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Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process¹

This standard is issued under the fixed designation A 525; 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 specification 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.

^{ε1}NOTE—Table 1 was corrected editorially in March 1992.

1. Scope

1.1 This specification covers the general requirements for the delivery of steel sheet in coils and cut lengths, zinc-coated (galvanized) on continuous lines by the hot-dip process. Galvanized steel sheet is customarily available in commercial quality, lock-forming quality, drawing quality, drawing quality special killed, and structural (physical) quality, which are fully described in separate standards (Section 2). Galvanized steel sheet is produced to various zinc-coating designations, as shown in Table 1, designed to give coatings compatible with the service life required. Except for differential-coated sheet, the coating is always expressed as the total coating of both surfaces. Galvanized steel sheet can be produced with the following types of coatings:

- 1.1.1 Regular spangle,
- 1.1.2 Minimized spangle,
- 1.1.3 Zinc-iron alloy, and
- 1.1.4 Differential.

NOTE 1—A complete metric companion to Specification A 525 has been developed—A 525M; therefore no metric equivalents are presented in this specification.

2. Referenced Documents

2.1 ASTM Standards:

- A 90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles²
- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products³
- A 444/A 444M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Storm Sewer and Drainage Pipe²
- A 446/A 446M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality²
- A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment³

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

D 2092 Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵

E 376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods⁶

2.2 U.S. Military Standards:

MIL-STD-129 Marking for Shipment and Storage⁷

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage⁷

2.3 U.S. Federal Standard:

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)⁷

3. Terminology

3.1 Definitions:

3.1.1 *chemical treatment*—a passivating chemical treatment normally applied to galvanized coatings to retard the formation of white oxide during shipment and storage. However, the inhibiting characteristics of the treatment are limited and if a shipment is received wet, the material should be used or dried immediately.

3.1.2 *differentially coated*—galvanized steel sheet having a specified “coating designation” on one surface and a significantly lighter specified “coating designation” on the other surface. The single side relationship of either specified “coating designation” is the same as shown in the note of Table 1 regarding uniformity of coating.

3.1.3 *extra smooth or skin passed*—material produced by skin passing the galvanized sheet to impart a higher degree of smoothness than is normal to the as-coated product, as in the case of critical painted surfaces. Extra smooth is normally furnished in coating Designations G 90 and A 60 and lighter only. If fluting or stretcher strains are a hazard, extra smooth or skin passed should be specified.

3.1.4 *mill phosphatized*—galvanized sheet chemically processed by the producer to prepare the surfaces for immediate

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² Annual Book of ASTM Standards, Vol 01.06.

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 06.01.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Annual Book of ASTM Standards, Vol 03.03.

⁷ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094 Attn: NPODS.

TABLE 1 Weight of Coating

NOTE 1—The coating designation number is the term by which this product is specified. The weight of coating in ounces per square foot of sheet refers to the total coating on both surfaces. Because of the many variables and changing conditions that are characteristic of continuous galvanizing, the weight of zinc coating is not always evenly divided between the two surfaces of a galvanized sheet; neither is the zinc coating evenly distributed from edge to edge. However, the minimum triple spot average coating mass on any side shall not be less than 40 % of the single spot test requirement.

NOTE 2—As it is an established fact that the atmospheric corrosion resistance of mill galvanized sheet products is a direct function of coating weight (thickness), the selection of lighter coating designations will result in almost linearly reduced corrosion performance of the zinc coating. For example, the heavier galvanized coatings perform adequately in bold atmospheric exposure whereas the lighter weight coatings are often further coated with paint or a similar barrier coating for increased corrosion resistance. Because of this relationship, products carrying the statement "meets ASTM A 525 requirements" should also specify the particular coating weight designation.

