

INTERNATIONAL STANDARD

ISO
9364

First edition
1991-07-15

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

iTeh STANDARD PREVIEW

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

[ISO 9364:1991](#)

<https://standards.iteh.ai/catalog/standards/sist/f8a0c38d-25bd-45b9-89c9-2091b060de69/iso-9364-1991>

INTERNATIONAL

ISO



Reference number
ISO 9364:1991(E)

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.

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.

International Standard ISO 9364 was prepared by Technical Committee ISO/TC 17, *Steel*, Sub-Committee SC 12, *Continuous mill flat rolled products*.

[ISO 9364:1991](https://standards.iteh.ai/catalog/standards/sist/f8a0c38d-25bd-45b9-89c9-2091b060de69/iso-9364-1991)

<https://standards.iteh.ai/catalog/standards/sist/f8a0c38d-25bd-45b9-89c9-2091b060de69/iso-9364-1991>

© ISO 1991

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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

1 Scope

1.1 This International Standard specifies the characteristics of steel of commercial, lock-forming 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 5,0 mm inclusive 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.

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 Lock-forming quality aluminium/zinc-coated steel sheet (quality 02) is intended for lock-seaming and other similar applications and has better formability than commercial 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 standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of ap-

plying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1460:1973, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Determination of the mass per unit area — Gravimetric method.*

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

ISO 3497:1990, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods.*

ISO 6892:1984, *Metallic materials — Tensile testing.*

ISO 7438:1985, *Metallic materials — Bend test.*

3 Definitions

For the purposes of this International Standard, the following 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 1 End-use applications may require negotiations between the supplier and consumer to establish specific surface requirements.

4 Designations

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

4.1 General

The letters AZ are used to indicate an aluminium/zinc coating.

4.2 Coating mass

The coating mass designations are 90, 100, 150, 165, 185 and 200 according to table 1.

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 with 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

The surface treatment is designated as

- A oiling;
- 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 lock-forming quality.

Structural quality grades are indicated by three digits according to table 4.

4.6 Complete designation

An example is AZ165NC02. This designation is obtained by combining the following components:

- AZ aluminium/zinc coating;
- 165 coating mass designation;

- N normal spangle coating condition;
- C mill passivation;
- 02 lock-forming quality.

An example of a complete designation for one of the structural-quality products is AZ150SB350. This designation is obtained by combining the following components:

- AZ aluminium/zinc coating;
- 150 coating mass designation;
- S skin-passed extra smooth coating condition;
- B mill passivation plus oiling;
- 350 structural quality grade.

5 General information

5.1 Skin-pass

This is a light cold rolling of the aluminium/zinc-coated steel sheet. The purposes of skin-passing are one or more of the following:

- a) to produce a higher degree of surface smoothness and to improve appearance (this process may adversely affect the ductility of the base metal);
- b) to minimize temporarily the occurrence of conditions known as stretcher strain (Luder's lines) or fluting during fabrication of finished parts;
- c) to control shape.

5.2 Strain ageing

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

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

5.3 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.

5.4 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.

5.5 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.

5.6 Coating line butt welds

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

6 Conditions of manufacture

6.1 Steelmaking

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 (cast analysis) shall be in accordance with the values given in table 2.

6.3 Chemical analysis

6.3.1 Cast analysis

A cast analysis of each cast of steel shall be made by the manufacturer to determine the percentage of carbon, manganese, phosphorus and sulfur. When requested, this analysis shall be reported to the purchaser or his representative.

6.3.2 Verification analysis

A verification 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 to verification analysis. For killed steels, the sampling method and deviation limits shall be agreed upon between manufacturer and purchaser at the time of ordering.

6.4 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 in 9.2 through 9.2.3.

6.5 Weldability

The product is normally suitable for welding if appropriate welding conditions are selected with special attention to the heavier coatings. If appropriate welding conditions are selected, the product is suitable for spot welding and roller seam welding, as well as fusion welding.

