
**Continuous hot-dip aluminium/zinc-coated
steel sheet of commercial, drawing and
structural qualities**

*Tôles en acier revêtues en continu par immersion à chaud d'une couche
d'alliage aluminium-zinc de qualité commerciale, pour emboutissage ou
destinées à la construction*

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9364 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 9364:1991), which has been technically revised.

Annex A forms a normative part of this International Standard.

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Continuous hot-dip aluminium/zinc-coated steel sheet of commercial, drawing and structural qualities

1 Scope

1.1 This International Standard specifies the characteristics of steel of commercial, drawing and structural qualities coated by a continuous hot-dip aluminium/zinc alloy coating process. The aluminium/zinc alloy composition by mass is nominally 55 % aluminium, 1,6 % silicon and the balance zinc. The product is intended for applications where the corrosion characteristics of aluminium coupled with those of zinc are desired.

1.2 Aluminium/zinc-coated steel sheet is produced in thicknesses up to 5 mm after coating, and in widths of 600 mm and over in coils and cut lengths. Aluminium/zinc-coated steel sheet less than 600 mm wide may be slit from wide sheet and will be considered as sheet.

NOTE Values of total theoretical thickness for coating mass are given in annex A.

1.3 Commercial quality aluminium/zinc-coated steel sheet (quality 01) is intended for general fabricating purposes where sheet is used in the flat, or for bending or moderate forming.

1.4 Drawing quality aluminium/zinc-coated steel sheet (qualities 02 and 03) are intended for drawing or severe forming. It is furnished to all the requirements of this International Standard or, with agreement when ordered, to fabricate an identified part, in which case the mechanical properties of Table 3 do not apply.

Drawing qualities are identified as follows:

02: Drawing quality

03: Deep drawing quality

1.5 Structural quality aluminium/zinc-coated steel sheet is produced in six grades as defined by a minimum yield stress.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2178:1982, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 3497:2000, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods*

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature*

3 Terms and definitions

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

3.1 continuous hot-dip aluminium/zinc coated steel sheet

product obtained by hot-dip coating steel sheet coils on a continuous aluminium/zinc coating line to produce either coated coils or cut lengths

3.2 types of aluminium/zinc coatings

3.2.1 normal spangle coating

coating formed as a result of unrestricted growth of aluminium/zinc crystals during normal solidification

3.2.2 smooth finish

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

NOTE End-use applications may require negotiations between the supplier and consumer in order to establish specific surface requirements.

3.3 skin pass

a light cold rolling of the product

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NOTE The purpose of the skin passing is one or more of the following:

- a) to minimize the appearance of coil breaks, stretcher strains and fluting;
- b) to control the shape;
- c) to obtain the required surface finish.

3.4 aluminum killed

deoxidized with aluminum sufficient to prevent the evolution of gas during solidification

3.5 resquared

attempt to approach a true 90° angle at the shear cut

NOTE 1 This normally applies to steel sheet for which tighter than standard width, length, camber or out-of-square tolerances are required and which typically necessitates an additional shearing operation after the sheet has been cut to length from a coil.

NOTE 2 “Resquared” is referred to as “restricted” in some areas of the world.

4 Designations

4.1 General

The designation system includes the coating mass designation, coating condition, surface treatment, quality and grade of steel.

The letters AZ in Table 1 are used to indicate 55 % aluminium/zinc coating.

4.2 Coating mass

The coating mass designations are 90, 100, 150, 165, 185 and 200 as listed in Table 1.

The coating is expressed as the total mass on both surfaces in g/m². The coating mass specified shall be compatible with the desired service life, the thickness of the base metal and the forming requirements involved.

4.3 Coating type

The type of coating is designated as:

- N normal spangle coating (as coated);
- S skin-passed for improved surface (smoother) condition.

4.4 Surface treatment

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The surface treatment is designated as:

- A oiling; [ISO 9364:2001
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- B mill passivation plus oiling;
- C mill passivation;
- D no surface treatment.

4.5 Base metal quality

This is designated as:

- 01 commercial quality;
- 02 drawing quality;
- 03 deep drawing quality.

Structural quality grades are indicated by three digits as listed in Table 2.

4.6 Complete designation

EXAMPLE 1

Steel sheet with a coating of 55 % aluminium/zinc of mass 150, of normal spangle quality, that has undergone mill passivation and is of drawing quality, aluminium killed is designated as follows:

AZ150NC02

EXAMPLE 2

Steel sheet with a coating of 55 % aluminium/zinc of mass 150, in the skin-passed condition, that has undergone mill passivation plus oiling and is of structural quality grade is designated as follows:

AZ150SB350

Table 1 — Coating mass test limits for aluminium/zinc-coated steel sheet

Coating designation	Triple-spot test total both sides min. g/m ²	Single-spot test, total both sides min. g/m ²
AZ090	90	75
AZ100	100	85
AZ150	150	130
AZ165	165	140
AZ185	185	160
AZ200	200	170

NOTE The coating mass in grams per square metre refers to the total coating on both surfaces. Because of the many variables and changing conditions that are characteristic of continuous hot-dip coating, the coating mass is not always evenly divided between the two surfaces of a sheet, neither is the coating evenly distributed from edge to edge. However, it can normally be expected that no less than 40 % of the single-spot test limit will be found on either surface.

