INTERNATIONAL STANDARD

ISO 14788

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Continuous hot-dip zinc-5 %aluminium alloy coated steel sheets and coils

Tôles et bobines en acier revêtues à chaud en continu d'alliage zinc-aluminium 5 %

Reference number
ISO 14788:1998(E)

Foreword

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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 14788 was prepared by Technical Committee ISO/TC 17, *Steels*, Subcommittee SC 12, *Continuous mill flat rolled products*.

Annex A of this International Standard is for information only.

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Continuous hot-dip zinc-5 %/aluminium alloy coated steel sheets and coils

1 Scope

1.1 This International Standard specifies the characteristics of various steel sheet qualities coated by a continuous hot dip zinc-5 % aluminium alloy coating process. The product is intended for applications requiring corrosion resistance, formability and paintability.

1.2 The product is produced in tow types:

Type I: zinc-5 % aluminium-mischmetal alloy coating, and

Type II: zinc-5 % aluminium-0,1 % magnesium alloy coating.

NOTE — There may be differences in product characteristics between Type I and Type II coated steel sheet, depending on the intended application.

1.3 Zinc-5 % aluminium alloy 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. Zinc-5 % aluminium alloy coated steel sheet less than 600 mm wide may be slit from wide sheet and will be considered as sheet.

1.4 Zinc-5 % aluminium alloy coated steel sheet is available in various coating designations and masses according to table 2.

1.5 Zinc-5 % aluminium alloy coated steel sheet is available in several fabrication qualities.

1.5.1 Commercial quality: intended for general fabrication purposes where sheet is used in the flat or for bending or moderate forming.

1.5.2 Lock-forming quality: intended for lock-seaming and other similar applications and has better formability than commercial quality.

1.5.3 Drawing quality: intended for fabricating parts where drawing or severe forming may be involved.

1.5.4 Drawing quality aluminium killed (non-ageing): intended for fabricating parts where particularly severe drawing or forming may be involved or essential freedom from ageing is required.

1.5.5 Extra deep drawing (stabilized interstitial free): intended for application requiring (IF) interstitial free steel; non-ageing, maximum formability.

1.6 Structural quality: zinc-5 % aluminium alloy coated steel sheet is produced in six grades as defined by a minimum yield stress according to table 4.

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

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:—[1)], *Metallic materials — Tensile testing at ambient temperature.*

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 zinc-5 % aluminium coating line to produce either coated coils or cut lengths

3.2 Conditions of zinc-5 %/aluminium alloy 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 negotiation between the supplier and consumer to establish specific surface requirements.

4 Designations

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

4.1 General

The letters ZA are used to indicate a zinc-5 % aluminium alloy coating. T1 and T2 are used to indicate Type I and Type II coatings respectively.

4.2 Coating mass

The coating mass designations are 001, 080, 090, 095, 100, 120, 130, 135, 140, 150, 160, 180, 185, 200, 225, 250, 255, 275, 300, 350, 450, 600, 700 according to table 2.

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

1) To be published. (Revision of ISO 6892:1984).

4.3 Coating condition

The condition of coating is designated as

— N normal spangle coating (as coated);

— S smooth finish: 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

— 03 Drawing quality

— 04 Drawing quality aluminium killed (non-ageing)

— 05 Extra deep drawing (stabilized interstitial free)

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

4.6 Complete designation

An example is ZAT1 160NC02. This designation is obtained by combining the following components:

— ZA: Zinc-5 %/aluminium alloy coating, type 1;

— 160: 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 ZAT2 150SB350. This designation is obtained by combining the following components:

— ZA: Zinc-5 %/aluminium alloy coating, type 2;

— 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 temporarily minimize 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

Zinc-5 %/aluminium alloy 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 zinc-5 %/aluminium alloy 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 zinc-5 %/aluminium alloy 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-5 % aluminium alloy 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 zinc-5 % aluminium alloy 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 white rust on this type of product). For these reasons, the purchaser is advised to consider specifying the zinc-5 %/aluminium alloy 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 zinc-5 %/aluminium alloy 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 table 1.

Table 1 — Chemical composition of the steel

Element	Base metal quality			
	Drawing quality drawing quality aluminium killed % (*m*/*m*)	Commercial quality lock-forming quality % (*m*/*m*)	Extra deep drawing (stabilized interstitial free) % (*m*/*m*)	Structural quality % (*m*/*m*)
C max.	0,10	0,15	0,02	0,40
P max.	0,025	0,035	0,02	0,20
S max.	0,035	0,04	0,02	0,04
Mn max.	0,50	0,60	0,25	1,70
Ti max.	—	—	0,30	—

NOTES

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

2 Titanium may be replaced totally or partially by Niobium or Vanadium, Carbon and Nitrogen shall be completely stabilized.

