Designation: A 624/A 624M – 03

Standard Specification for Tin Mill Products, Electrolytic Tin Plate, Single Reduced[1]

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.

1. Scope*

1.1 This specification covers single-reduced electrolytic tin plate 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 coating weights [masses], 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 to 0.0149 in. or SI units [as A 624M] which is supplied in nominal thicknesses from 0.155 to 0.378 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 brackets. 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.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 623 Specification for Tin Mill Products, General Requirements

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

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

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

B 339 Specification for Pig Tin

3. Ordering Information

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

3.1.1 Name of product (single-reduced electrolytic tin plate) (Section 1),

3.1.2 Tin coating weight [mass] designation and marking, if any (Section 4, Table 1, and Fig. 1 and Fig. 2),

3.1.3 Surface appearance and finish (Section 5),

3.1.4 Chemical treatment (Section 6),

3.1.5 Oiling (Section 7),

3.1.6 Thickness (Specification A 623 [A 623M]) (this must be consistent with the intended application),

3.1.7 Coil width or cut size in increments of 1/16 in. or 1 mm,

3.1.8 Where required, rolling direction will be specified on cut sizes and will be indicated by underlining the slit (rolling width) dimension,

3.1.9 Steel type (Specification A 623 [A 623M]),

3.1.10 Temper designation (Specification A 623 [A 623M]) (this must be consistent with the intended application),

3.1.11 Intended application,

3.1.12 Quantity in base boxes (SITAS) (see Note 4),

3.1.13 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 A 624M]. 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,

3.1.14 Packaging,

3.1.15 Special requirements where applicable, J = plate or K = plate, and

3.1.16 ASTM specification designation and year of issue.

NOTE 1—A typical ordering description for coils is as follows: 1250 base boxes, single reduced, electrolytic tin plate, No. 20, DOS, L, T-5 CA, 7C, 0.0088 in. thickness 31 ¼ 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/A 624M - XX. [250 SITAS, single reduced electrolytic tin plate, 2.2/2.2,

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.20 on Tin Mill Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

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TABLE 1 Electrolytic Tin Plate Coating Weight [Mass]

NOTE 1—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]
5 [0.6/0.6][B]	0.025/0.025 [0.6/0.6]	0.02/0.02 [0.5/0.5]
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]	0.075/0.075 [1.7/1.7]	0.06/0.06 [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][C]	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 4.3 and 4.4).

[B]Some No. 5 melted applications may require revised minimum and maximum levels for fully alloyed end uses.

[C]The letter D on differentially coated tin plate indicates the coated surface to be marked. For example, the examples indicate that the heavy-coated side is marked (see 4.1.2 and 4.1.3).

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 624/A 624M - XX.]

NOTE 2—A typical ordering description for cut sizes is as follows: 500 base boxes, single reduced electrolytic tin plate, No. 25, DOS, MR, T-2BA, 7C, 0.0110 in. thickness, 30 ¾ in. by 30 7⁄16 in., for 307 diameter general line rings in accordance with Specification A 624/A 624M - XX. [100 SITAS, single reduced electrolytic tin plate, 2.8/2.8, DOS, MR, T-2, 7C, 0.28 mm thickness, 781 by 773 mm, for 83-mm diameter general line rings in accordance with Specification A 624/A 624M - XX.]

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 tin plate 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 tin plate 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/m^3].

4. Tin Coating Weight [Mass]

4.1 *Class Designations and Marking*:

4.1.1 Electrolytic tin plate 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.

4.1.2 Differentially coated tin plate 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, D50/25 [D5.6/2.8]. The first number will represent the coating weight [mass] on the outside of the coil or the top surface of the cut sizes.

4.1.3 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 Fig. 1 and Fig. 2). The letter *D* is shown along with the coating number to indicate the side of the plate to be marked.

4.2 *Sampling for Tin Coating Weights [Masses]*:

4.2.1 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 tin plate, the following procedure shall be used:

4.2.1.1 *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.

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

4.2.1.3 *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.

4.2.2 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:

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

4.2.2.2 No test spots shall be closer than 1 in. [25 mm] from the mill-trimmed edge of the test sheets.

4.2.2.3 No test spots shall be closer than 2 in. [50 mm] from one another.

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

4.2.2.5 The average of all spot tests on all test strips or sheets represents the average coating weight [mass] test value.

4.3 Coating weight [mass] test values shall conform to the values shown in Table 1.

4.4 *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.

