



Designation: **A787/A787M—09 A787/A787M – 14**

Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing¹

This standard is issued under the fixed designation A787/A787M; 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 round, square, rectangular, and special shape, electric-resistance-welded mechanical tubing, either zinc-coated (galvanized) after welding or produced from aluminum-coated, zinc-coated (galvanized), zinc-iron alloy-coated (galvannealed), or 55 % aluminum-zinc alloy-coated steel sheet. Tubing for use as electrical conduit (EMT) or intermediate metallic conduit (IMC) is not covered by this specification.

1.2 This specification covers mechanical tubing with outside diameters or maximum outside dimensions ranging from 1/2 to 15 in. [12.7 to 380.0 mm] and wall thickness from 0.028 to 0.180 in. [0.70 to 4.60 mm].

1.3 Sizes outside the ranges listed above may be ordered provided all other requirements of the specification are met.

1.4 This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order specifies the applicable M specification designation (SI units), the inch-pound units shall apply. The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards*:²

[A463/A463M Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process](#)

[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](#)

[A924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process](#)

[B6 Specification for Zinc](#)

3. Classification

3.1 The types of tubing covered by this specification are:

| Type Number | Code Letters | Description |
|-------------|--------------|--|
| 1 | AWAC | electric-resistance-welded aluminum-coated carbon steel mechanical tubing |
| 2 | AWG | electric-resistance-welded galvanized carbon steel mechanical tubing |
| 3 | AWPG | electric-resistance-welded carbon steel mechanical tubing, post-hot dipped galvanized |
| 4 | AWGA | electric-resistance-welded carbon steel mechanical tubing, zinc-iron alloy-coated (galvannealed) |
| 5 | AWGZ | electric-resistance-welded carbon steel mechanical tubing, 55 % aluminum-zinc alloy-coated |

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 A01.09 on Carbon Steel Tubular 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

4. Ordering Information

- 4.1 The ordered wall thickness of the tubing shall be the total of the base metal and the metallic coating.
- 4.2 Orders for material under this specification shall include the following:
- 4.2.1 Quantity (feet, metres, or number of lengths),
 - 4.2.2 Type, code letters, and description (Sections 1 and 3),
 - 4.2.3 Applicable ASTM designation number(s),
 - 4.2.4 Coating designation and type of coating,
 - 4.2.5 Chemically treated or not chemically treated raw material,
 - 4.2.6 Oiled or dry (Section 16),
 - 4.2.7 Extra smooth coating (if required),
 - 4.2.8 Customer application, including fabrication,
 - 4.2.9 Flash condition (7.1),
 - 4.2.10 Steel grade designation (Sections 5 and 9),
 - 4.2.11 Report of chemical analysis if required (Sections 10 and 11),
 - 4.2.12 Shape (round, square, rectangular, or special),
 - 4.2.12.1 Dimensions: round—any two of the following: inside diameter, outside diameter, or wall thickness; square or rectangular—outside dimension, wall thickness, and corner radii, if required. (See 12.1 and 13.1 and 13.2.)
 - 4.2.13 Length: round tubing—mill lengths or definite cut lengths (see 12.2); square and rectangular tubing—mill cut lengths and specified length (see 13.4).
 - 4.2.14 Squareness of cut: round tubing, if required (see 12.3); square and rectangular tubing, if required (see 13.7),
 - 4.2.15 Burrs removed, if required (see 15.2),
 - 4.2.16 Special packaging (Section 19),
 - 4.2.17 Customer specification number, if applicable,
 - 4.2.18 Special requirements,
 - 4.2.19 Special marking (Section 18), and
 - 4.2.20 Recoating of outside diameter weld and heat-affected area, on precoated steel, if required.

5. Process

- 5.1 The steel shall be made from any process.
- 5.1.1 If a specific type of melting is required by the purchaser, it shall be stated on the purchase order.
 - 5.1.2 The primary melting may incorporate separate degassing or refining and may be followed by secondary melting, using electroslag remelting or vacuum remelting. If secondary melting is employed, the heat shall be defined as all of the ingots remelted from a single primary heat.
 - 5.1.3 Steel may be cast in ingots or may be strand cast. When steel of different grades is sequentially strand cast, identification of the resultant transition material is required. The producer shall remove the transition material by an established procedure that positively separates the grades.
- 5.2 For tubing produced from precoated steel sheet, the composition of the coating shall comply with the applicable specification.
- 5.2.1 *Specification A463/A463M*—Coating designation for aluminum coated-sheet.
 - 5.2.2 *Specification A653/A653M*—Coating designation for galvanized and galvanized steel sheet.
 - 5.2.3 *Specification A792/A792M*—Coating designation for 55 % aluminum-zinc alloy-coated steel sheet.
 - 5.2.4 Other grades of coated steel sheet, as listed in **Table 1** and **Table 2**, may be used as the precoated material for the steel tubing upon agreement between the manufacturer and the purchaser. Such steel sheet shall meet the requirements of *Specification A463/A463M, A653/A653M, A792/A792M, and A924/A924M*, except for the chemical requirements.