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 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 2 for the specified coating designation. The coating mass is the total amount of the zinc-5 %/aluminium alloy, including both sides of the sheet, expressed in grams per square meter (g/m^2) of sheet. Methods of checking that the material complies with this International Standard are given in 8.2.1 and in 9.2.1 to 9.2.3.

The coating mass in grams per square meter refers to the total coating on both surfaces. Because of the many variables and changing conditions that are characteristics 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.

Table 2 — Coating mass test limits for zinc-5 % aluminium alloy coated steel sheet

Coating designation	Triple-spot test, total both sides min. g/m	Single-spot test, total both sides min. g/m
ZA001	no minimum	no minimum
ZA080	80	70
ZA090	90	75
ZA095	95	80
ZA100	100	85
ZA120	120	100
ZA130	130	110
ZA135	135	115
ZA140	140	120
ZA150	150	130
ZA160	160	135
ZA180	180	155
ZA185	185	155
ZA200	200	170
ZA225	225	190
ZA250	250	210
ZA255	255	215
ZA275	275	235
ZA300	300	255
ZA350	350	300
ZA450	450	385
ZA600	600	510
ZA700	700	595

NOTE — Not all coating designations may be available from all producers.

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

It is desirable that the zinc-5 %/aluminium alloy coated steel sheet be identified for fabrication by the name of the part or by the intended application. Zinc-5 %/aluminium alloy coated steel sheet of drawing qualities (03, 04 and 05) may be produced to make an identified part to a performance criterion or within a properly established breakage allowance, which shall be previously agreed upon between the interested parties. In these cases, the part name, the details of fabrication, and special requirements (such as freedom from stretcher strain or fluting) shall be specified and the mechanical properties in table 3 do not apply.

6.7 Mechanical properties

See tables 3 and 4.

Except when ordered according to an identified part as explained in 6.6, at the time that the steel is made available for shipment, the mechanical properties for designations 03, 04 and 05 shall be as stated in table 3 when they are determined on test pieces obtained in accordance with requirements of 8.1.

NOTE — Prolonged storage of the sheet can cause a change in mechanical properties (increase in hardness and decrease in elongation), leading to a decrease in drawability. To minimize this effect, quality 04 or 05 should be specified.

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

7.1 Dimensional tolerances applicable to zinc-5 %/aluminium alloy coated steel sheet shall be as given in tables 5 to 15. The thickness is the total of the base metal and the coating.

7.2 Restricted thickness tolerances are given in table 7.

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

See figure 1.

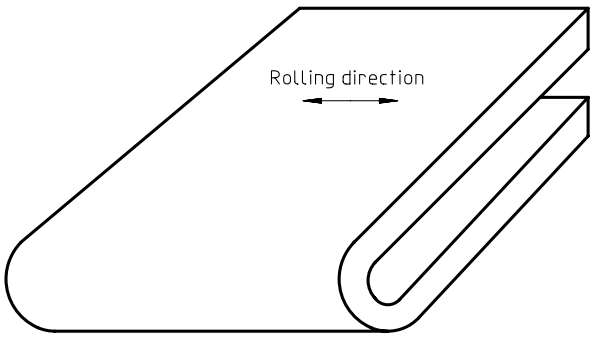

Figure 1 — Transverse bend test piece (after bending)

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 mm.

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. Transverse 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.

9.2 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 2.

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 g/m total both sides $\triangleq$ 0,027 mm total both sides

9.2.3.2 Coating mass is determined by converting coating thickness measurements made with magnetic gauges (see ISO 2178) or by X-ray spectrometry (see 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, lock-forming, drawing, drawing aluminium killed and extra deep drawing (stabilized interstitial free) 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 zinc-5 %/aluminium alloy 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 the 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 zinc-5 %/aluminium alloy coated steel sheet is ordered in coils, a minimum or range of acceptable inside diameter (ID) shall be specified. In addition, the maximum outside diameter (OD) 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) reference to this International Standard, i.e. ISO 14788;

c) the designation (coating, type, coating mass, coating condition, surface treatment and quality or grade or 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) reference to this International Standard, i.e. ISO 14788;

b) the name and designation of the material, i.e. the letters, coating mass designation, coating type, surface treatment, base metal quality.

