

Electrolytic Tinplate,
Single Reduced



Standard Specification for Tin Mill Products, Electrolytic Tinplate, Single Reduced¹

This standard is issued under the fixed designation A 624/A 624M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification covers single-reduced electrolytic tinplate produced from low-carbon cold-reduced steel furnished in coils and cut sizes for use in the manufacture of cans, closures, crowns, and other products. It is furnished in commercially available tin coatings, and is normally supplied with a trimmed edge.

1.2 This specification is applicable to orders in either inch-pound units (as A 624) which is supplied in nominal thicknesses from 0.0061 in. to 0.0149 in. or SI units (as A 624M) which is supplied in nominal thicknesses from 0.15 mm to 0.38 mm.

1.3 The values stated in either inch-pound or SI units are to be regarded as standard within the text, the SI units are shown in parentheses. The values stated in each system are not exact equivalents. Therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.

2. Referenced Documents

2.1 ASTM Standards:

A 623 Specification for Tin Mill Products, General Requirements²

A 623M Specification for Tin Mill Products, General Requirements (Metric)²

A 630 Test Methods for Determination of Tin Coating Weights for Hot-Dip and Electrolytic Tinplate²

A 754 Test Method for Coating Thickness by X-Ray Fluorescence²

B 339 Specification for Pig Tin³

3. General Requirements for Delivery

3.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specifications A 623 or A 623M, unless otherwise provided herein.

4. Ordering Information

4.1 Orders for product under this specification shall include the following information, as required and applicable, to describe adequately the desired product:

4.1.1 Name of product (single-reduced electrolytic tinplate) (Section 1),

4.1.2 Tin coating weight (mass) designation and marking, if any (Section 5, Table 1, and Figs. 1 and 2)

4.1.3 Surface appearance and finish (Section 6),

4.1.4 Chemical treatment (Section 7),

4.1.5 Oiling (Section 8),

4.1.6 Thickness (Specification A623 [A623M]) (this must be consistent with the intended application),

4.1.7 Coil width or cut size,

4.1.8 Where required, rolling direction will be specified on cut sizes and will be indicated by

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²Annual Book of ASTM Standards, Vol 01.06

³Annual Book of ASTM Standards, Vol 02.04

- underlining the slit (rolling width) dimension,
- 4.1.9 Steel type (Specification A 623 [A 623M]),
- 4.1.10 Temper designation (Specification A 623 [A 623M]) (this must be consistent with the intended application),
- 4.1.11 Intended application,
- 4.1.12 Quantity in base boxes (SITAS) (see Note 4),
- 4.1.13 On coils, specify minimum or range of acceptable inside diameters. The standard inside diameter is approximately 16 in. if ordered as A 624 [410 mm if ordered as A624M]. Coils should be specified to a maximum coil weight if ordered as A 624 [mass if ordered as A 624M], or maximum outside diameter or both,
- 4.1.14 Packaging,
- 4.1.15 Special requirements where applicable, J = plate or K = plate, and
- 4.1.16 ASTM specification designation and year of issue.

NOTE 1—A typical ordering description for coils is as follows: 1250 base boxes, single reduced, electrolytic tinplate, No. 20, DOS, L, T-5, 7C, 0.0088 in. thickness 31 4/16 in. by coil, 16 in. inside diameter, 65 in. maximum outside diameter, 25 000 lbs maximum coil weight, for 300 diameter sanitary open top ends in accordance with Specification A 624. [250 SITAS, single reduced electrolytic tinplate, 2.2/2.2, DOS, L, T-5, 7C, 0.22 mm thickness, 794 mm by coil, 410 mm inside diameter, 1650 mm maximum outside diameter, 11 500 kg maximum coil mass, for 73-mm diameter sanitary open top ends in accordance with Specification A 624M.]

NOTE 2—A typical ordering description for cut sizes is as follows: 500 base boxes, single reduced electrolytic tinplate, No. 25, DOS, MR, T-2, 7C, 0.0110 in. thickness, 30 12/16 in. by 30 7/16 in., for 307 diameter general line rings in accordance with Specification A 624. [100 SITAS, single reduced electrolytic tinplate, 2.8/2.8, DOS, MR, T-2, 7C, 0.28 mm thickness, 781 mm by 773 mm, for 83 mm diameter general line rings in accordance with Specification A 624M.]

NOTE 3—The production of coils does not afford the same opportunity for inspection, grading, and sorting as does the production of cut sizes. Accordingly, appropriate processing and quality-control procedures are required by the purchaser to obtain optimum utilization of the material. Cut sizes are line inspected visually and mechanically during production. Sheets having surface imperfections that will not interfere with their utilization are included.

