
**Hot-rolled and cold-reduced electrolytic
zinc-coated carbon steel sheet of
commercial and drawing qualities**

*Tôles en acier au carbone laminées à chaud et à froid, revêtues par
zingage électrolytique (tôles électro-zinguées) de qualité commerciale
et pour emboutissage*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 5002:2013](https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-e174c5bc871e/iso-5002-2013)

[https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-
e174c5bc871e/iso-5002-2013](https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-e174c5bc871e/iso-5002-2013)



iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 5002:2013](https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-e174c5bc871e/iso-5002-2013)

<https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-e174c5bc871e/iso-5002-2013>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

Contents

	Page
Foreword.....	iv
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Dimensions.....	2
5 Conditions of manufacture.....	2
5.1 Steelmaking.....	2
5.2 Chemical composition.....	2
5.3 Chemical analysis.....	3
5.4 Coating.....	4
5.5 Fabrication qualities.....	5
5.6 Weldability.....	6
5.7 Application.....	6
5.8 Mechanical properties.....	6
5.9 Strain ageing.....	7
5.10 Surface treatment of electrolytic zinc-coated products.....	8
5.11 Oiling.....	8
5.12 Painting.....	8
6 Dimensional and shape tolerances.....	9
7 Sampling.....	9
7.1 Tensile sampling.....	9
7.2 Coating tests.....	9
8 Test methods.....	9
8.1 Tensile test.....	9
8.2 Coating tests.....	9
9 Retests.....	10
10 Resubmission.....	10
11 Workmanship.....	10
12 Inspection and acceptance.....	10
13 Coil size.....	10
14 Marking.....	11
15 Designation.....	11
16 Information to be supplied by the purchaser.....	12
Annex A (normative) Specification of thickness as base metal alone.....	13
Bibliography.....	15

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. www.iso.org/directives

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

iTeh STANDARD PREVIEW

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: http://www.iso.org/iso/home/standards_development/resources_for_technical_work/foreword.htm

<https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-17481d87141c/iso-5002-2013>

This fourth edition cancels and replaces the third edition (ISO 5002:2008), of which it constitutes a minor revision.

Hot-rolled and cold-reduced electrolytic zinc-coated carbon steel sheet of commercial and drawing qualities

1 Scope

This International Standard specifies the characteristics of carbon steel sheet of commercial and drawing qualities in cut length or coil form, zinc coated by electrolytic deposition. Electrolytic zinc-coated sheet is intended for the manufacture of formed or of miscellaneous parts, and can be supplied chemically treated to render it more suitable for painting. The zinc coating is expressed in micrometres of thickness per side, for equally coated, differentially coated, or one-side-coated sheets. These sheets are generally produced with coatings, which are not intended to withstand outdoor exposure without chemical treatment and painting. Electrolytic zinc-coated sheet can be produced in thicknesses of 0,36 mm and thicker (normally up to 4,0 mm) and in widths of 600 mm and over in coils or cut lengths. It is recognized that materials thinner than 0,36 mm or thicker than 4,0 mm can be suitable for electrolytic zinc coating, and, if required, be the subject of agreement between the interested parties.

2 Normative references

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

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7438, *Metallic materials — Bend test* [ISO 5002:2013](https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-174c5bc871e/iso-5002-2013)

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

ISO 16162, *Cold-rolled 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

electrolytic zinc-coated steel sheet

product obtained by electrolytic deposition of a zinc coating on steel sheet on a zinc coating line to produce either electrolytic zinc-coated coils or electrolytic zinc-coated cut lengths

3.2

skin pass

light cold rolling of hot-rolled descaled sheet or of the cold-reduced and annealed steel sheet prior to zinc coating

Note 1 to entry: 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 (Luders 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 will result from skin passing.