6. Manufacture

- 6.1 Tubes shall be made by the electric-resistance welding process and shall be made from hot or cold-rolled precoated steel-steel except for Type 3.
- 6.1.1 The weld shall not be located within the radius of the corners of any shaped tube unless specified by the purchaser.
- 6.2 Special manufacturing practices allow for post-hot dipped galvanizing of welded tubing. If this product is desired all sections of this specification will apply except **Tables 3 and 4** **Table 3**. Wall thickness tolerances shall be determined by agreement between the producer and purchaser.

7. Flash Conditions

- 7.1 The flash conditions under which tubing may be furnished are as follows: The flash shall be removed from the outside diameter of tubing covered by this specification. Tubing furnished to this specification may have the following conditions of welding flash on the inside diameter.

TABLE 1 Chemical Requirements for Low-Carbon Steels^{A, B}

| Grade Designation ^C | Composition, % | | | |
|--------------------------------|----------------|--------------|-----------------|-------------|
| | Carbon | Manganese | Phosphorus, max | Sulfur, max |
| MT1010 | 0.05 to 0.15 | 0.30 to 0.60 | 0.035 | 0.035 |
| MT1015 | 0.10 to 0.20 | 0.30 to 0.60 | 0.035 | 0.035 |
| MTX1015 | 0.10 to 0.20 | 0.60 to 0.90 | 0.035 | 0.035 |
| MT1020 | 0.15 to 0.25 | 0.30 to 0.60 | 0.035 | 0.035 |
| MTX1020 | 0.15 to 0.25 | 0.70 to 1.00 | 0.035 | 0.035 |

^A Rimmed or capped steels that may be used for the above grades are characterized by a lack of uniformity in their chemical composition, and for this reason product analysis is not technologically appropriate unless misapplication is clearly indicated.

^B Chemistry represents heat analysis. Product analysis, except for rimmed or capped steel, is to be in accordance with usual practice as shown in Table 7.

^C The letters MT indicate mechanical tubing.

TABLE 2 Chemical Requirements for Other Carbon Steels^A

| Grade Designation | Composition, % | | | |
|-------------------|----------------|--------------|-----------------|-------------|
| | Carbon | Manganese | Phosphorus, max | Sulfur, max |
| 1008 | 0.10 max | 0.50 | 0.035 | 0.035 |
| 1010 | 0.08 to 0.13 | 0.30 to 0.60 | 0.035 | 0.035 |
| 1015 | 0.12 to 0.18 | 0.30 to 0.60 | 0.035 | 0.035 |
| 1016 | 0.12 to 0.19 | 0.60 to 0.90 | 0.035 | 0.035 |
| 1017 | 0.14 to 0.21 | 0.30 to 0.60 | 0.035 | 0.035 |
| 1018 | 0.14 to 0.21 | 0.60 to 0.90 | 0.035 | 0.035 |
| 1019 | 0.14 to 0.21 | 0.70 to 1.00 | 0.035 | 0.035 |
| 1021 | 0.17 to 0.24 | 0.60 to 0.90 | 0.035 | 0.035 |

^A Chemistry represents heat analysis. Product analysis, except for rimmed or capped steel, is to be in accordance with usual practice as shown in Table 7.

7.1.1 *Flash-In*—All tubing in which the inside diameter welding flash does not exceed the wall thickness or $\frac{3}{32}$ in. [2.38 mm], whichever is less.

7.1.2 *Flash Controlled to 0.010 in. [0.25 mm], Maximum*—Tubing in which the height of the remaining welding flash is controlled so as not to exceed 0.010 in. [0.25 mm]. This condition is available in over 0.750 in. [19.0 mm] outside diameter and gages/gauges consistent with Tables 5 and 6.

7.1.3 *Flash Controlled to 0.005 in. [0.13 mm], Maximum*—When the inside diameter flash is controlled to 0.005 in. [0.13 mm] maximum in tubing produced to outside diameter and wall thickness, inside diameter and wall thickness, or outside diameter and inside diameter tolerances, the remaining inside diameter flash, if any, is part of the applicable inside diameter tolerance. This controlled flash is available in 0.750 in. [19.0 mm] outside diameter or greater.

7.2 Tubes shall be furnished in the following shapes, as specified by the purchaser: round, square, rectangular, or special shapes (as negotiated).

7.3 Recoating of the outside diameter weld-heat-affected area on precoated steel tubing may be performed at the manufacture's option, if not specifically requested by the purchaser.