EXAMPLE

Zinc-5 %/aluminium alloy, type 1 coated steel sheet, commercial quality, normal spangle, passivated and oiled, ZAT2 160NC01B (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 heat 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);

k) restricted thickness tolerances, if required (see 7.2).

NOTE — A typical ordering description is as follows:

International Standard ISO, zinc-5 %/aluminium alloy, Type I, coated steel sheet, commercial quality, designation ZATI 160C01, normal thickness tolerance, 1,0 mm × 1 200 mm × coil, 20 000 kg, exhaust pipe tubing, # 6201.

Table 3 — Mechanical properties and coating bend test (see 6.7)

Base metal quality [1]		R_e [2] max.	R_m [3] max.	A min. [4] %				Coating 180° bend mandral diameter	
Designation	Name	N/mm² [5]	N/mm² [5]	L_o = 50 mm	L_o = 80 mm	$L_o = 5{,}65\sqrt{S_o}$ [6]		$e < 3$ mm	$e \geqslant 3$ mm
01	Commercial	—	—	—	—	—	—	1*a*	2*a*
02	Lock-forming	—	—	—	—	—	—	0 (flat on itself)	1*a*
03	Drawing	300 [2]	430	24	23	22		0 (flat on itself)	0 (flat on itself)
04	Deep drawing aluminium special killed	220	410	29	28	27		0 (flat on itself)	0 (flat on itself)
05	Extra deep drawing (stabilized interstitial free)	200	350	37	36	35		0 (flat on itself)	0 (flat on itself)

R_e yield stress

R_m tensile strength

A percentage elongation after fracture

L_o gauge length of test piece

S_o original cross-sectional area of gauge length

a thickness of bend test piece

e thickness of steel sheet, in millimetres

NOTES

1 Time period for values stated in this table to be applicable:

Designation	Time period
01	—
02	8 days
03	8 days
04	6 months
05	6 months

2 For product produced to performance criteria, para. 6.6, the typical mechanical properties presented here are non-mandatory. They are intended solely to provide the purchaser with as much information as possible to make an intelligent ordering decision. Values outside these ranges are to be expected. The purchaser may negotiate with the supplier if a specific range or a more restrictive range is required for the application.

3 These typical mechanical properties apply to the full range of steel sheet thicknesses. The yield tends to increase and some of the formability aspects tend to decrease as the sheet thickness decreases.

1) All qualities are available with a normal spangle or smooth finish zinc-5 % aluminium alloy coating.

2) The yield values apply to 0,2 % proof stress if the yield point is not pronounced, otherwise to the lower yield point (R_{eL}).

3) Minimum tensile strength for qualities 03, 04 and 05 would normally be expected to be 260 N/mm². All tensile strength values determined to the nearest 10 N/mm².

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

5) 1 N/mm² = 1 MPa.

6) May be used for material over 3 mm thickness.

7) This value applies to skin passed products only.

Table 4 — Mechanical properties and coating bend test of structural-quality steels

Grade	R_{el} [1] min. N/mm^2	R_m min. N/mm^2	A min. [2] % L_o = 50 mm	A min. [2] % L_o = 80 mm	Coated metal 180° bend mandrel diameter mm e < 3	Coated metal 180° bend mandrel diameter mm $e \geqslant 3$
220	220	310	20	18	1*a*	2*a*
250	250	360	18	16	1*a*	2*a*
280	280	380	16	14	2*a*	3*a*
320	320	430	14	12	3*a*	3*a*
350	350	450	12	10	3*a*	—
550 [3]	550	570	—	—	—	—

NOTE — 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 this table 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/mm^2 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.