3.3

stabilized interstitial free steel

extra low carbon steel in which all interstitial elements are combined with titanium and/or equivalent elements

**3.4
grade substitution**

interstitial free steel (IF steel) may be applied on orders specifying CR4

Note 1 to entry: Deep drawing special killed, provided that the customer is informed of the substitution and related shipping documents reflecting the actual material shipped.

**3.5
lot**

50 t or less of sheet of the same designation rolled to the same thickness and condition

4 Dimensions

4.1 The thickness of zinc-coated sheet can be specified as a combination of the base metal and metallic coating, or as the base metal alone. The purchaser indicates 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 requirement for specifying the thickness as base metal alone.

4.2 Electrolytic zinc-coated sheet less than 600 mm wide can be slit from wide sheet and will be considered as sheet.

5 Conditions of manufacture

STANDARD PREVIEW
(standards.iteh.ai)

5.1 Steelmaking

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

5.2 Chemical composition

The chemical composition (heat analysis) shall not exceed the values given in [Tables 1, 2, and 3](#).

Table 1 — Chemical composition (heat analysis) for hot-rolled electrolytic zinc-coated carbon steel sheet

Mass fractions in percent

Quality		C max.	Mn max.	P max.	S max.
Designation	Name				
HR1	commercial	0,12	0,60	0,045	0,035
HR2	drawing	0,10	0,45	0,035	0,035
HR3	deep drawing	0,08	0,40	0,030	0,030
HR4	deep drawing aluminium killed	0,08	0,35	0,025	0,030

Table 2 — Chemical composition (heat analysis) for cold-rolled electrolytic zinc-coated carbon steel sheet

Mass fractions in percent

Quality		C max.	Mn max.	P max.	S max.	Ti ^a max.
Designation	Name					
CR1	commercial	0,15	0,60	0,050	0,035	—
CR2	drawing ^c	0,10	0,50	0,040	0,035	—
CR3	deep drawing ^c	0,08	0,45	0,030	0,03	—
CR4	deep drawing aluminum killed ^c (non-ageing)	0,06	0,45	0,030	0,03	—
CR5	extra deep drawing ^b (stabilized interstitial free)	0,02	0,25	0,020	0,02	0,15

a Titanium may be replaced totally or partially by niobium or vanadium. Carbon and nitrogen shall be completely stabilized.

b By agreement, the manganese, phosphorus, and sulfur maximums may be adjusted.

c If IF steel is to be applied to CR1 or CR4 orders, the values of 0,15 % maximum Ti and 0,10 % maximum Nb and V are acceptable to ensure that carbon and nitrogen are fully stabilized.

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat of steel shall be made by the manufacturer in order to determine compliance with the requirements given in [Tables 1, 2 and 3](#). On request, at the time of ordering, this analysis shall be reported to the purchaser or his representative. Each of the elements listed in [Tables 1 and 2](#) shall be included in the report of the heat analysis. If one or more of the elements in [Table 3](#) is/are specified, the analysis shall be reported.

5.3.2 Product analysis

A 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. The sampling method and deviation limits shall be agreed upon between the manufacturer and the purchaser at the time of ordering. The product analysis tolerances shall be in accordance with [Table 3](#) and [Table 4](#).

Table 3 — Limits on additional chemical elements

Mass fractions in percent

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

c An analysis greater than 0,008 % may be supplied after agreement between the producer and the consumer.

d For IF steel, only the values of 0,15 % maximum Ti and 0,010 % maximum for Nb and V are acceptable to ensure that carbon and nitrogen are fully stabilized.

Table 4 — Product analysis tolerances
(standards.iteh.ai)

Mass fractions in percent

Element	Maximum of specified element ISO 5002:2013	Tolerance over maximum specified
C	0,15	0,03
Mn	0,60	0,03
P	0,05	0,01
S	0,035	0,01
Ti	0,15	0,01

NOTE The maximum tolerance in this table is the allowable excess over the specified requirements and not the heat analysis.