8. Surface Finish

8.1 Special surface finishes as may be required for specific applications shall be provided in the purchase order by agreement between the producer and purchaser.

9. Base Metal Chemical Composition

9.1 The chemical composition of the sheet steel base metal shall conform to the requirements of Table 1.

9.2 Copper-bearing steel, with 0.20 % minimum copper, may be ordered in any of the grades shown in Table 1 or Table 2.

9.3 An analysis of each heat of steel shall be made by the basic steel producer to determine the percentage of the elements specified. The heat analysis, as supplied by the steel melter, shall conform to the requirements of Table 1 or Table 2.

9.4 When a grade is ordered under this specification, supplying an alloy grade that specifically requires the addition of any element other than those listed for the ordered grade in Table 1 and Table 2 is not permitted.

**TABLE 3 Wall Thickness Tolerance for Premetallic Coated As-Welded Tubing^A (inch-pound units)
Outside Diameter, in.**

| Wall Thickness BWG ^B | ½ to 1, incl | | Over 1 to 1 1/16, incl | | Over 1 1/16 to 3/4, incl | | Over 3/4 to 4 1/2, incl | | Over 4 1/2 to 6, incl | | Over 6 to 8, incl | | Over 8 to 10, incl | | Over 10 to 12, incl | | Over 12 to 15, incl | | | |
|------------------------------------|--------------|-------|---------------------------|-------|-----------------------------|-------|----------------------------|-------|--------------------------|-------|----------------------|-------|-----------------------|-------|------------------------|-------|------------------------|-------|-------|-------|
| | in. | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | |
| 22 | 0.028 | 0.002 | 0.006 | 0.002 | 0.006 | | | | | | | | | | | | | | | |
| 20 | 0.035 | 0.003 | 0.006 | 0.002 | 0.006 | 0.002 | 0.006 | | | | | | | | | | | | | |
| 18 | 0.049 | 0.004 | 0.007 | 0.003 | 0.008 | 0.003 | 0.008 | | | | | | | | | | | | | |
| 16 | 0.065 | 0.005 | 0.007 | 0.004 | 0.008 | 0.003 | 0.009 | 0.003 | 0.009 | 0.002 | 0.010 | 0.002 | 0.010 | 0.002 | 0.010 | 0.002 | 0.010 | 0.002 | 0.010 | 0.010 |
| 14 | 0.083 | 0.006 | 0.008 | 0.006 | 0.008 | 0.005 | 0.009 | 0.005 | 0.009 | 0.004 | 0.010 | 0.004 | 0.010 | 0.003 | 0.011 | 0.003 | 0.011 | 0.003 | 0.011 | 0.011 |
| 13 | 0.095 | 0.008 | 0.010 | 0.008 | 0.010 | 0.007 | 0.011 | 0.007 | 0.011 | 0.006 | 0.012 | 0.006 | 0.012 | 0.004 | 0.014 | 0.004 | 0.014 | 0.004 | 0.014 | 0.014 |
| 12 | 0.109 | 0.008 | 0.010 | 0.008 | 0.010 | 0.007 | 0.011 | 0.007 | 0.011 | 0.006 | 0.012 | 0.006 | 0.012 | 0.004 | 0.014 | 0.004 | 0.014 | 0.004 | 0.014 | 0.014 |
| 11 | 0.120 | 0.009 | 0.011 | 0.009 | 0.011 | 0.008 | 0.012 | 0.008 | 0.012 | 0.007 | 0.013 | 0.007 | 0.013 | 0.004 | 0.016 | 0.004 | 0.016 | 0.004 | 0.016 | 0.016 |
| 10 | 0.134 | 0.009 | 0.011 | 0.009 | 0.011 | 0.008 | 0.012 | 0.008 | 0.012 | 0.007 | 0.013 | 0.007 | 0.013 | 0.004 | 0.016 | 0.004 | 0.016 | 0.004 | 0.016 | 0.016 |
| 9 | 0.148 | | | 0.009 | 0.012 | 0.008 | 0.012 | 0.008 | 0.012 | 0.007 | 0.013 | 0.007 | 0.013 | 0.006 | 0.014 | 0.006 | 0.014 | 0.006 | 0.014 | 0.014 |
| 8 | 0.165 | | | 0.009 | 0.012 | 0.008 | 0.012 | 0.008 | 0.012 | 0.007 | 0.013 | 0.007 | 0.013 | 0.006 | 0.014 | 0.006 | 0.014 | 0.006 | 0.014 | 0.014 |
| 7 | 0.180 | | | 0.009 | 0.012 | 0.008 | 0.012 | 0.008 | 0.012 | 0.007 | 0.013 | 0.007 | 0.013 | 0.006 | 0.014 | 0.006 | 0.014 | 0.006 | 0.014 | 0.014 |

^A Post-hot dipped galvanized welded tubing wall thickness tolerances shall be determined by agreement between the producer and purchaser (6.2).