When the carbon content increases above 0,15 %, spot welding becomes increasingly difficult. Because the heat of welding might have a significant effect on lowering the strength of grade 550, this grade is not recommended for welding.

6.6 Application

Aluminium/zinc-coated steel sheet shall be identified for fabrication by the name of the part and the intended application.

6.7 Mechanical properties

The mechanical properties for the structural quality grades shall be as stated in table 4 when they are determined on test pieces obtained according to the requirements of 8.1.

7 Dimensional tolerances

Dimensional tolerances applicable to aluminium/zinc-coated steel sheet shall be as given in tables 5 to 14. The thickness is the total of the base metal and the coating.

8 Sampling

8.1 Sampling for mechanical tests

8.1.1 Tensile test

One representative sample for the tensile test required in table 4 shall be taken from each lot of steel for shipment. A lot consists of 50 tonnes or less of sheet of the same grade rolled to the same thickness and condition.

8.1.2 Bend test

One representative sample for the bend test shall be taken from each lot of steel for shipment, except that bend tests are not required for structural grades 350 and 550. A lot consists of all sheet of the same quality or grade rolled to the same thickness and condition.

8.2 Sampling for coating tests

8.2.1 Mass of coating

Test specimens for coils and cut lengths coated in coils shall be taken from a sample piece approximately 300 mm in length by the as-coated width. The purchaser, in order to verify the mass of coating, shall use the following sampling method: three specimens shall be cut — one from the mid-width position and one from each side, not closer than 25 mm from the side edge. The minimum specimen area shall be 2 000 mm².

8.2.2 Bend test

One representative sample shall be taken from each lot of sheet for shipment, except that bend tests are not required for structural grades 350 and 550. The specimens for the coated bend test shall be taken not closer than 25 mm from the side edge. The minimum width shall be 50 mm.

9 Test methods

9.1 Mechanical tests

9.1.1 Tensile test (base metal/structural grades)

The tensile test shall be carried out in accordance with ISO 6892. Longitudinal test pieces shall be

taken mid-way between the centre and edge of the sheet as rolled. Since the tensile test is for the determination of properties of the base metal, ends of test pieces shall be stripped of the coating to measure base metal thickness for calculation of cross-sectional area.

9.1.2 Bend test (base metal)

The bend test for the base metal shall be performed on specimens stripped of coating and shall be conducted at ambient temperature according to procedures described in ISO 7438. Small cracks on the edges of test pieces, and cracks which require magnification to be visible, shall be disregarded.

9.1.2.1 Commercial- and lock-forming-quality steel specimens for these grades shall be capable of being bent in any direction in accordance with the requirements of table 3, without cracking on the outside of the bend.

9.1.2.2 For the structural quality steel for these grades a transverse bend test piece shall withstand being bent in the direction as shown in figure 1 through 180° without cracking on the outside of the bent portion, around the inside diameter, as shown in table 4.

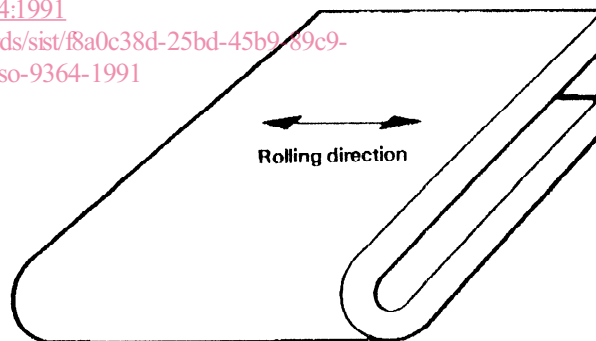


Figure 1 — Transverse bend test piece (after bending)

9.2 Coating tests (mass and bend)

The manufacturer shall make such tests and measurements as he deems necessary to ensure that the material produced complies with the values given in table 1.