Table 5 — Normal thickness tolerances for commercial, lock-forming, drawing, drawing aluminium killed and extra deep drawing stabilized interstitial free quality coils and cut lengths

Dimensions and tolerances in millimetres

Specified width	Specified thicknesses [1]										
	⩽ 0,4	**> 0,4 ⩽ 0,6**	**> 0,6 ⩽ 0,8**	**> 0,8 ⩽ 1,0**	**> 1,0 ⩽ 1,2**	**> 1,2 ⩽ 1,6**	**> 1,6 ⩽ 2,0**	**> 2,0 ⩽ 2,5**	**> 2,5 ⩽ 3,0**	**> 3,0 ⩽ 4,0**	**> 4,0 ⩽ 5,0**
600 ⩽ 1 200	0,05	0,06	0,08	0,09	0,10	0,12	0,18	0,19	0,21	0,23	0,25
> 1 200 ⩽ 1 500	0,06	0,07	0,09	0,10	0,11	0,13	0,20	0,22	0,23	0,25	0,27
> 1 500 ⩽ 1 800	—	0,09	0,10	0,11	0,13	0,15	0,22	0,24	0,25	0,27	0,29

NOTES

1 The tolerances listed above are plus and minus (±). Upon agreement, the thickness tolerances may be specified “all plus”, in which case the tolerances shown shall be doubled.

2 Thickness tolerances for sheet in coil form are the same as for sheets supplied in cut lengths, but in cases where welds are present, the tolerances shall be double those given over a length of 15 m in the vicinity of the weld.

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

Table 6 — Normal thickness tolerances for structural-quality coils and cut lengths

Dimensions and tolerances in millimetres

Specified width	Specified thicknesses[1)]										
	0,25 ⩽ 0,4	> 0,4 ⩽ 0,6	> 0,6 ⩽ 0,8	> 0,8 ⩽ 1,0	> 1,0 ⩽ 1,2	> 1,2 ⩽ 1,6	> 1,6 ⩽ 2,0	> 2,0 ⩽ 2,5	> 2,5 ⩽ 3,0	> 3,0 ⩽ 4,0	> 4,0 ⩽ 5,0
600 ⩽ 1 200	0,06	0,07	0,09	0,10	0,11	0,13	0,18	0,19	0,21	0,23	0,25
> 1 200 ⩽ 1 500	0,07	0,08	0,10	0,11	0,12	0,14	0,20	0,22	0,23	0,25	0,27
> 1 500 ⩽ 1 800	—	0,10	0,11	0,12	0,14	0,16	0,22	0,24	0,25	0,27	0,29

NOTES

1 The tolerances listed above are plus and minus (±). Upon agreement, the thickness tolerances may be specified "all plus", in which case the tolerances shown shall be doubled.

2 The tolerances for grades 320 and 350 shall be increased by 10 % for thicknesses of 1,6 mm and over and shall be increased by 20 % for thicknesses less than 1,6 mm.

3 Tolerances for grade 550 shall be as agreed upon between the purchaser and the manufacturer.

4 Thickness tolerances for sheet in coil form are the same as for sheets supplied in cut lengths, but in cases where welds are present, the tolerances shall be double those given over a length of 15 m in the vicinity of the weld.

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

Table 7 — Restricted thickness tolerances for commercial, lock-forming, drawing, drawing aluminium killed, extra deep drawing (stabilized interstitial free) and structural quality coils and cut lengths

Dimensions and tolerances in millimetres

Specified width	Specified thicknesses[1)]									
	> 0,4 ⩽ 0,6	> 0,6 ⩽ 0,8	> 0,8 ⩽ 1,0	> 1,0 ⩽ 1,2	> 1,2 ⩽ 1,6	> 1,6 ⩽ 2,0	> 2,0 ⩽ 2,5	> 2,5 ⩽ 3,0	> 3,0 ⩽ 4,0	> 4,0 ⩽ 5,0
> 800 ⩽ 1 200	0,045	0,050	0,055	0,065	0,080	0,090	0,110	0,120	0,130	0,140
> 1 200 ⩽ 1 500	0,055	0,060	0,070	0,080	0,090	0,100	0,120	0,130	0,140	0,150
> 1 500 ⩽ 1 800	0,060	0,060	0,070	0,080	0,090	0,100	0,120	0,130	0,140	0,150

NOTES

1 The tolerances listed above are plus and minus (±). Upon agreement, the thickness tolerances may be specified "all plus", in which case the tolerances shown shall be doubled.

2 Thickness tolerances for sheet in coil form are the same as for sheets supplied in cut lengths, but in cases where welds are present, the tolerances shall be double those given over a length of 15 m in the vicinity of the weld.

3 The tolerances for grades 320 and 350 shall be increased by 10 % for thicknesses of 1,6 mm and over and shall be increased by 20 % for thicknesses less than 1,6 mm.

