
**Cold-reduced tinmill products —
Electrolytic tinplate**

Aciers pour emballage laminés à froid — Fer blanc électrolytique

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Contents

	Page
Foreword.....	v
Introduction.....	vi
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 General technical delivery condition.....	4
5 Classification.....	4
6 Information to be supplied by the purchaser.....	4
6.1 Designation.....	4
6.2 Mandatory information.....	5
6.3 Options.....	5
7 Manufacturing features.....	6
7.1 Manufacture.....	6
7.2 Annealing.....	6
7.3 Finish.....	6
7.4 Passivation and oiling.....	7
7.5 Imperfections.....	7
7.5.1 Coils.....	7
7.5.2 Sheets.....	7
8 Tin coating mass.....	8
9 Mechanical properties.....	8
9.1 General.....	8
9.2 Hardness requirement.....	8
9.3 Tensile property requirement.....	8
10 Tolerances on dimensions and shape.....	9
10.1 General.....	9
10.2 Thickness and feather edge.....	9
10.2.1 Thickness.....	9
10.2.2 Feather edge.....	9
10.3 Width.....	9
10.4 Length.....	9
10.4.1 Length of coil.....	9
10.4.2 Length of sheet.....	9
10.5 Edge camber.....	9
10.6 Out-of-squareness of sheet.....	10
10.7 Flatness.....	11
10.7.1 Edge wave.....	11
10.7.2 Longitudinal and transverse bow.....	11
10.7.3 Centre fullness.....	11
11 Joint within a coil.....	12
11.1 General.....	12
11.2 Number of joint.....	12
11.3 Location of joint.....	12
11.4 Dimension of joint.....	12
11.4.1 Thickness.....	12
11.4.2 Overlap.....	12
12 Marking of differentially coated cold-reduced tinplate.....	12
12.1 General.....	12
12.2 Marking on heavily coated surface.....	13

12.3	Marking on lightly coated surface	13
12.4	Marking designation	13
13	Sampling	13
14	Test method	13
14.1	Tin coating mass	13
14.1.1	Test piece	13
14.1.2	Method of determination	14
14.2	Hardness test	14
14.2.1	Test piece	14
14.2.2	Test method	15
14.3	Tensile test	15
14.3.1	Test piece	15
14.3.2	Test method	15
14.4	Flatness test	15
14.4.1	General	15
14.4.2	Edge wave	15
14.4.3	Longitudinal or transverse bow	16
14.4.4	Centre fullness	16
15	Retests	18
16	Inspection document	18
17	Dispatch and packaging	18
17.1	Coils	18
17.2	Sheets	19
17.3	Labelling	19
Annex A	(normative) Hardness requirements for tinplate	20
Annex B	(normative) Tensile property requirements for tinplate	21
Annex C	(informative) Steel types	23
Annex D	(informative) Springback test for routine determination of proof strength for tinplate	24
Annex E	(informative) Alternative marking system for differentially coated tinplate	25
Annex F	(normative) Referee method for determining tin coating mass	27
Annex G	(normative) Rockwell HR15Tm values and their HR30Tm equivalents	34
Bibliography	35

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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 (see 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.

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: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 9, *Tinplate and blackplate*.

This second edition ~~replaces the first edition (ISO 11949:1995)~~, which has been technically revised.

Introduction

Selling of packaging steels is today a worldwide business. Therefore, revision of this International Standard was expected earlier since the last edition dated from 1995. Because of the long period between revisions, harmonization became difficult. In some regions, the properties of the packaging steels are determined by the hardness test whereas in other regions, a decade ago, the hardness test was replaced by the tensile test. Since the latest available techniques should be reflected in this International Standard, the possibility of using the tensile test as the reference test for determining the mechanical properties should be considered during the next revision of this International Standard.

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Cold-reduced tinmill products — Electrolytic tinplate

1 Scope

This International Standard specifies requirements for single and double cold-reduced low-carbon mild steel electrolytic tinplate in the form of sheets or coils.

Single cold-reduced tinplate is generally specified in nominal thicknesses that are multiples of 0,005 mm, from 0,150 mm up to and including 0,600 mm. Double cold-reduced tinplate is generally specified in nominal thicknesses that are multiples of 0,005 mm, from 0,100 mm up to and including 0,360 mm.