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

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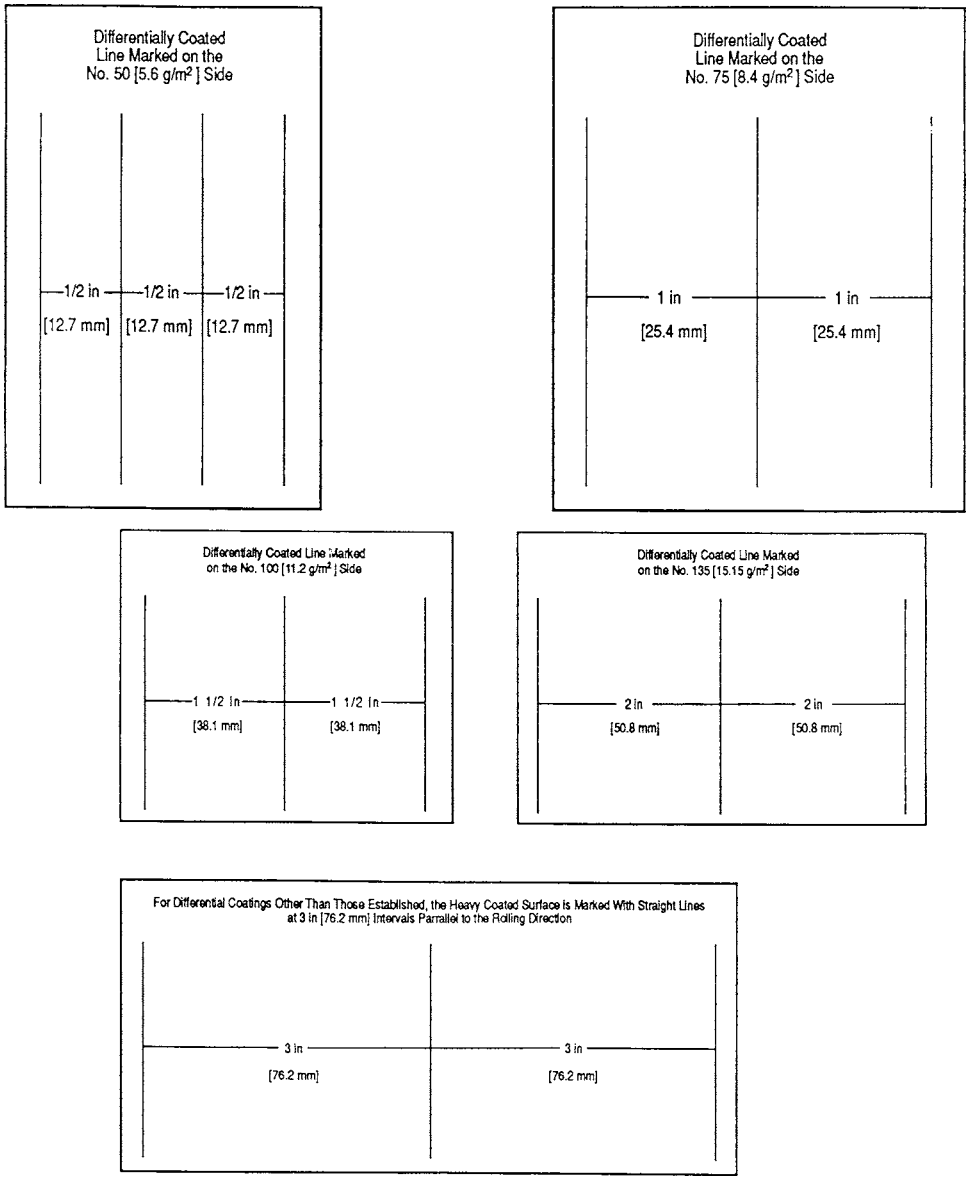


FIG. 1 Standard Heavy Side Marking System for Differential Electrolytic Tin Plate

5. Surface Appearance and Finish

5.1 *Surface Appearance*—Single-reduced electrolytic tin plate is customarily produced with a melted coating (bright). Unmelted coating (matte) is also available.

5.2 *Base Metal Finish*—Single-reduced electrolytic tin plate is produced with ground roll finishes and shot-blasted roll finishes as follows:

5.2.1 *Ground Roll Finishes* (produced as either melted or unmelted coatings):

5.2.1.1 *7B*—A smooth finish which may contain fine grit lines. This finish is specified for special applications.

5.2.1.2 *7C*—A smooth finish with grit lines. The surface roughness will range between 10 and 25 µin. Ra [0.254 to 0.635 µm Ra]. This is the standard finish for tin mill products.

5.2.2 *Blasted and/or Otherwise Textured Roll Finishes* (produced as either melted or unmelted coatings):

5.2.2.1 *5C*— A shot blasted finish (SBF) for general applications. The surface roughness will range from 30 to 60 µin. Ra [0.760 to 1.52 µm Ra].

5.2.2.2 *5D*—A shot blasted finish (SBF) for special applications.

