



Designation: **A1076/A1076M – 13 A1076/A1076M – 20**

## Standard Specification for Cold Formed Carbon Structural Steel Tubing Made from Metallic Precoated Sheet Steel<sup>1</sup>

This standard is issued under the fixed designation A1076/A1076M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification covers round, square, rectangular, and special shape, electric-resistance-welded structural tubing produced from precoated sheet steel with the following coatings on both sides: zinc (galvanized) or 55% aluminum-zinc alloy or zinc-5 % aluminum alloy-coated. This product is intended for applications requiring minimum mechanical properties and corrosion resistance of both exterior and interior surfaces.

1.2 This specification covers:

1.2.1 Three grades of round tubing and three grades of shaped tubing, identified in [Table 1](#) (Chemical Requirements), [Table 2](#) (Mechanical Requirements of Round Structural Tubing), and [Table 3](#) (Mechanical Requirements of Shaped Structural Tubing).

1.2.2 Three different types of coating composition/designations (Section 7).

1.3 This specification is applicable to orders in either inch-pound units (as A1076) or SI units (as A1076M). Within the text, SI units are shown in brackets. The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

- 2.1 *ASTM Standards:*<sup>2</sup>
- A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
  - A370 Test Methods and Definitions for Mechanical Testing of Steel Products
  - A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - A792/A792M Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
  - A875/A875M Specification for Steel Sheet, Zinc-5 % Aluminum Alloy-Coated by the Hot-Dip Process
  - A902 Terminology Relating to Metallic Coated Steel Products
  - A500/A500M Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - 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

### 3. Terminology

3.1 *Definitions*—See Terminology [A902](#) for definitions of general terminology relating to metallic-coated hot-dip products.

3.2 *Definitions of Terms Specific to This Standard:*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee [A01](#) on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee [A01.09](#) on Carbon Steel Tubular Products.

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<sup>2</sup> 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

TABLE 1 Chemical Requirements<sup>A,B,C,D</sup>

Designation	Composition, %—Heat Analysis Element, max (unless otherwise shown)												
	Carbon	Manganese	Phosphorus	Sulfur	Si	Al, min	Cu	Ni	Cr	Mo	V	CbNb	Ti
Round Grade 33 [230]	0.15	1.35	0.04	0.04	...	...	0.25	0.20	0.15	0.06	0.008	0.008	0.03
Round Grade 42 [290]	0.18	1.35	0.04	0.04	...	...	0.25	0.20	0.15	0.06	0.008	0.008	0.03
Round Grade 46 [315]	0.25	1.35	0.04	0.04	...	...	0.25	0.20	0.15	0.06	0.008	0.008	0.03
Shaped Grade 39 [270]	0.15	1.35	0.04	0.04	...	...	0.25	0.20	0.15	0.06	0.008	0.008	0.03
Shaped Grade 46 [315]	0.18	1.35	0.04	0.04	...	...	0.25	0.20	0.15	0.06	0.008	0.008	0.03
Shaped Grade 50 [345]	0.25	1.35	0.04	0.04	...	...	0.25	0.20	0.15	0.06	0.008	0.008	0.03

<sup>A</sup> Where an ellipsis ( . . . ) appears in this table, there is no requirement, but the analysis shall be reported.

<sup>B</sup> Si may be added as a strengthening element.

<sup>C</sup> Columbium Niobium and Vanadium may be added singly or in combination for strengthening. When used, the maximum values in the table may be exceeded.

<sup>D</sup> As determined by Committee A01, element 41 may be represented by niobium or columbium interchangeably.

TABLE 2 Mechanical Requirements of Round Structural Tubing

Designation	Yield Strength, min, ksi [MPa]	Tensile Strength, min, ksi [MPa]	Elongation in 2 in. [50 mm], min, %
Grade 33 [230]	33 [230]	45 [310]	25 <sup>A</sup>
Grade 42 [290]	42 [290]	58 [400]	23 <sup>B</sup>
Grade 46 [315]	46 [315]	62 [425]	21 <sup>C</sup>

<sup>A</sup> Applies to specified wall thicknesses (t) of 0.120 in [3.05 mm] and over. For wall thicknesses under 0.120 in [3.05 mm], the minimum elongation shall be calculated using this formula: Elongation, in = 56t + 17.5, rounded to the nearest percent.

<sup>B</sup> Applies to specified wall thicknesses of 0.180 in [4.57 mm] and over. For wall thicknesses under 0.180 in [4.57 mm], the minimum elongation shall be calculated using this formula: Elongation, in = 61t + 12, rounded to the nearest percent.

<sup>C</sup> Applies to specified wall thicknesses of 0.120 in [3.05 mm] and over. For wall thicknesses under 0.120 in [3.05 mm], the minimum elongation shall be subject to agreement between the manufacturer and purchaser.