This International Standard applies to coils and sheets cut from coils in nominal minimum rolling widths of 600 mm.¹⁾

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 404, *Steel and steel products — General technical delivery requirements*

ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO 6892-1:—²⁾, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 10474, *Steel and steel products — Inspection documents*

3 Terms and definitions

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

3.1

blackplate

cold-reduced low-carbon mild steel, applied for manufacturing electrolytic tinplate

Note 1 to entry: See ISO 11951.^[1]

3.2

electrolytic tinplate

cold-reduced low-carbon steel sheet or coil coated on both surfaces with tin that is applied in a continuous electrolytic operation

3.3

differentially coated electrolytic tinplate

cold-reduced electrolytic tinplate, one surface of which carries a heavier tin coating than the other

1) Nominal minimum rolling widths of 500 mm may be applied by agreement between the purchaser and the manufacturer.

2) To be published (Revision of ISO 6892-1:2009)

**3.4
single cold-reduced**

description of product in which the blackplate has been reduced to the desired thickness in a cold-reduction mill and subsequently annealed and temper rolled

**3.5
double cold-reduced**

description of product in which the blackplate has had a second major reduction after annealing

**3.6
standard grade tinplate sheet**

product in sheet form which is confirmed to be suitable, under normal conditions of storage, for established lacquering and printing over the entire sheet and is

- a) free from surface imperfections which render the material unsuitable for the intended use and
- b) free from damage which render the material unsuitable for the intended use

Note 1 to entry: The standard material is compliant with the requirements as specified in this International Standard.

**3.7
batch annealed
box annealed**

BA
annealed by the process in which the cold-reduced strip is annealed in coil form, within a protective atmosphere, for a predetermined time-temperature cycle

**3.8
continuously annealed**

CA
annealed by the process in which cold-reduced coils are unwound and annealed in strip form within a protective atmosphere

**3.9
finish**

surface appearance of tinplate, determined by the surface roughness, R_a , of the steel base together with the conditioning of the tin coating which can be either flow-melted or unflow-melted

**3.9.1
smooth finish**

finish of blackplate resulting from the use of temper-mill work rolls that have been ground to a low roughness

Note 1 to entry: This finish is used for the production of bright finish tinplate.

**3.9.2
bright finish**

finish on flow-melted tinplate using the smooth finish blackplate

**3.9.3
stone finish**

finish on flow-melted tinplate characterized by a directional pattern, resulting from the use of final-mill work rolls that have been ground to a higher level of roughness than those used for the smooth finish

**3.9.4
silver finish**

finish resulting from the use of temper-mill work rolls with dull surface textured by shot blast, electro discharge texturing (EDT), electron beam texturing (EBT) or another suitable method, together with a flow-melted tin coating

3.9.5**matt finish**

finish resulting from the use of temper-mill work rolls with dull surface textured by shot blast, electro discharge texturing (EDT), electron beam texturing (EBT) or another suitable method, together with an unflow-melted tin coating

3.10**coil**

rolled flat strip product which is wound into regularly superimposed laps so as to form a coil with almost flat sides

3.11**longitudinal bow****line bow**

residual curvature in the strip remaining along the direction of rolling

3.12**transverse bow****cross bow**

mode of curvature in the sheet such that the distance between its edges parallel to the direction of rolling is less than the sheet width

3.13**centre fullness****centre buckle****full centre**

intermittent vertical displacement or wave in the strip occurring other than at the edges

Note 1 to entry: See [Figure 8](#).

3.14**edge wave**

intermittent vertical displacement occurring at the strip edge when the strip is laid on a flat surface

3.15**feather edge****transverse thickness profile**

variation in thickness, characterized by a reduction in thickness close to the edges, at right angles to the direction of rolling

3.16**edge camber**

deviation of edge of coil/sheet from a straight line forming its chord

3.17**burr**

metal displaced beyond the plane of the surface of the strip by shearing action

3.18**rolling width**

width of the rolled strip perpendicular to the direction of rolling

3.19**pallet**

base platform on which a coil is placed to facilitate ready transportation

3.20**stillage platform**

base platform on which sheets are stacked to facilitate packing and ready transportation

3.21

consignment

quantity of material of the same specification made available for dispatch at the same time

3.22

bulk package

bulk

packaging unit comprising a stillage platform, the sheets and packaging material

3.23

line inspection

final inspection of the finished product performed by instruments and/or visual examination at normal production-line speeds

3.24

anvil effect

effect that a hard anvil can produce on the numerical hardness value obtained when a hardness test is performed on very thin sheet supported on such an anvil

4 General technical delivery condition

In cases where the technical delivery condition is not specified in this International Standard, then ISO 404 shall apply.