9.2.1 Triple-spot test

The triple-spot test result shall be the average coating mass found on the three specimens taken according to 8.2.1. The method given in ISO 1460 may be used as a reference method.

9.2.2 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 subject to a single-spot test only.

9.2.3 Estimated coating thickness and coating mass

9.2.3.1 The coating thickness may be estimated from the coating mass by using the following relationship:

$$100 \text{ g/m}^2 \text{ total both sides} = 0,027 \text{ mm total both sides}$$

9.2.3.2 Coating mass is determined by converting coating thickness measurements made with magnetic gauges (ISO 2178) or by X-ray spectrometry (ISO 3497). These test methods may be used as a basis for acceptance, but rejection shall be governed by the coating mass tests described in 9.2.1 and 9.2.2.

9.2.4 Bend test (coating)

For commercial and lock-forming qualities, the coated sheet shall be capable of being bent in any direction, in accordance with the requirements of table 3, without flaking of the coating on the outside of the bend.

For structural-quality grades, coating bend test requirements are as shown in table 4. Flaking of coating within 7 mm from the edge of the test piece shall not be cause for rejection.

10 Retests

If a test does not give 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, otherwise the lot shall be rejected.

11 Resubmission

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

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

12 Workmanship

The aluminium/zinc-coated steel sheet in cut lengths shall be free from amounts of laminations, surface flaws and other imperfections that 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 in the cut-length product.

13 Inspection and acceptance

13.1 While not usually required for products covered by this International Standard, when the purchaser specifies that inspection and tests for acceptance 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 International Standard.

13.2 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.

14 Coil size

When aluminium/zinc-coated steel sheet is ordered in coils, a minimum or range of acceptable inside diameter (I.D.) shall be specified. In addition, the maximum outside diameter (O.D.) and maximum acceptable coil mass shall be specified.

15 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) the number of this International Standard;
- c) the designation (coating, coating mass, coating condition, surface treatment and quality or grade of the base metal);
- d) the order number;
- e) the product dimensions;
- f) the lot number;
- g) the mass.

16 Information to be supplied by the purchaser

To specify adequately requirements under this International Standard, inquiries and orders should include the following information:

- a) the number of this International Standard;
- b) the name and designation of the material, i.e. the letters AZ, coating mass designation, coating type, surface treatment, base metal quality.

EXAMPLE

Aluminium/zinc-coated steel sheet, commercial quality, normal spangle, passivated and oiled, AZ165NC01B (see clause 4);

- c) coil or cut length, and the dimensions of the product in the sequence: thickness, width, length and bundle mass (for cut lengths) and the total quantity required;
- d) the application (name of part), if possible;
- e) whether or not mill passivation is required (see 5.3);
- f) whether or not oiling is required (see 5.5);
- g) the coil size requirements (see clause 14);
- h) report of cast analysis and/or mechanical properties, if required (see 6.3.1 and clause 9);
- i) details of fabrication, special requirements or application (i.e. coating performance, non-fluting, paintability, weldability, exposure environment, etc.) (see 6.6);
- j) inspection and tests for acceptance prior to shipment from the producer's works, if required (see 13.1).

NOTE 2 A typical ordering description is as follows:

International Standard ISO 9364, aluminium/zinc-coated steel sheet, commercial quality, designation AZ165NC01, 1,0 x 1200 mm x coil, 20 000 kg, exhaust pipe tubing, # 6201.

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

Coating designation	Triple-spot test, total both sides	Single-spot test, total both sides
	min. g/m ²	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.

iTeh STANDARD PREVIEW

Table 2 — Chemical composition of the steel

Element		Commercial quality, lock-forming quality	Structural quality ¹⁾
		% (m/m)	% (m/m)
C	max.	0,15	0,40
P	max.	0,035	0,20
S	max.	0,04	0,04
Mn	max.	0,60	1,70

1) Microalloy additions can be used to achieve desired stress levels and to minimize welding problems created by higher carbon levels.

