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# Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe[1]

This standard is issued under the fixed designation A929/A929M; 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.

## 1. Scope

1.1 This specification covers steel sheet used in the manufacture of corrugated steel pipe for storm sewers, culverts, drains, and similar uses. The sheet is metallic coated by the hot-dip process. Material for this use is furnished in coils, flat in cut lengths, and corrugated in cut lengths. Many metallic coated materials are covered in this material specification. Users must determine which product best serves their needs. Five different metallic coatings are included:

1.1.1 Zinc-coated (galvanized),

1.1.2 Zinc-5 % aluminum-Mischmetal (Zn-5Al-MM) alloy coated,

1.1.3 55 % aluminum-zinc (55Al-Zn) alloy coated,

1.1.4 Aluminum-coated Type 2 (aluminized Type 2), and

1.1.5 Aluminum-coated Type 1 (aluminized Type 1).

1.2 Zinc-coated sheet is available in two coating weights [masses]. Other metallic coatings are available in one coating weight [mass] only.

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

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

A428/A428M Test Method for Weight [Mass] of Coating on Aluminum-Coated Iron or Steel Articles

A902 Terminology Relating to Metallic Coated Steel Products

A924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

B750 Specification for GALFAN (Zinc-5 % Aluminum-Mischmetal) Alloy in Ingot Form for Hot-Dip Coatings

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this specification, refer to Terminology A902. The following definitions are as stated in that terminology:

3.1.2 *fabricator, n— as related to corrugated metal pipe*, (*1*) the organization that produces the finished pipe; or (*2*) *for structural plate pipe*, the organization that processes flat sheets and other items necessary for the field assembly of finished products.

3.1.3 *manufacturer, n— as related to corrugated metal pipe*, the organization that produces the metal sheet from which pipe is made.

3.1.4 *purchaser, n—as related to corrugated metal pipe*, the person or agency that purchases the finished pipe.

3.1.5 *Discussion*—With regard to this specification for sheet for corrugated steel pipe, the fabricator may also be considered as the purchaser of the sheet, where that term is used in this specification. Such interpretation would not restrict the purchaser of the finished pipe from enforcing any provisions of this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *minimized coating structure, n*—a coating characterized by a finer metallurgical coating structure obtained by a treatment designed to restrict the formation of the normal coarse grain structure formed during solidification of the Zn-5Al-MM coating.

3.2.2 *regular coating structure, n*—the normal coating structure resulting from unrestricted grain growth during normal solidification of the Zn-5Al-MM coating.

3.3 *Abbreviations:*

3.3.1 Al T2—aluminum-coated Type 2

[1] This specification is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.11 on Sheet Specifications.

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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.

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3.3.2 Al T1—aluminum-coated Type 1
3.3.3 55Al-Zn—55 % aluminum-zinc alloy
3.3.4 Zn—zinc
3.3.5 Zn-5Al-MM—zinc-5 % aluminum-Mischmetal alloy

## 4. Classification

4.1 The Zn-5Al-MM coating is available in two coating classes, as follows:
4.1.1 *Class A*—Minimized coating structure, and
4.1.2 *Class B*—Regular coating structure.

## 5. Ordering Information

5.1 All sheet, both flat and formed, covered by this specification shall be ordered only to the specified thicknesses in the table on coated steel sheet thickness requirements.

5.2 All material furnished to this specification shall be chemically treated unless otherwise specified in the purchase order.

5.3 Orders for material to this specification shall include the following information, as necessary, to describe the desired product adequately:
5.3.1 Name of material (steel sheet for corrugated pipe):
5.3.2 ASTM designation and year of issue, as A929-_____ for inch-pound units, or A929M-_____ for SI units;
5.3.3 Type of metallic coating (zinc, zinc-5 % aluminum-Mischmetal alloy, 55 % aluminum-zinc alloy, aluminum-coated Type 2, or aluminum-coated Type 1) (Note 1);
5.3.3.1 For zinc-coated sheet, the coating weight [mass] (see Table 3). If the coating weight [mass] is not stated, sheet having 2.00 oz/ft$^2$ [610 g/m$^2$] nominal coating shall be furnished.
5.3.3.2 For Zn-5Al-MM coating the class (coating structure) (see 4.1).
5.3.4 *Quantity and Dimensions:*
5.3.4.1 *Cut Lengths*—Show the number of sheets; thickness; width, either flat or overall corrugated; length; pitch; and depth of corrugations, if corrugated;
5.3.4.2 *Coiled Sheet*—Show the total weight [mass]; thickness; width; coil requirements (maximum outside diameter, acceptable inside diameter, and maximum weight [mass] of individual coils).

