for immediate painting without further treatment, except normal cleaning. Zinc-iron alloy coatings can powder during severe forming.

3.3
normal coating
coating formed 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 as S (normal coating, with skin pass) or N (normal coating, no skin pass); however, it can be variable in appearance and is not suitable for decorative painting.

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

3.8
coating mass
total amount of coating on both sides of the sheet, expressed in grams per square metre (g/m^2) of sheet

4 Dimensions

4.1 Zinc-coated and zinc-iron alloy-coated structural quality steel sheet is produced in thicknesses from 0,25 mm to 5 mm inclusive after coating, and in widths of 600 mm and over in coils and cut lengths. Zinc-coated and zinc-iron alloy-coated steel sheet less than 600 mm wide, slit from wide sheet, is considered as sheet.

NOTE Thicknesses less than 0,4 mm will possibly not be available in grades 220, 250, 280, and 320.

4.2 The thickness of zinc-coated and zinc-iron alloy-coated steel sheet may be specified as a combination of the base-metal and metallic coating, or as the 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 will be provided. Annex A describes the requirements for specifying the thickness as the 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 and zinc-iron alloy-coated steel sheet of structural quality are left to the discretion of the manufacturer. On 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 fraction in per cent

Element	Maximum of specified element
C	0,25
Mn	1,70
P[a]	0,05
S	0,035
[a] Grades 250 and 280: P – 0,10 % max.; Grade 350: P – 0,20 % max.	

Table 2 — Limits on additional chemical elements

Mass fraction in per cent

Element	Cu[a] max.	Ni[a] max.	Cr[a, b] max.	Mo[a, b] max.	Nb[c] max.	V[c] max.	Ti[c] max.
Heat analysis	0,20	0,20	0,15	0,06	0,008	0,008	0,008
Product analysis	0,23	0,23	0,19	0,07	0,018	0,018	0,018

[a] The sum of copper, nickel, chromium, and molybdenum shall not exceed 0,50 % on heat analysis. When one or more of these elements are specified, the sum does not apply, in which case only the individual limits on the remaining elements apply.

[b] The sum of chromium and molybdenum shall not exceed 0,16 % on heat analysis. When one or more of these elements are specified, the sum does not apply, in which case only the individual limits on the remaining elements apply.

[c] Heat analysis greater than 0,008 % may be supplied after agreement between the producer and purchaser.

Table 3 — Product analysis tolerances for Table 1

Mass fraction in per cent

Element	Maximum of specified element	Tolerance over maximum specified
C	0,25	0,04
Mn	1,70	0,05
P	0,05	0,01
S	0,035	0,01

NOTE The above maximum tolerance is the allowable excess over the requirement of heat analysis shown in Table 1.

5.4 Mechanical properties

Structural quality grades shall satisfy the mechanical properties shown in Table 4. On request, a report of the mechanical properties shall be made to the purchaser.

Table 4 — Mechanical properties

Grade	R_{eL}[a] min. MPa[b]	R_m max. MPa	A[c] min. %	
			L_o = 50 mm	L_o = 80 mm
220	220	310	20	18
250	250	360	18	16
280	280	380	16	14
320	320	430	14	12
350	350	450	12	10
380	380	540	12	10
550	550	570	—	—

R_{eL}: lower yield strength

R_m: tensile strength (for information only)

A: percentage elongation after fracture

L_o: gauge length of original test piece

[a] The yield strength specified in this table shall be the lower yield strength (R_{eL}). The values can also be measured by 0,5 % total elongation proof strength (proof strength under load) or by 0,2 % offset when a definite yield phenomenon is not present. When the upper yield strength (R_{eH}) is specified, the values shall be 20 MPa above the R_{eL} values for each grade.

[b] 1 MPa = 1 N/mm^2.

[c] Use either L_o = 50 mm or L_o = 80 mm to measure elongation. For material up to and including 0,6 mm in thickness, the elongation values in this table shall be reduced by 2.

5.5 Coating

5.5.1 Coating mass

The coating mass limits shall conform to the limits for the designations shown in Table 5. The interested parties shall agree upon the coating mass of differentially coated product. If a maximum coating mass is required, the manufacturer shall be notified at the time of ordering.

Table 5 — Coating mass (total both sides)

Coating mass designation	Minimum check limit	
	Triple-spot test g/m² (of sheet)	**Single-spot test** g/m² (of sheet)
Z001	No minimum[b]	No minimum[b]
Z080	80	68
Z100	100	85
Z120	120	102
Z140	140	119
Z180	180	150
Z200	200	170
Z220	220	187
Z275	275	235
Z350	350	300
Z450[a]	450	385
Z600[a]	600	510
Z700[a]	700	585
ZF001	No minimum[b]	No minimum[b]
ZF080	80	68
ZF100	100	85
ZF120	120	102
ZF180	180	150

Z: zinc

ZF: zinc-iron alloy

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 zinc-coated steel sheet and the two surfaces of zinc-iron alloy-coated steel 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 by using the following relationship: 100 g/m² total coating mass both sides = 0,014 mm total coating thickness both sides.

[a] Coating masses corresponding to the designations Z450, Z600, and Z700 are not available for steels with minimum yield stresses of 340 N/mm², 370 N/mm², 400 N/mm², and 570 N/mm².

[b] "No minimum" means that there are no established minimum check limits for triple-spot and single-spot tests.

5.5.2 Coating adherence

The zinc-coated (Z) steel sheet shall be capable of being bent in any direction, in accordance with the mandrel diameter requirements of Table 6, 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. The bend test requirements of Table 6 do not apply to zinc-iron alloy-coated (ZF) steel sheet.