5 Classification

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Steel grades for this International Standard are generally classified as non-alloy quality steels.

6 Information to be supplied by the purchaser

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6.1 Designation

For the purposes of this International Standard, tinplate is designated in terms of a steel grade classification based either on the Rockwell HR30Tm hardness values or on the tensile properties. For the hardness requirements, the steel grade designations are given in [Table A.1](#) for single cold-reduced tinplate and in [Table A.2](#) for double cold-reduced tinplate. For the tensile properties requirements, the steel grade designations are given in [Table B.1](#).

Tinplate covered by this International Standard shall be designated by the following characteristics in the given sequence:

- a) a reference to this International Standard, i.e. ISO 11949;
- b) the steel grade designation in accordance with [Table A.1](#), [Table A.2](#) or [Table B.1](#);
- c) the type of annealing used by the manufacturer (see [7.2](#));
- d) the type of finish (see [7.3](#));
- e) the coating masses and their combinations, D or S(for differentially coated), together with numbers representing the nominal coating mass on top/bottom surface (see [Clause 12](#));
- f) the dimensions, in millimetres:
 - for coils, thickness × width;
 - for sheets, thickness × width × length.

By agreement, the symbol “× C” after width may be designated for coils.

By agreement, the symbol “w” may be designated after the number for the width to indicate that the number is the dimension perpendicular to the direction of rolling.

EXAMPLE

Single cold-reduced tinplate sheet, in accordance with this International Standard, steel grade T61, continuously annealed (CA), stone finish, equally coated with a coating mass of 2,8 g/m², with a thickness of 0,220 mm, a width of 800 mm and a length of 900 mm shall be designated:

ISO 11949 - T61 CA - stone - 2,8/2,8 - 0,220 × 800 × 900

Double cold-reduced tinplate coil, in accordance with this International Standard, steel grade T75, continuously annealed (CA), stone finish, differentially coated with coating masses of 8,4 g/m² and 5,6 g/m², with marking on 5,6 g/m² side, with a thickness of 0,180 mm and a width of 750 mm shall be designated:

ISO 11949 - T75 CA - stone - 8,4/D5,6 - 0,180 × 750

Tinplate coil, in accordance with this International Standard, steel grade TH415, continuously annealed (CA), stone finish (ST), differentially coated with a coating mass of 2,8 g/m² and 5,6 g/m², with marking on 5,6 g/m² side, with a thickness of 0,200 mm, a width of 750 mm shall be designated:

ISO 11949 - TH415 CA - ST - 2,8/D5,6 - 0,200 × 750 × C

Tinplate sheet, in accordance with this International Standard, steel grade TS520, batch annealed (BA), stone finish, differentially coated with coating masses of 5,6 g/m² and 8,4 g/m², with single line marked on 5,6 g/m² side, with a thickness of 0,140 mm, a dimension perpendicular to the direction of rolling of 844 mm and a length of 755 mm shall be designated:

ISO 11949 - TS520 BA - stone - 5,6/8,4 - 0,140 × 844w × 755

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6.2 Mandatory information

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The following information shall be given in the enquiry and order to assist the manufacturer in supplying the correct material:

- a) the designation as given in [6.1](#);
- b) the quantity, expressed on an area or mass basis, e.g. 50 tons of sheets, 100 tons of coils;
- c) marking requirements for differentially coated tinplate (see [Clause 12](#));
- d) the minimum and the maximum coil weight, the minimum and the maximum coil outer diameter, the coil internal diameter, the core vertical or horizontal and the direction of winding (see [17.1](#));
- e) the maximum weight of bulk package;
- f) other inspection document than that specified by the manufacturer (see [Clause 16](#));
- g) end use;
- h) any further special requirements.

NOTE Appropriate steel grade is suitable for shaping operations such as stamping, drawing, folding, beading and bending, and assembly work such as joint forming, soldering and welding. The end use is important when the steel grade is selected.

6.3 Options

In addition to the information in [6.2](#), the purchaser may wish to provide additional information to the manufacturer to ensure that the order requirements are consistent with the end use of the product.

The purchaser shall inform the manufacturer of any modifications to his/her fabrication operations that will significantly affect the way in which the tinplate is used.

NOTE When ordering double cold-reduced tinplate, the purpose of manufacture for which the material is intended is generally stated. It is noted that double cold-reduced tinplate is relatively less ductile than single cold-reduced tinplate and has very distinct directional properties, so for some uses, for example for built-up can bodies, the direction of rolling is usually stated. When double cold-reduced tinplate is used for built-up can bodies, the direction of rolling is around the circumference of the can so as to minimize the hazard of flange cracking.