5.4 Certification, if required (see 12.1); and

5.5 Special requirements.

NOTE 1—Abbreviations may be used to describe the coating type (see 3.3).

NOTE 2—A typical ordering description (inch-pound units) is as follows: steel sheet for corrugated pipe in accordance with ASTM A929-_____, zinc coated, 5000 sheets, 0.064 by 25½ by 60 in. with 2⅔ by ½ in. corrugations, certified.

**TABLE 1 Chemical Composition**

| | Cast Analysis | Product Analysis |
|---|---|---|
| Sulfur, max, % | 0.05 | 0.06 |
| Sum of carbon, manganese, phosphorus, sulfur, and silicon, max, % | 0.70 | 0.74 |

**TABLE 2 Mechanical Requirements (Properties of Flat Sheet Prior to Fabrication)[A]**

| | |
|---|---|
| Tensile strength, min,[B] ksi [MPa] | 45.0 [310] |
| Yield strength, min,[B] ksi [MPa] | 33.0 [230] |
| Elongation in 2 in. [50 mm],[C] min, % | 20 |

[A] To determine conformance with this specification, round each value for tensile strength and yield strength to the nearest 0.1 ksi [1 MPa] and each value for elongation to the nearest 1 %, both in accordance with the rounding method of Practice E29.
[B] Yield point and tensile strength are based on the thickness of the base metal. If tests are made after coating, determine the base metal thickness after stripping the coating from the ends of the specimen contacting the grips of the tension testing machine prior to tensile testing.
[C] The elongation requirement does not apply to material tested after corrugating.

NOTE 3—A typical ordering description [SI units] is as follows: steel sheet for corrugated pipe in accordance with ASTM A929M-_____, aluminum coated, Type 2, 45 000 kg, 2.77 by 700 mm by coil, 1500 mm max outside diameter, 600 mm, inside diameter, 7000 kg max, certified.

## 6. Chemical Composition

6.1 *Base Metal Analysis*—The base metal cast or product analyses shall conform to the chemical requirements of Table 1.

6.2 *Coating Bath Composition:*
6.2.1 *Zinc Coating*—The coating bath metal shall contain not less than 99 % zinc.
6.2.2 *Zinc-5 % Aluminum-Mischmetal Alloy Coating*—The ingot used for the coating bath shall conform to Specification B750.
6.2.3 *55 % Aluminum-Zinc Alloy Coating*—The coating bath metal composition shall be 52 to 58 % aluminum, 2.0 % silicon maximum, and balance zinc.
6.2.4 *Aluminum Coating Type 2*—The coating bath metal composition shall be as follows (all percentages are maximum): Iron, 3.0 %; silicon, 0.35 %; magnesium, 0.50 %; other, each, 0.05 %; other, total, 0.20 %; balance, aluminum.
6.2.5 *Aluminum Coating Type 1*—The coating bath metal composition shall be 5 to 11 % silicon, the balance aluminum.

## 7. Mechanical Properties

7.1 The metallic-coated sheet shall conform to the mechanical requirements listed in Table 2.

7.2 Two tension tests shall be made on random samples of finished material from each cast or heat. One test is sufficient when the finished material from said cast or heat is less than 50 tons [45 Mg]. One tension test shall be made from both the thickest and thinnest material rolled, regardless of the weight represented, when material rolled from one cast or heat differs 0.050 in. [1.25 mm] or more in thickness. The samples shall be prepared and tested in accordance with the method specified in Specification A924/A924M.

## 8. Coating Requirements

8.1 The metallic coating weight [mass] shall conform to the requirements listed in Table 3 for the type of metallic coating specified.

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