6. Chemical Treatment

6.1 Electrolytic tin plate 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

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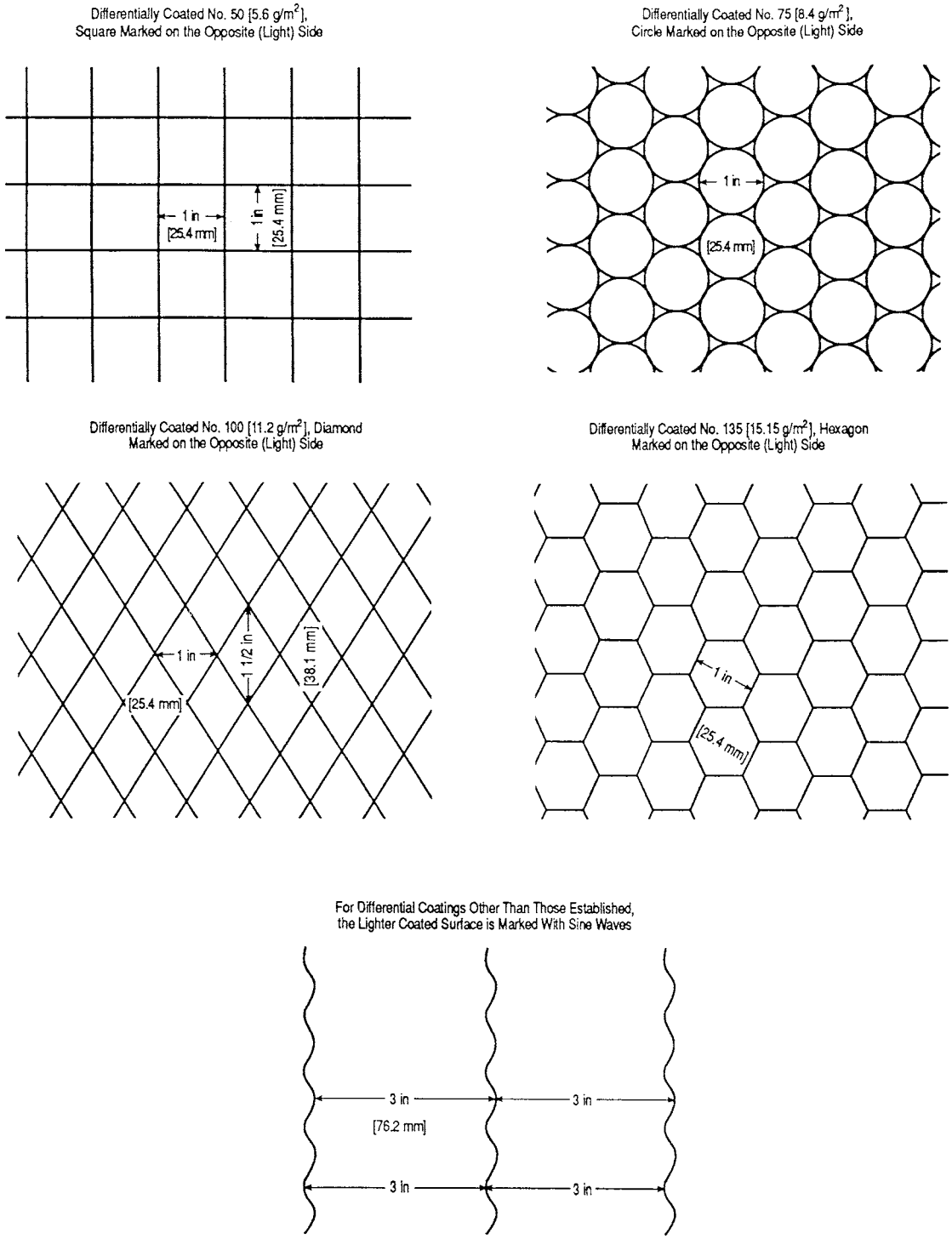


FIG. 2 Standard Light Side Marking System for Differential Electrolytic Tin Plate

current. Chemical treatments on electrolytic tin plate 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 tin plate producer.

6.2 In order of decreasing surface passivation, the commonly used chemical treatments for tin plate are as follows:

6.2.1 *Cathodic Sodium Dichromate (CDC) Treatment*:

6.2.1.1 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.

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6.2.1.2 Cathodic sodium dichromate-treated tin plate 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.]

6.2.2 *Sodium Dichromate Dip (SDCD/SDD) Treatment*:

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

6.2.2.2 Sodium dichromate dip-treated tin plate has a maximum of 200 µg of chromium per square foot of surface. [2200 µg of chromium per square metre of surface.]

7. Oiling

7.1 Electrolytic tin plate is furnished with an oil film applied to both surfaces. The most commonly used oil films are dioctyl sebacate (DOS) and acetyl tributyl citrate (ATBC). Other oil films may be used. Surface active agents such as glycerol monooleate (GMO) may be incorporated into the oil films for application on tin plate.

7.2 Unless indicated by the purchaser the specific oiling treatment will be left to the discretion of the tin plate producer.

7.3 *Weight [Mass] of Oil Films*—The weight [mass] of oil film as applied by the supplier of tin plate normally ranges from approximately 0.10 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.

8. General Requirements for Delivery

8.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 623 [A 623M], unless otherwise provided herein.

9. Keywords

9.1 coated steel sheet; tin mill products; tin plate

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 624/A 624M - 98) that may impact the use of this standard.

A 624/A 624M - 03:

(*1*) Changed metric decimal thickness from two significant figures to three significant figures in paragraph 1.2.

(*2*) Minor editorial corrections were made throughout the standard.

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