
Continuous electrolytic tin-coated cold-reduced carbon steel sheet of commercial and drawing qualities

Tôles en acier au carbone laminées à froid, revêtues en continu d'un dépôt électrolytique d'étain, de qualité commerciale et pour emboutissage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 5950 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This third edition cancels and replaces the second edition (ISO 5950:1991), which has been technically revised.

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Continuous electrolytic tin-coated cold-reduced carbon steel sheet of commercial and drawing qualities

1 Scope

1.1 This International Standard applies to cold-reduced carbon steel sheet of commercial and drawing qualities coated in coil form by electro-deposition of tin. The product is commonly known as electrolytic tin-coated sheet and is used where solderability is desired, appearance is important, or a degree of corrosion resistance under specific conditions is advantageous and coating mass may be specified. The coating is expressed as the total coating on both surfaces in grams per square metre. The coating mass specified should be compatible with the desired service life, thickness of the base metal and the forming requirements involved. A designation system (clause 4) includes the coating designation, coating condition and quality.

1.2 Electrolytic tin-coated sheet¹⁾ is normally produced in thicknesses from 0,50 mm to 0,85 mm and widths of 600 mm to 1 050 mm, in coils and cut lengths.

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

1.4 Drawing quality electrolytic tin-coated sheet (qualities 02, 03, 04) is intended for drawing or severe forming. It is furnished according to the requirements of this International Standard or, with agreement where ordered, to fabricate an identified part, in which case mechanical properties do not apply. Drawing qualities are identified as follows:

- 02 drawing quality;
- 03 deep drawing quality;
- 04 deep drawing quality aluminum killed (non-ageing).

1.5 This International Standard does not cover tinplate and blackplate.

2 Normative reference

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

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

1) Some world markets define "electrolytic tinplate" as having a maximum thickness of 0,38 mm in which case the thickness range for 'electrolytic tin-coated sheet' will have a minimum of 0,38 mm.

3 Terms and definitions

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

3.1

electrolytic tin-coated sheet

product obtained by electrolytic deposition of tin on cold-reduced steel sheet on a continuous electrolytic tinning line to produce either tin-coated coils or tin-coated cut lengths

3.2

skin pass

light cold rolling of the cold-reduced and annealed sheet prior to electroplating

NOTE The purposes of skin passing are one or more of the following:

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

An increase in hardness and some loss in ductility will result from skin passing.

3.3

aluminium killed

steel which has been deoxidized with aluminium sufficient to prevent the evolution of gas during solidification

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4 Designation system

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The as-produced electrolytic tin-coated sheet coatings are designated as SN, as shown in Table 3. The coating mass designation follows the SN and three spaces are allocated for coating mass designation. If only two spaces are required, such as for designation 56, then the 56 is preceded by a "0" to fill computer space and is shown as "056". Since this product is always skin-passed, the section in this designation system usually reserved for S or N will be used to indicate where the tin has been reflowed or whether it is "matt" or not reflowed (see 5.7 and 5.10). Therefore the designations for this tin condition are as follows:

- BR: bright – reflowed, fused, melted
- MA: matt – dull, not reflowed, unmelted

The numbers 01, 02, 03 and 04 are common to other standards indicating the qualities of commercial drawing, deep drawing, and deep drawing aluminum killed.

EXAMPLE SN056BR03 is a complete designation, including coating, coating mass, coating condition and quality signifying:

- SN: tin coating
- 056: coating designation (see Table 3)
- BR: bright (tin has been reflowed)
- 03: deep drawing quality

5 Conditions of manufacture

5.1 Steelmaking

The processes used in making the steel and in electrolytic tin-coated sheet are left to the discretion of the producer. When requested, the purchaser shall be informed of the steelmaking process used.

5.2 Chemical composition

The chemical composition of the steel (heat analysis) would not be expected to exceed the values given in Tables 1 and 2.

Table 1 — Chemical composition (heat analysis)

Quality		C	Mn	P	S
Designation	Name	% max.	% max. ^a	% max. ^a	% max.
01	Commercial	0,15	0,60	0,03	0,035
02	Drawing	0,12	0,50	0,03	0,035
03	Deep drawing	0,10	0,45	0,02	0,03
04	Deep drawing aluminum killed (non-ageing)	0,08	0,45	0,02	0,03

^a Higher maximum required for certain applications subject to agreement.

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Table 2 — Limits on additional chemical elements ^a

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

^a Each of the elements listed in this table shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis may be reported as "< 0,02 %".