Table 3 — Coating and base metal bend test requirements for commercial and lock-forming qualities

Base metal quality		Coating and base metal, 180° bend mandrel diameter ¹⁾	
Designation	Name	$e < 3$	$e \geq 3$
01	Commercial	$1a$	$2a$
		0 (flat on it-self)	$1a$
02	Lock-forming	0 (flat on it-self)	$1a$

1) e = thickness of steel sheet, in millimetres
 a = thickness of bend test piece, in millimetres

Table 4 — Mechanical properties of structural-quality steels

Grade	R_{eL} ¹⁾ min. N/mm ²	R_m min. N/mm ²	A min. ²⁾ %		Base metal and coated metal 180° bend mandrel diameter, mm	
			$L_0 = 50$ mm	$L_0 = 80$ mm	$e < 3$	$e \geq 3$
220	220	310	20	18	1a	2a
250	250	360	18	16	1a	2a
280	280	380	16	14	2a	3a
320	320	430	14	12	3a	3a
350	350	450	12	10	3a	—
550 ³⁾	550	570	—	—	—	—

NOTES

1 R_{eL} = lower yield stress; R_m = tensile strength; A = percentage elongation after fracture; L_0 = gauge length on test piece; a = thickness of bend test piece; e = thickness of steel sheet; 1 N/mm² = 1 MPa.

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 tension-testing machine before testing.

1) The yield stress specified in table 4 shall be the lower yield stress (R_{eL}). The values can also 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. When upper yield stress (R_{eH}) is specified, the values shall be 20 N/mm² above the R_{eL} values for each grade.

2) For material up to and including 0,6 mm in thickness, the elongation values in the table shall be reduced by 2.

3) Grade 550 is in the unannealed condition and therefore has limited ductility. If the hardness is HRB 85 or higher, no tension test is required.

ISO 9364:1991

[https://standards.itech.ai/catalog/standards/sist/f8a0c38d-25bd-45b9-89c9-](https://standards.itech.ai/catalog/standards/sist/f8a0c38d-25bd-45b9-89c9-2091b060de69/iso-9364-1991)

2091b060de69/iso-9364-1991

Table 5 — Thickness tolerances for commercial- and lock-forming-quality coils and cut lengths

Values in millimetres

Specified widths	Thickness tolerances for specified thicknesses										
	$\leq 0,4$	$> 0,4$ $\leq 0,6$	$> 0,6$ $\leq 0,8$	$> 0,8$ $\leq 1,0$	$> 1,0$ $\leq 1,2$	$> 1,2$ $\leq 1,6$	$> 1,6$ $\leq 2,0$	$> 2,0$ $\leq 2,5$	$> 2,5$ $\leq 3,0$	$> 3,0$ $\leq 4,0$	$> 4,0$ $\leq 5,0$
$600 \leq 1200$	$\pm 0,05$	$\pm 0,06$	$\pm 0,08$	$\pm 0,09$	$\pm 0,10$	$\pm 0,12$	$\pm 0,18$	$\pm 0,19$	$\pm 0,21$	$\pm 0,23$	$\pm 0,25$
$> 1200 \leq 1500$	$\pm 0,06$	$\pm 0,07$	$\pm 0,09$	$\pm 0,10$	$\pm 0,11$	$\pm 0,13$	$\pm 0,20$	$\pm 0,22$	$\pm 0,23$	$\pm 0,25$	$\pm 0,27$
$> 1500 \leq 1800$	—	$\pm 0,09$	$\pm 0,10$	$\pm 0,11$	$\pm 0,13$	$\pm 0,15$	$\pm 0,22$	$\pm 0,24$	$\pm 0,25$	$\pm 0,27$	$\pm 0,29$

NOTES

1 Thickness is measured at any point on the sheet not less than 25 mm from a side edge.

2 Upon agreement, the thickness tolerances may be specified "all plus", in which case the tolerances shown shall be doubled.