5.4 Coating

5.4.1 Coating mass

The amount of coating is expressed in micrometres of thickness per surface of sheet and shall conform to the requirements of minimum thickness given in [Table 5](#).

5.4.2 Coating adherence

The zinc-coated sheet shall be capable of being bent in any direction, in accordance with the mandrel diameter requirements for the quality designations included in [Table 6](#).

Table 5 — Zinc coatings for electrolytic zinc-coated hot-rolled and cold-reduced steel sheet

Coating designation ^a	Nominal thickness per surface μm	Minimum thickness per surface μm	Nominal coating mass per surface ^b g/m^2
ZE 04	0,4	0,4	3
ZE 10	1,0	0,9	7
ZE 14	1,4	1,2	10
ZE 25	2,5	2,2	18
ZE 28	2,8	2,4	20
ZE 38	3,8	3,4	27
ZE 42	4,2	3,6	30
ZE 50	5,0	4,5	36
ZE 56	5,6	4,8	40
ZE 70	7,0	6,0	50
ZE 75	7,5	6,8	54
ZE 100	10,1	9,1	75
ZE 135	13,5	12,2	96
ZE 150	15,0	13,5	107

NOTE The density of zinc used is $7\,100\text{ kg}/\text{m}^3$.

a Equally coated material should be designated as ZE 10/10, for example. Differentially coated material should be designated as ZE 50/10, for example. Single-surface-coated material should be designated as ZE 38/0, for example.

b This is for information only.

ISO 5002:2013

Table 6 — Coating bend test requirements for electrolytic zinc-coated hot-rolled and cold-reduced steel sheet

Designation	180° bend mandrel diameter	
	$e < 3$	$e \geq 3$
HR1, HR2, HR3, HR4	0	$1,0a$
CR1, CR2, CR3, CR4, CR5	0	0

NOTE 1 e is the thickness of the sheet in millimetres.
NOTE 2 a is the thickness of bend test piece.

5.5 Fabrication qualities

5.5.1 Commercial quality electrolytic zinc-coated sheet (HR1 or CR1) is intended for general fabricating purposes where sheet is used in the flat state or for bending or moderate forming.

5.5.2 Drawing quality electrolytic zinc-coated sheet (HR2, HR3, and HR4 or CR2, CR3, CR4, and CR5) is intended for drawing or severe forming. It is furnished according to all requirements of this International Standard or by agreement when ordered to fabricate an identified part, in which case the mechanical properties of [Table 4](#) (for hot-rolled steel sheet) and [Table 5](#) (for cold-reduced steel sheet) do not apply.

Drawing qualities are identified as follows:

- HR2/CR2 (drawing quality);
- HR3/CR3 (deep drawing quality);
- HR4/CR4 [deep drawing quality aluminium killed (see [5.9](#))];

— CR5 [extra deep drawing quality (stabilized interstitial free)].

5.6 Weldability

The product is suitable for welding if appropriate conditions are selected.

5.7 Application

It is desirable that electrolytic zinc-coated steel sheet be identified for fabrication by the name of the part or by the intended application. Steel sheet of drawing qualities HR2, HR3, and HR4 and CR2, CR3, CR4, and CR5 may be produced to make an identified part within a properly established breakage allowance, which shall be previously agreed upon between the interested parties. In this case, the part name, the details of fabrication, and special requirements (i.e. exposed or unexposed, freedom from stretcher strains or fluting, and coating performance requirements) shall be specified, and the mechanical properties of Table 7 or 8 do not apply.

5.8 Mechanical properties

Except when ordered according to an identified part as explained in 5.6, at the time that the steel is made available for shipment, the mechanical properties shall be as stated in Table 7 or 8 when they are determined on test pieces obtained according to the requirements of Clause 7. Prolonged storage of the sheet can cause a change in mechanical properties, leading to a decrease in drawability. To minimize this effect, quality CR4 or CR5 should be specified. The properties in Table 8 are after skin passing.