NOTE 4—In inch-pound units, single reduced electrolytic tinplate is supplied on an area basis expressed in base boxes. In coils the number of base boxes is computed from the measured length and the specified width. In cut sizes the number of base boxes is computed from the specified length and width dimensions and sheet count. (In SI units, single-reduced electrolytic tinplate is supplied on an area basis expressed in SITAS. In coils, the number of SITAS is computed from the measured length and the specified width. In cut sizes, the number of SITAS is computed from the specified length and width dimensions and sheet count). For calculating mass, the density of steel for tin mill products is 0.2836 lb/in.³ [7850 kg/m³].

TABLE 1 Electrolytic Tinplate Coating Weight (Mass)

NOTE - Listed below are commonly produced coating weights (masses). By agreement between the producer and the purchaser, other combinations of the coatings may be specified and the appropriate minimum average test values will apply.

Designation No.	Nominal Tin Coating Weight (Mass) each Surface, lb/base box (g/m ²)	Minimum Average Coating Weight (Mass) each Surface, Test Value, lb/base box ^a (g/m ²)
10 (1.1/1.1)	0.05/0.05 (1.1/1.1)	0.04/0.04 (0.9/0.9)
15 (1.7/1.7)	0.515/0.515 (1.7/1.7)	0.08/0.08 (1.4/1.4)
20 (2.2/2.2)	0.10/0.10 (2.2/2.2)	0.08/0.08 (1.8/1.8)
25 (2.8/2.8)	0.125/0.125 (2.8/2.8)	0.11/0.11 (2.5/2.5)
35 (3.9/3.9)	0.175/0.175 (3.9/3.9)	0.16/0.16 (3.6/3.6)
50 (5.6/5.6)	0.25/0.25 (5.6/5.6)	0.23/0.23 (5.2/5.2)
75 (8.4/8.4)	0.375/0.375 (8.4/8.4)	0.35/0.35 (7.8/7.8)
100 (11.2/11.2)	0.50/0.50 (11.2/11.2)	0.45/0.45 (10.1/10.1)
D 50/25 (D 5.6/2.8) ^b	0.25/0.125 (5.6/2.8)	0.23/0.11 (5.2/2.5)
D 75/25 (D 8.4/2.8)	0.375/0.125 (8.4/2.8)	0.35/0.11 (7.8/2.5)
D 100/25 (D 11.2/2.8)	0.50/0.125 (11.2/2.8)	0.45/0.11 (10.1/2.5)
D 100/50 (D 11.2/5.6)	0.50/0.25 (11.2/5.6)	0.45/0.23 (10.1/5.2)
D 135/25 (D 15.2/2.8)	0.675/0.125 (15.2/2.8)	0.62/0.11 (14.0/2.5)

^a The minimum spot value shall be not less than 80% of the minimum average coating weight (mass) (see 5.3 and 5.4).

^b The letter D on differentially coated tinplate indicates the coated surface to be marked. For example, the examples indicate that the heavy-coated side is marked (see 5.1.2 and 5.1.3).

5. Tin Coating Weight (Mass)

5.1 Class Designations and Marking:

5.1.1 Electrolytic tinplate is commonly produced to the class designations shown in Table 1. Other combinations of coatings may be specified by agreement between the producer and the purchaser.

5.1.2 Differentially coated tinplate is a product having one surface more heavily tin coated than the opposite. The class designation is expressed by showing the two tin coating weights (masses) separated by a slash mark, for example, 50/25 D 5.6/2.8. The first number will represent the coating weight (mass) on the outside of the coil or the top surface of the cut sizes.

5.1.3 In order to distinguish material having differential coatings, the face with the heavier coating is normally marked. By arrangement, a special marking can be supplied on the light-coated face (see Figs. 1 and 2). The letter *D* is shown along with the coating number to indicate the side of the plate to be marked.

5.2 Sampling for Tin Coating Weights (Masses):

5.2.1 When the purchaser wishes to make tests to ascertain compliance with the requirements of this specification for tin coating weight (mass) on a lot of any specific item of electrolytic tinplate, the following procedure shall be used:

5.2.1.1 *Coils* - One test strip shall be taken at random from a representative section of each coil across its width. A minimum of three test strips, each taken from different coils from any one item of a specific lot shall be selected.

5.2.1.2 From one or two coil lots, each coil shall be sampled. A minimum of three randomly selected test strips shall represent the lot.

5.2.1.3 *Cut Sizes* - One sheet shall be taken at random from each 50 packages, or part thereof, with a minimum of three different sample plates, each taken from different bundles from any one item of a specific shipment.