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Table 2 — Mechanical properties of structural-quality steels and coating bend test

Grade	R_e min. N/mm ²	R_m min. N/mm ²	A min. ^a %		Coated metal 180° bend mandrel diameter mm	
			$L_o = 50$ mm	$L_o = 80$ mm	$e < 3$	$e \geq 3$
220	220	320	20	18	1 e	2 e
250	250	350	18	16	1 e	2 e
280	280	390	16	14	2 e	3 e
320	320	430	14	12	3 e	3 e
350	350	450	12	10	—	—
550 ^b	550	560	—	—	—	—

R_e = yield stress – can be either R_{eL} or R_{eH} but not both

R_{eL} = lower yield stress

R_{eH} = higher yield stress

R_m = tensile strength

A = percentage elongation after fracture

L_o = gauge length on test piece

e = thickness of bend test piece

1 N/mm² = 1 MPa

NOTE 1 R_{eL} can be measured by 0,5% total elongation proof stress (proof stress under load) or by 0,2% offset when a definite yield phenomenon is not present.

NOTE 2 In determining the base metal mechanical properties, base metal thickness should be measured after stripping the coating from the end of the specimen contacting the grips of the tensile-testing machine before testing.

^a 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 the table shall be reduced by 2.

^b Grade 550 is the unannealed condition and therefore has limited ductility. If the hardness is HRB 85 or higher, no tensile test is required.

5 Manufacturing processes

5.1 Strain ageing

Aluminium/zinc coated steel sheet tends to strain age, and this may lead to the following:

- surface marking from stretcher strain (Luder's lines) or fluting when the steel is formed;
- a deterioration in ductility.

Because of these factors, it is essential that the period between final processing at the mill and fabrication be kept to a minimum. Rotation of stock, by using the oldest material first, is important. Reasonable freedom from stretcher strain can be achieved by effective roller levelling immediately prior to fabrication at the purchaser's plant.

5.2 Mill passivation

A chemical treatment may be applied to aluminium/zinc-coated steel sheet to minimize the hazard of wet storage stain 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.

5.3 Painting

Hot-dip aluminium/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/aluminium-coated sheet. In a painting schedule, it should be considered whether the product should be ordered with or without chemical passivation. Surfaces with certain passivation treatments (e.g. chromated) are not suitable for phosphating or the application of a pretreatment (etch) primer.

5.4 Oiling

Oiling of the as-produced aluminium/zinc-coated steel sheet prevents marring and scratching of the soft surface during handling or shipping and helps to minimize the hazard of wet storage stains (known as black rust on this type of product). For these reasons, the purchaser is advised to consider specifying the aluminium/zinc-coated steel in the oiled condition, provided this is compatible with his processing system.

5.5 Coating line butt welds

These may be permitted if agreed upon between the manufacturer and purchaser.

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6 Conditions of manufacture

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6.1 Steelmaking

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The processes used in making the steel and in manufacturing aluminium/zinc-coated sheet are left to the discretion of the manufacturer. When requested, the purchaser shall be informed of the steelmaking process being used.

6.2 Chemical composition of the steel

The chemical composition (heat analysis) shall be in accordance with the values given in Tables 3 and 4.

6.3 Chemical analysis

6.3.1 Heat analysis

A heat analysis of each heat of steel shall be made by the manufacturer to determine compliance with the requirements of Tables 3 and 4. When requested, this analysis shall be reported to the purchaser or his representative.

6.3.2 Product analysis

A product analysis may be made by the purchaser to verify the specified analysis of the product and shall take into consideration any normal heterogeneity. Non-killed steels (such as rimmed or capped) are not technologically suited to product analysis. For killed steels, the sampling method and deviation limits shall be agreed upon between manufacturer and purchaser at the time of ordering.

Table 3 — Chemical composition (heat analysis) %

Base Metal Quality		C	Mn	P	S
Name	Designation	max.	max.	max.	max.
Commercial	01	0,10	0,60	0,030	0,035
Drawing	02 and 03	0,06	0,50	0,020	0,025
Structural	220 to 550	0,25 ^a	1,15	0,20 ^b	0,040

^a Grade 350 may exceed the limits given in Table 4 or conform to all requirements of Table 4 and have 0,40 % max. carbon.

^b Grades 250 and 280 phosphorus: 0,10 % max. Grade 350: phosphorus: 0,20 % max.

Table 4 — Limits on additional chemical elements^a

Element max. %	Heat analysis	Product analysis
Cu ^b	0,20	0,23
Ni ^b	0,20	0,23
Cr ^{b, c}	0,15	0,19
Mo ^{b, c}	0,06	0,07
Nb ^d	0,008	0,018
V ^d	0,008	0,018
Ti ^d	0,008	0,018

^a Each of the elements listed in this table 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 %".

^b 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 will apply.

^c 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 will apply.

^d Heat analysis greater than 0,008 % may be supplied after agreement between producer and consumer.

6.4 Steel substrate

Unless otherwise agreed between interested parties, the rolling condition of the sheets to be coated (cold rolled sheet or hot-rolled sheet) is at the discretion of the manufacturer.

6.5 Coating mass

The coating mass shall conform to the requirements presented in Table 1 for the specified coating designation. The coating mass is the total amount of the aluminium/zinc alloy, including both sides of the sheet, expressed in grams per square metre (g/m²) of sheet. Methods of checking that the material complies with this International Standard are given in 8.2.1 and 9.2.2 to 9.2.4.