Table 7 — Mechanical property requirements for hot-rolled electrolytic zinc-coated carbon steel sheet

Base metal quality		R _m ^a max. MPa	Material thickness mm ^b			
Designation	Name		e < 3		3 ≤ e ≤ 6	
			L ₀ = 80 mm	L ₀ = 50 mm	L ₀ = 5,65√S ₀	L ₀ = 50 mm
HR1	commercial	440	23	24	28	29
HR2	drawing	420	25	26	30	31
HR3	deep drawing	400	28	29	33	34
HR4	deep drawing aluminium killed	380	31	32	36	37

R_m tensile strength

A percent elongation after fracture

L₀ gauge length of original test piece

S₀ original cross-sectional area of gauge length

e thickness of steel sheet in millimetres

1 MPa = 1 N/mm²

a The minimum tensile strength for quality HR2, HR3, and HR4 would normally be expected to be 270 N/mm². All tensile strength values are determined to the nearest 10 MPa.

b The non-proportional test piece with a fixed gauge length (50 mm), up to 6-mm-thick sheet, can be used in conjunction with a conversion table. In case of dispute, however, only the results obtained on a proportional test piece will be valid for material 3 mm and over in thickness.

Table 8 — Mechanical property requirements^a for cold-reduced electrolytic zinc-coated carbon steel sheet

Quality		R_e^a max. MPa	R_m max. MPa	A^b min. %		$\bar{r}^{c,d,e,g}$	$\bar{n}^{c,d,f,g}$
Designation	Name			$L_o = 80$ mm	$L_o = 50$ mm		
CR1	commercial ^h	280	410	27 (<0,6 mm) 28 (≥0,6 mm)	28	—	—
CR2	drawing	240	370	33 (<0,6 mm) 34 (≥0,6 mm)	31	—	—
CR3	deep drawing	220	350	35 (<0,6 mm) 36 (≥0,6 mm)	35	1,3 min.	0,16 min.
CR4	deep drawing aluminium killed (non-ageing)	210	350	37 (<0,6 mm) 38 (≥0,6 mm)	37	1,4 min.	0,19 min.
CR5	extra deep drawing (stabilized interstitial free)	190	350	39 (<0,6 mm) 40 (≥0,6 mm)	38	1,7 min.	0,22 min.

R_e yield strength

R_m tensile strength

A percent elongation after fracture

L_o gauge length of original test piece

r plastic strain ratio <https://standards.iteh.ai/catalog/standards/sist/c7116cde-8f73-4c11-b6c1-e174c5bc871e/iso-5002-2013>

n tensile strain hardening exponent

1 MPa = 1N/mm²

a The minimum tensile strength for qualities CR2, CR3, and CR4 would normally be expected to be 270 MPa. All tensile strength values are determined to the nearest 10 MPa. For designing purposes, the lower limit for R_e may be assumed to be 140 MPa for grades CR1, CR2, CR3, and CR4, and 120 MPa for grade CR5.

b For material up to and including 0,6 mm in thickness, the elongation values in this table shall be reduced by 1.

c r and n values are only applicable to thicknesses ≥ 0,5 mm. For thicknesses >2,0 mm, the r value is reduced by 0,2.

d r can also be written as \bar{r} and n can also be written as \bar{n} .

e r is an index of the drawability of the product.

f n is an index of the stretchability of the product.

g For grades CR3, CR4, and CR5, \bar{r} and \bar{n} values may be modified or excluded from this specification by the agreement between the producer and the purchaser.

h Mechanical properties are not generally done on commercial quality products and the values in this table are for information only.

5.9 Strain ageing

Electrolytic zinc-coated steel sheet (except CR4 and CR5) tends to strain age and this may lead to the following:

- surface marking from stretcher strains or fluting when the steel is formed;
- deterioration in ductility.

Cold-reduced electrolytic zinc-coated carbon steel sheet of quality CR4 supplied in the skin-passed condition may be subject to strain ageing under certain conditions.