5.2.2 Each test sheet shall be spot tested at a minimum of three locations across the rolling direction of the sheet. Spot tests are customarily disks or squares 4 in.² (26 cm.²) in area; other sizes may be used. In order to secure representative samples, the following procedure shall be used:

5.2.2.1 All test spots are taken on a center line at right angles to the rolling direction.

5.2.2.2 No test spots shall be closer than 1 in. (25 mm) from the mill-trimmed edge of the test sheets.

5.2.2.3 No test spots shall be closer than 2 in. (50 mm) from one another.

5.2.2.4 If the minimum of three test spots are taken they shall be edge, center, and edge tests.

5.2.2.5 The average of all spot tests on all test strips or sheets represents the average coating weight (mass) test value.

5.3 Coating weight (mass) test values shall conform to the values shown in Table 1.

5.4 *Determination of Tin Coating Weights (Masses)* - Typical methods for determination of tin coating weights (masses) are described in Test Methods A 630. An acceptable method for determining tin coating weight (mass) is the x-ray fluorescence method, performed in accordance with Test Method A 754. In cases of dispute, Method B, Referee Method, shall be used.

5.5 Pig tin used in the production of tinplate shall be Grade A as shown in the latest revision of Specification B 339.

6. Surface Appearance and Finish

6.1 *Surface Appearance* - Single-reduced electrolytic tinplate is customarily produced with a melted coating (bright). Unmelted coating (matte) is also available.

6.2 *Base Metal Finishes* - Single-reduced electrolytic tinplate is produced with ground-roll finishes and shot-blasted-roll finishes, designated as follows:

6.2.1 *Ground-Roll Finishes* (produced either melted or unmelted):

6.2.1.1 *7B* - A smooth finish may contain fine grit lines. This finish is specified for special applications.

6.2.1.2 *7C* - A smooth finish with grit lines. This is the standard finish for tin mill products.

6.2.2 *Blasted-Roll Finishes* (produced either melted or unmelted):

6.2.2.1 *5C* - A shot-blast finish (SBF) for general applications.

6.2.2.2 *5D* - A shot-blast finish for special applications.

7. Chemical Treatment

7.1 Electrolytic tinplate as produced without a surface chemical treatment is subject to tin oxide growth that is manifested by surface discoloration during storage and subsequent baking operations and may adversely affect application and adhesion of organic coatings and lithography, and may cause poor solderability. A chemical treatment is therefore applied in most cases after the tin coating has been deposited and immediately preceding the oiling, to control tin oxide formation and growth. The chemical treatment is applied by passing the strip through a chemical solution with or without current. Chemical treatments on electrolytic tinplate are applied commensurate with each supplier's method and equipment; however, one of the controlling factors is the amount of combined chromium present on the surface. Unless otherwise specified, the surface chemical treatment will be left to the discretion of the tinplate producer.