TABLE 3 Mechanical Requirements of Shaped Structural Tubing

Designation	Yield Strength, min, ksi [MPa]	Tensile Strength, min, ksi [MPa]	Elongation in 2 in. [50 mm], min, %
Grade 39 [270]	39 [270]	45 [310]	25 <sup>A</sup>
Grade 46 [315]	46 [315]	58 [400]	23 <sup>B</sup>
Grade 50 [345]	50 [345]	62 [425]	21 <sup>C</sup>

<sup>A</sup> Applies to specified wall thicknesses (t) of 0.120 in [3.05 mm] and over. For wall thicknesses under 0.120 in [3.05 mm], the minimum elongation shall be calculated using this formula: Elongation, in = 56t + 17.5, rounded to the nearest percent.

<sup>B</sup> Applies to specified wall thicknesses of 0.180 in [4.57 mm] and over. For wall thicknesses under 0.180 in [4.57 mm], the minimum elongation shall be calculated using this formula: Elongation, in = 61t + 12, rounded to the nearest percent.

<sup>C</sup> Applies to specified wall thicknesses of 0.120 in [3.05 mm] and over. For wall thicknesses under 0.120 in [3.05 mm], the minimum elongation shall be subject to agreement between the manufacturer and purchaser.

3.2.1 *de-dimpled, adj*—the condition of the end of tubing after removal of the protrusion or deformation created by the punch cut operation.

#### 3.2.1.1 Discussion—

The dimple is a protrusion that is displaced from the inside diameter and is unrelated to a shear burr.

#### 3.2.2 structural tubing, n—tubing tension tested with reported test results.

#### 4. Product Size

4.1 The standard covers products available in the following sizes:

Product	Wall Thickness, max	Exterior Dimension, max
Round Tubing	0.25 in. [6.35 mm]	Diameter – 5 in. [130 mm]
Square, Rectangular, or Special Shapes	0.25 in. [6.35 mm]	Periphery – 16 in. [405 mm]

#### 5. Classification

5.1 The finished tube is available in the following designations:

5.1.1 Round structural tubing steel grade with minimum yield strength 33 ksi [230 MPa], 42 ksi [290 MPa], and 46 ksi [315 MPa] in the finished tube.

5.1.2 Shaped structural tubing steel grade with minimum yield strength 39 ksi [270 MPa], 46 ksi [315 MPa], and 50 ksi [345 MPa] in the finished tube.

5.1.3 The finished tube is available as zinc-coated or 55% aluminum-zinc alloy-coated or zinc-5 % aluminum alloy-coated.

#### 6. Ordering Information

6.1 The ordered wall thickness of the tubing shall be the total of the base metal and the metallic coating.

6.2 Orders for product to this specification shall include the following information, as necessary, to adequately describe the desired product.

6.2.1 Steel grade designation,

6.2.2 Chemically treated or not chemically treated raw material,

6.2.3 Coating designation and type of coating,

6.2.4 Organic or inorganic coating if required,

6.2.5 Oiled or dry,

6.2.6 End condition,

6.2.6.1 Burrs removed if required,

6.2.7 Mill cut or de-dimpled end condition,

6.2.7.1 When the end finish is not specified, mill cut will be furnished,

6.2.8 Dimensions (show outside diameter and wall thickness for round tubing), (outside dimensions and wall thickness for square, rectangle, or special shapes), and length,

6.2.9 Quantity (length or weight),

6.2.10 Mill certification (if required),

6.2.11 End-use application, and

6.2.12 Recoating of outside diameter weld and heat-affected area of coating, if required.

#### 7. Coating Composition

7.1 For tubing produced from precoated steel sheet, the composition of the coating shall comply with the applicable specification.

7.1.1 Specification **A653/A653M** – Coating designation for galvanized steel sheet.

7.1.2 Specification **A792/A792M** – Coating designation for 55 % aluminum-zinc alloy coated steel sheet.

7.1.3 Specification **A875/A875M** – Coating designation for zinc-5 % aluminum alloy coated steel sheet.

#### 8. Chemical Composition

8.1 *Base Metal:*

8.1.1 The base metal shall be manufactured using the basic oxygen or electric furnace process.

8.1.2 The heat analysis shall conform to the requirements of **Table 1**.

#### 9. Mechanical Properties of Finished Tube

9.1 The precoated mechanical tubing shall conform to the mechanical properties of **Tables 2 and 3**.

9.2 Tests for mechanical properties shall be conducted in accordance with the methods specified in Specification **A924/A924M** except that the requirements of **A370** for the preparation of tubing-test specimen shall apply.

#### 10. Flattening Test

10.1 The integrity of the weld shall be determined in conjunction with the flattening test described in Specification **A500/A500M**. The flattening test shall be made on round structural tubing. A flattening test is not required for shaped structural tubing.