Type	Coating Designation	Previous Coating Class	Minimum Check Limit		
			Triple-Spot Test oz/ft ²		Single Spot Test oz/ft ²
			Total Both Sides	Total One Side	Total Both Sides
Zinc	G 360	...	3.60	1.28	3.20
	G 300	...	3.00	1.04	2.60
	G 235	2.75	2.35	.80	2.00
	G 210	2.50	2.10	.72	1.80
	G 185	2.25	1.85	.64	1.60
	G 165	2.00	1.65	.56	1.40
	G 140	1.75	1.40	.48	1.20
	G 115	1.50	1.15	.40	1.00
	G 90	1.25 Commercial	0.90	.32	0.80
	G 60	Light Commercial	0.60	.20	0.50
	G 40	...	0.40	.10	0.30
	G 01	...	no minimum		no minimum
Zinc-iron alloy	A 60	...	0.60	.20	0.50
	A 40	...	0.40	.12	0.30
	A 25	...	0.25	.08	0.20
	A 01	...	no minimum		no minimum

painting without further treatment except normal cleaning (refer to Practices D 2092). Since this is a surface treatment only, all other characteristics of the coating remain unchanged. This sheet is normally produced to all coating designations in Table 1.

3.1.5 *minimized spangle*—galvanized sheet obtained by treating the regular galvanized sheet during the solidification of the zinc to restrict the normal spangle formation. This product usually has a dull appearance not characterized by a high degree of uniformity, and dissimilarity from coil to coil is not unusual. Minimum spangle is normally produced in coating designations G 90 and lighter.

3.1.6 *oiling*—a coating applied to the galvanized sheet as produced, either alone or in addition to the chemical treatment for further insurance against white oxide. In the event a chemical treatment is undesirable because of further processing such as phosphatizing, an oil coating offers protection during shipment and storage.

3.1.7 *regular spangle*—galvanized sheet coated on continuous lines to the coating designations prefixed "G" shown in Table 1. Regular spangles are the result of the unrestricted growth of zinc crystals during normal solidification.

3.1.8 *zinc-iron alloy*—galvanized sheet produced by processing the steel through the galvanizing line to produce a completely alloyed coating. This product is not spangled, is normally dull gray in appearance, and is suitable for immediate painting without further treatment except normal cleaning (refer to Practices D 2092). The lack of ductility of the alloy coating may result in powdering of the coating during fabrication. Iron-zinc alloy coated sheet can be supplied in the four coating designations in Table 1 prefixed by the letter "A". This product may be produced as galvanized or wiped coat.

4. General Requirements for Delivery

4.1 The requirements of the purchase order, the indi-

vidual material specification, and this general specification shall govern in the sequence stated.

4.2 Galvanized sheet in coils and cut lengths is produced to decimal thickness only and thickness tolerances apply. The thickness of the sheet includes both the base steel and the coating.

5. Manufacture

5.1 The base metal shall be made by the open-hearth, basic-oxygen, or electric-furnace process.

6. Chemical Composition

6.1 An analysis of each cast or heat (formerly ladle) of steel shall be made by the producer to determine the percentage of carbon, manganese, phosphorus, sulfur, copper (when specified), and any other elements specified or restricted by the applicable specification.

6.1.1 When requested, cast or heat (formerly ladle) analysis for elements listed or required shall be reported to

TABLE 2 Tolerances for Product (Formerly Check) Analysis

Element	Limit, or Maximum of Specified Element, %	Tolerance Over the Maximum Limit or Under the Minimum Limit	
		Under Minimum Limit	Over Maximum Limit
Carbon	To 0.15, incl	0.02	0.03
	Over 0.15 to 0.40, incl	0.03	0.04
	Over 0.40 to 0.80, incl	0.03	0.05
Manganese	To 0.60, incl	0.03	0.03
	Over 0.60 to 1.15, incl	0.04	0.04
	Over 1.15 to 1.65, incl	0.05	0.05
Phosphorus	...	...	0.01
Sulfur	...	...	0.01
Silicon	To 0.30, incl	0.02	0.03
	Over 0.30 to 0.60	0.05	0.05
Copper	...	0.02	...