^b The sum of copper, nickel, chromium and molybdenum shall not exceed 0,50 % on heat analysis. When one or more of these elements are specified, the sum shall not apply, in which case only the individual limits on the remaining elements shall apply.

^c The sum of chromium and molybdenum shall not exceed 0,16 % on heat analysis. When one or more of these elements are specified, the sum shall not apply, in which case only the individual limits on the remaining elements shall apply.

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

5.3 Chemical analysis

5.3.1 Heat analysis

A heat analysis of each heat of steel shall be made by the manufacturer in order to determine compliance with the requirements of Tables 1 and 2. When requested, at the time of ordering, this analysis shall be reported to the purchaser or to his representative.

5.3.2 Product analysis

A product analysis may be made by the purchaser in order 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 product analysis. For killed steels, the sampling method and deviation limits shall be agreed upon between manufacturer and purchaser at the time of ordering.

5.4 Coating mass

The coating mass shall conform to the requirements presented in Table 3 for the specific coating designation. The coating mass is the total amount of the tin, including both sides of the sheet, expressed in grams per square metre (g/m²) of sheet. Methods checking that the material complies with this International Standard are given in 7.2 and 8.2.

Table 3 — Mass of coating (total both sides)

Coating designation	Nominal coating g/m ²	Minimum coating mass limits	
		Triple spot test check limits g/m ² (of sheet)	Single spot test check limits g/m ² (of sheet)
SN56	5,6	3,7	2,8
SN112	11,2	7,3	5,6
SN168	16,8	11	8,2
SN224	22,4	14,6	11

NOTE Because of the many variables and changing conditions that are characteristic of continuous tin coating, the mass of coating is not always evenly divided between the two surfaces of a tin-coated sheet, neither is the tin coating evenly distributed from edge to edge. However, it can normally be expected that not less than 40 % of the single-spot check limit will be found on either surface.

5.5 Weldability

The product is suitable for welding if appropriate welding conditions are selected; however, because of its excellent solderability, welding is seldom performed.

5.6 Mill passivation

A passivating chemical or electrochemical treatment is applied to the surface of electrolytic tin-coated sheet to stabilize the plate surface characteristics compatible with a specific application.

5.7 Coating condition

The as-produced tin-coated sheet has a dull (matt) appearance (see clause 4 and 5.10). If it is heated to the melting point of tin, the tin reflows and has a bright (fused, melted) appearance. Some iron-tin alloy will also form at the steel surface interface during this heating process.

Normally "matt" finish sheet is produced from cold-reduced sheet having a "shot-blasted" surface, and "bright" finish sheet is produced from cold-reduced sheet having "ground" roll surfaces (see 5.10). All tinning lines have strip thickness limits on bright finish sheet because of melting limitations.

5.8 Application

Tin-coated steel shall be identified for fabrication using the name of the part or intended application. Steel sheet of drawing quality (02, 03 and 04) may be produced to make an identified part, which shall be previously agreed upon between manufacturer and purchaser. In such a case, the part name, the details of fabrication and special requirements (freedom from stretcher strains or fluting, coating performance requirements) shall be specified and the mechanical properties of Table 4 do not apply.

5.9 Mechanical properties

Except when ordering an identified part, as explained in 5.8, at the time that the steel is made available for shipment, the mechanical properties shall be as stated in Table 4 when they are determined on test pieces obtained according to the requirements of 7.1 (mechanical tests). Prolonged storing of the sheet can cause changes in mechanical properties (increase in hardness and decrease in elongation), leading to a decrease in drawability. To minimize this effect, quality 04 should be specified.

Table 4 — Mechanical properties

Quality	Designation	Name	A min. ^b	
			R_m max. ^a N/mm ²	$L_o = 80$ mm
01	Commercial ^c		—	—
02	Drawing		370	30
03	Deep drawing		350	34
04	Deep drawing aluminum killed (non-ageing)		340	36

R_m = tensile strength
 A = percentage elongation after fracture
 L_o = gauge length on test piece
 S_o = initial cross-sectional area of gauge length
 $1 \text{ N/mm}^2 = 1 \text{ MPa}$

^a Minimum tensile strength for qualities 02, 03 and 04 would normally be expected to be 270 N/mm². All tensile strength values are determined to the nearest 10 N/mm².
^b For material up to and including 0,6 mm in thickness, the elongation values in the table shall be reduced by 1. Minimum elongation values on a gauge length of $L_o = 5,65 \sqrt{S_o}$ may be the subject of agreement between the interested parties.
^c The hardness of quality 01 steel sheet is expected not to exceed the equivalent of Rockwell HRB65 at the time it is made available for shipment.