4 Tolerances for grade 550 shall be as agreed upon between the purchaser and the manufacturer.

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

Table 8 — Width tolerances of zinc-5 % aluminium alloy coated sheet, not resquared

Dimensions and tolerances in millimetres

Specified width	Tolerance (all plus)
⩽ 1 500	+ 7
> 1 500 ⩽ 1 800	+ 10

Table 9 — Length tolerances for zinc-5 % aluminium alloy coated sheet, not resquared

Specified width mm	Tolerance (all plus)
⩽ 3 000	+ 20 mm
> 3 000 ⩽ 6 000	+ 30 mm
> 6 000	+ 0,5 %

Table 10 — Camber tolerances

Quality of material	Form	Tolerance
Commercial, lock-forming, drawing, drawing aluminium killed and extra deep drawing (stabilized interstitial free)	Cut lengths Coils	0,4 % × length 20 mm in any 5 000 mm length
Structural	Cut lengths Coils	0,5 % × length 25 mm in any 5 000 mm length
NOTE — Camber is the greatest deviation of a side edge from straight line, the measurement being taken on the concave side with straightedge.		

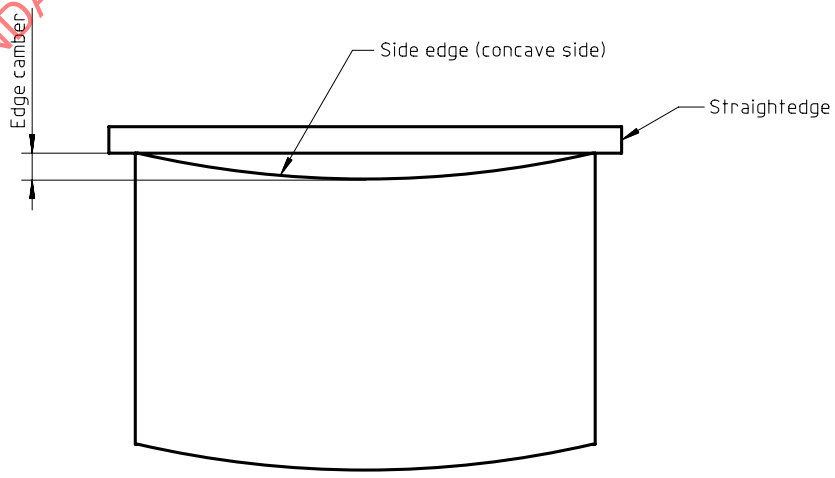

Figure 2 — Measurement of camber

Table 11 — Width and length allowances for stretcher-levelled materials of commercial lock-forming, drawing, drawing aluminium killed and extra deep drawing stabilized interstitial free quality

Dimensions in millimetres

Specified length	Allowances over specified dimensions		
	Width	Length	
		Grip or entry marks outside specified lengths	Grip or entry marks inside specified lengths
⩽ 3 000	19	100	75
> 3 000 ⩽ 4 000	25	100	75
> 4 000	32	125	100

NOTES

1 Allowances for sheet exceeding 5 000 mm in length shall be subject to agreement.

2 When cut lengths are specified to stretcher-levelled standard of flatness, and not resquared, the allowances over specified dimensions in width and length apply. Under these conditions, the allowances for width and length are added by the manufacturer to the specified width and length, and the tolerances given in tables 8 and 9 apply to the new size established. The camber tolerances in table 10 do not apply.

3 When cut lengths do not have grip or entry marks within the specified length, the purchaser should specify “grip or entry marks outside specified length”. When cut lengths may have grip or entry marks within the specified length, the purchaser should specify “grip or entry marks inside specified length”.

Table 12 — Out-of-square tolerance for cut lengths, not resquared, of commercial lock-forming drawing, drawing aluminium killed and extra deep drawing stabilized interstitial free quality

Dimensions	Out-of-square tolerance
All thicknesses and all sizes	1 % × width

Table 13 — Out-of-square width and length tolerances for resquared material of commercial, lock-forming drawing, drawing aluminium killed and extra deep drawing stabilized interstitial free quality

Dimensions in millimetres

Specified length	Specified width	Tolerances
⩽ 3 000	< 1 200	$+^{2}_{0}$
	> 1 200	$+^{3}_{0}$
> 3 000	All widths	$+^{3}_{0}$

NOTES

1 Out-of-square is the greatest deviation of an end edge from a straight line at right angles to a side and touching one corner, the measurement being taken as shown. It can also be measured as one-half the difference between the diagonals of the cut-length sheet.

2 When measuring material ordered to resquared tolerances, consideration may have to be given to extreme, variations in temperature.