7.2 In order of decreasing surface passivation, the commonly used chemical treatments for tinplate are as follows:

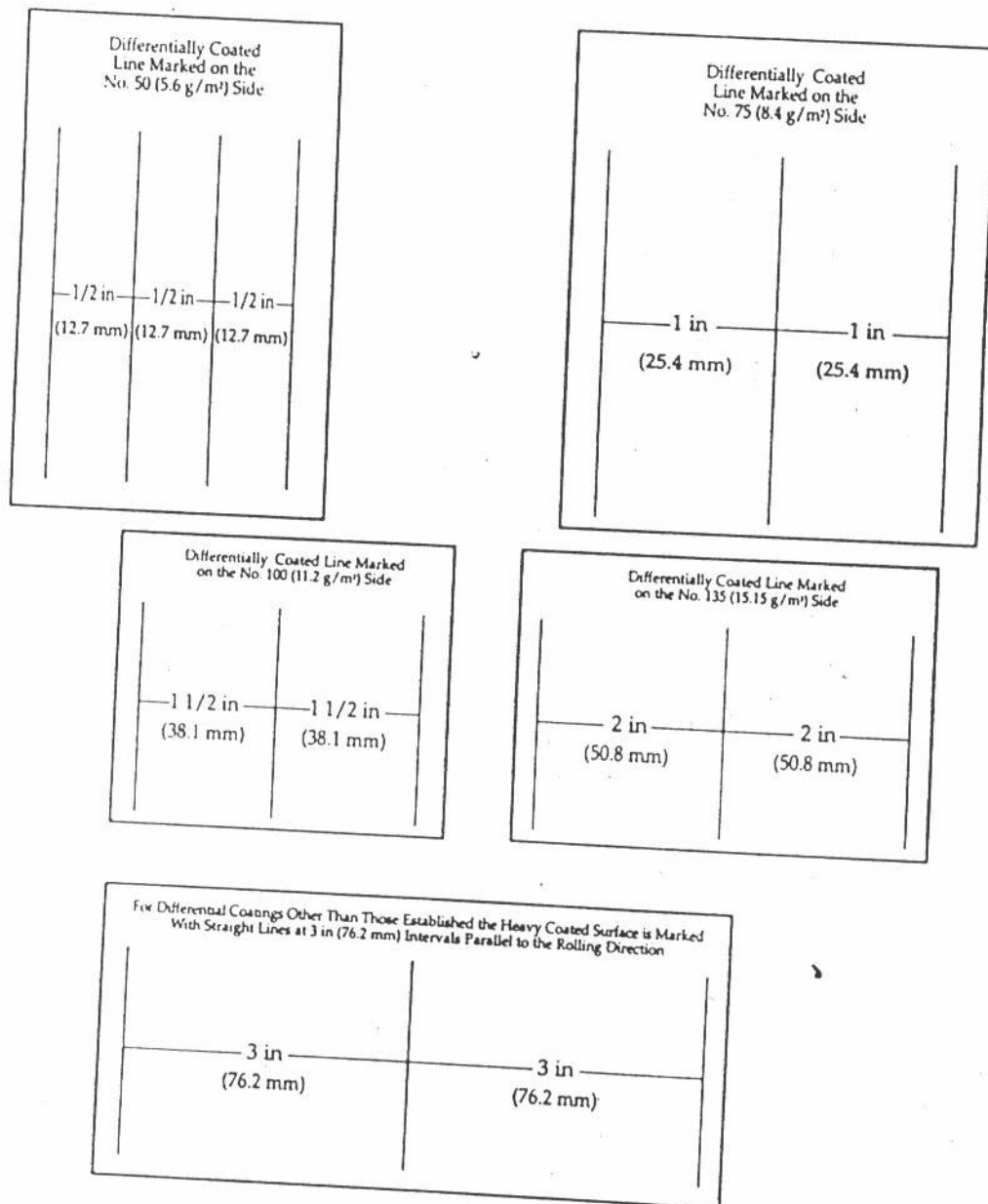
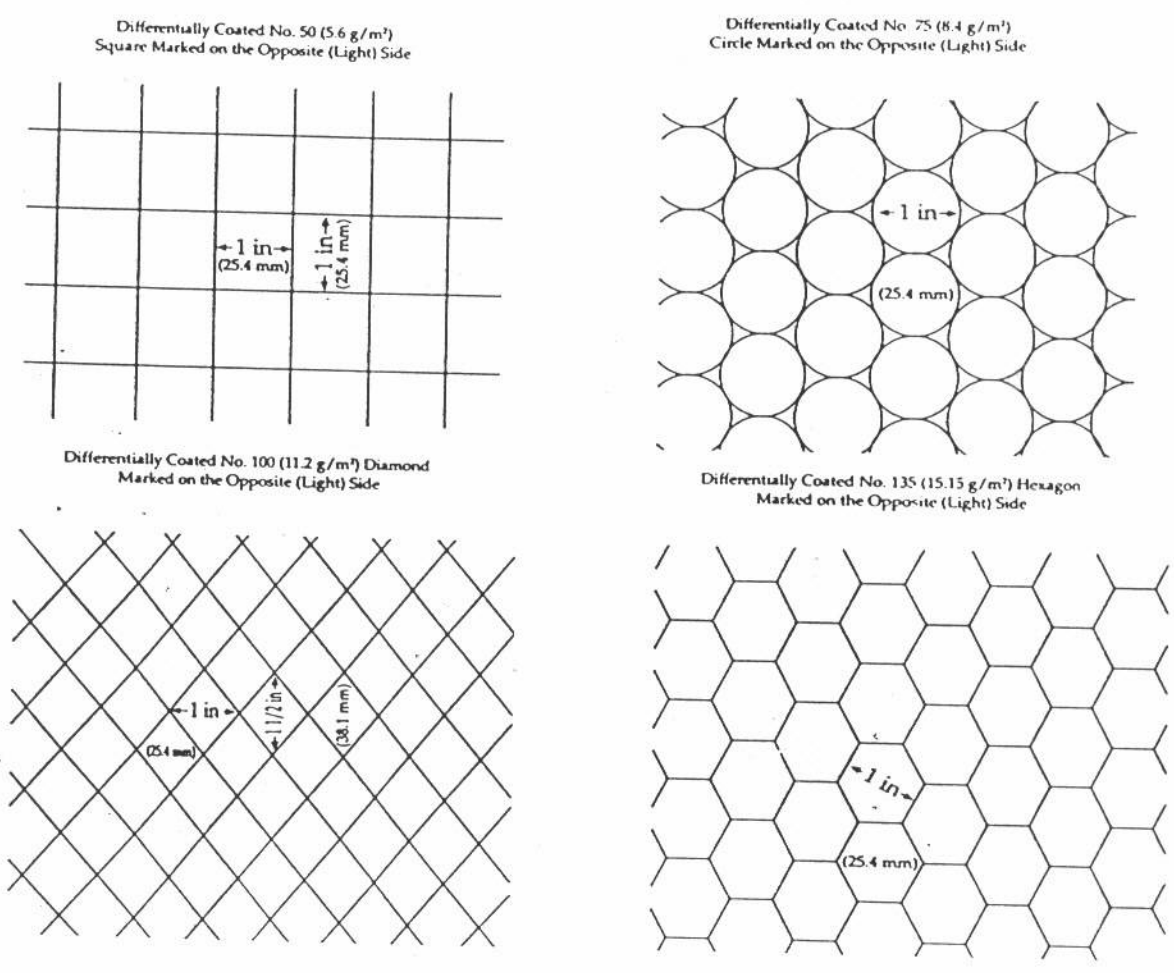