7 Manufacturing features

7.1 Manufacture

Continuously cast, fully-killed steel is applied except when otherwise specified. The examples of the steel types of tinplate are shown in [Annex C](#).

The steel type of tinplate shall be designed to secure food safety when tinplate is used for food application. The purchasers should be aware of existing national regulations which may impose limitations on some elements.

The purity of tin used to produce the coating shall be not less than 99,85 %(mass fraction).

The manufacturing method of tinplate is left to the discretion of the manufacturer and is not specified in this International Standard.

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7.2 Annealing

Annealing of tinplate shall be either batch annealing (BA) or continuous annealing(CA) and shall be specified by the purchaser at the time of enquiry and order.

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7.3 Finish

Tinplate is usually available in the finishes as indicated in [Table 1](#). The type of finish is designated either by the tinplate finish or the code shown in [Table 1](#).

Table 1 — Typical finishes for tinplate

Tinplate finish	Code ^a	Blackplate		Flow-melt-ed
		Finish	Surface roughness ^{bc} <i>Ra</i> µm	
Bright	BT	Smooth	≤0,35	Yes
Fine stone	FS	Fine stone	0,25 – 0,45	Yes
Stone	ST	Stone	0,35 – 0,60	Yes
Silver	AM	Matt	≥0,90	Yes
Matt	MM	Matt		No

^a By agreement between the purchaser and the manufacturer, another code system may be applied.
^b Values of surface roughness in this table are not mandatory. The values are given for reference in order to classify the finishes.
^c The measurement of surface roughness is in accordance with ISO 4288.

NOTE 1 The appearance is governed by the following:

- a) the surface characteristics of the blackplate principally result from controlled preparation of the work rolls used during the final stages of temper rolling;

- b) the mass of the coating applied;
- c) whether the tin layer is flow-melted or unflow-melted.

NOTE 2 Double cold-reduced tinplate is usually supplied with a stone finish and a flow-melted tin coating.

7.4 Passivation and oiling

The surface of electrolytic tinplate is normally subjected to a passivation treatment and to oiling. Passivation, produced either by a chemical or an electrochemical treatment, gives a surface with an improved resistance to oxidation and improved suitability for lacquering and printing. Unless otherwise agreed at the time of ordering, the usual passivation procedure is a cathodic treatment in an acidic chromate solution. The typical range of this passivation is generally up to 10 mg/m² for each side.

Under normal conditions of transport and storage, electrolytic tinplate shall be suitable for surface treatments such as established lacquering and printing operations.

Tinplate coils and sheets are supplied with an oil coating. The oil shall be one that is recognized (i.e. by the relevant national or international authority) as being suitable for food packaging. Unless otherwise agreed at the time of ordering, the kind of oil is at the discretion of the manufacturer.

NOTE 1 For the oil, dioctyl sebacate (DOS) is usually used.

NOTE 2 For measuring chromium of passivation film, the diphenylcarbazide method or the X-ray fluorescence spectrometric method is usually applied. When the X-ray method is applied, it is necessary to consider the influence of chromium in base metal.

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7.5 Imperfections (standards.iteh.ai)

7.5.1 Coils

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The manufacturer is expected to employ his/her normal quality control and line inspection procedures to ensure that the tinplate manufactured is in accordance with the requirements of this International Standard.

However, the production of tinplate coils in continuous-strip mill operations does not afford the opportunity for removal of all tinplate that do not comply with the requirements of this International Standard.

At the time of shearing, sheets not conforming to the standard grade shall be set aside by the purchaser or his/her agent.

The quantity of sheets complying with this International Standard shall be at least 90 % of any one coil.

List items a) and b) in 3.6 cannot be verified by specific tests. Accordingly, those items are recommended to be the subject of a special agreement between the purchaser and the manufacturer.

In processing tinplate coil, when the purchaser (or his/her agent) encounters recurring imperfections which in his/her opinion seem excessive, it is essential, where practicable, that he/she stops processing the coil and advises the manufacturer.

The purchaser is expected to have adequate handling, roller levelling and shearing equipment and inspection facilities to segregate the sheets not conforming to the standard grade, and to take reasonable care during these operations.

7.5.2 Sheets

Sheets shall not contain any imperfections as defined in 3.6.