FIG. 1 Standard Heavy Side Marking System for Differential Electrolytic Tinplate

7.2.1 Cathodic Sodium Dichromate (CDC) Treatment:

7.2.1.1 The cathodic sodium dichromate treatment is the most widely used treatment, and provides a highly passivated surface against the formation of tin oxides. It has the following attributes: (1) minimum tin oxide growth after prolonged storage; (2) minimized discoloration during subsequent baking required for organic coatings and lithography; (3) minimized discoloration due to soldering operation; and (4) provides some resistance to tin sulfide discoloration of certain sulfur-bearing food products.



For Differential Coatings Other Than Those Established
the Lighter Coated Surface is Marked with Sine Waves

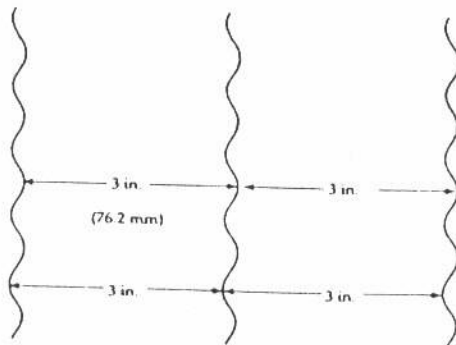


FIG. 2 Standard Light Side Marking System for Differential Electrolytic Tinplate

7.2.1.2 Cathodic sodium dichromate-treated tinplate has an aim range of 350 to 650 μg of chromium per square foot of surface. [4000 to 7000 μg of chromium per square metre of surface.]

7.2.2 *Sodium Dichromate Dip (SDCD) Treatment:*

7.2.2.1 The sodium dichromate dip treatment provides moderate passivation against tin oxide formation.

7.2.2.2 Sodium dichromate dip-treated tinplate has an aim of 150 μg of chromium per square foot of surface. [1600 μg of chromium per square metre of surface.]

7.2.3 *Cathodic Sodium Carbonate (CSC) Treatment:*

7.2.3.1 The cathodic sodium carbonate treatment has the least passivation against tin oxide formation, and is generally used for such products as evaporated milk can stock.

7.2.3.2 Cathodic sodium carbonate-treated tinplate has no added surface chromium.

8. Oiling

8.1 Electrolytic tinplate is furnished with an oil film applied to both surfaces. The most commonly used oil films are dioctyl sebacate (di(2-ethyl-hexyl) sebacate) and acetyl tributyl citrate. Other oil films may be used. Surface active agents such as glycerol monooleate may be incorporated into the oil films for application on tinplate.

8.2 Unless indicated by the purchaser the specific oiling treatment will be left to the discretion of the tinplate producer.

8.3 *Weight [Mass] of Oil Films* - The weight [mass] of oil film as applied by the supplier of tinplate normally ranges from approximately 0.10 g/base box to 0.40 g/base box [0.50 to 2.00 g/SITA (5 to 20 mg/m^2)]. Specific aim ranges required for particular end uses and handling practices may be supplied as agreed upon between the producer and the purchaser.

9. Keywords

9.1 Coated steel sheet; tin mill products; tinplate