^B Birmingham Wire Gauge-Gauge.



**TABLE 4 Wall Thickness Tolerance for Premetallic Coated As-Welded Tubing^A (SI Units)
Outside Diameter, mm**

| Wall Thickness mm | 13 to 25, incl | | Over 25 to 50, incl | | Over 50 to 100, incl | | Over 100 to 150, incl | | Over 150 to 200, incl | | Over 200 to 250, incl | | Over 250 to 375, incl | |
|----------------------|----------------|-------|---------------------|-------|----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|
| | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus | Plus | Minus |
| 1.0 | 0.04 | 0.08 | 0.08 | 0.20 | 0.08 | 0.20 | | | | | | | | |
| 1.5 | 0.10 | 0.18 | 0.10 | 0.15 | 0.08 | 0.23 | 0.05 | 0.25 | 0.05 | 0.25 | 0.05 | 0.25 | | |
| 2.0 | 0.15 | 0.20 | 0.15 | 0.20 | 0.13 | 0.23 | 0.10 | 0.25 | 0.10 | 0.25 | 0.10 | 0.25 | 0.08 | 0.28 |
| 2.5 | 0.20 | 0.25 | 0.20 | 0.25 | 0.18 | 0.28 | 0.15 | 0.30 | 0.15 | 0.30 | 0.10 | 0.30 | 0.10 | 0.35 |
| 3.0 | 0.22 | 0.27 | 0.23 | 0.28 | 0.20 | 0.30 | 0.18 | 0.33 | 0.18 | 0.33 | 0.10 | 0.40 | 0.10 | 0.40 |
| 3.5 | 0.23 | 0.28 | 0.23 | 0.28 | 0.20 | 0.30 | 0.18 | 0.33 | 0.18 | 0.33 | 0.10 | 0.40 | 0.10 | 0.40 |
| 4.0 | | | 0.23 | 0.30 | 0.20 | 0.30 | 0.18 | 0.33 | 0.18 | 0.33 | 0.15 | 0.40 | 0.15 | 0.40 |
| 4.5 | | | 0.23 | 0.30 | 0.20 | 0.30 | 0.18 | 0.33 | 0.18 | 0.33 | 0.15 | 0.40 | 0.15 | 0.40 |

^APost-hot dipped galvanized welded tubing wall thickness tolerances shall be determined by agreement between the producer and purchaser (6.2).





TABLE 5 Diameter Tolerances for Metallic-Coated Round Tubing (inch-pound units)

| Outside Diameter Range, Range ^F , in. | Wall Thickness | | Tubing with Any Inside Flash Condition | Flash-Controlled to 0.005 in. Tubing Only ^A |
|---|------------------|-------------|---|--|
| | BWG ^B | in. | Outside ^{C,D} Diameter, Plus and Minus | Inside Diameter, Plus and Minus |
| Tolerances, in. ^E | | | | |
| ½ to 1⅛, incl | 22 to 16 | 0.028/0.065 | 0.0035 | 0.019 |
| Over 1⅛ to 2, incl | 22 to 14 | 0.028/0.083 | 0.005 | 0.021 |
| Over 1⅛ to 2, incl | 13 to 10 | 0.095/0.134 | 0.005 | 0.027 |
| Over 2 to 2½, incl | 20 to 14 | 0.035/0.083 | 0.006 | 0.023 |
| Over 2 to 2½, incl | 13 to 10 | 0.095/0.134 | 0.006 | 0.029 |
| Over 2½ to 3, incl | 20 to 14 | 0.035/0.083 | 0.008 | 0.025 |
| Over 2½ to 3, incl | 13 to 10 | 0.095/0.134 | 0.008 | 0.031 |
| Over 3 to 3½, incl | 20 to 14 | 0.035/0.083 | 0.009 | 0.026 |
| Over 3 to 3½, incl | 13 to 10 | 0.095/0.134 | 0.009 | 0.032 |
| Over 3½ to 4, incl | 20 to 14 | 0.035/0.083 | 0.010 | 0.027 |
| Over 3½ to 4, incl | 13 to 10 | 0.095/0.134 | 0.010 | 0.033 |
| Over 4 to 5, incl | 16 to 14 | 0.065/0.083 | 0.020 | 0.037 |
| Over 4 to 5, incl | 13 to 10 | 0.095/0.134 | 0.020 | 0.043 |
| Over 5 to 6, incl | 16 to 14 | 0.065/0.083 | 0.020 | 0.037 |
| Over 5 to 6, incl | 13 to 10 | 0.095/0.134 | 0.020 | 0.043 |
| Over 6 to 8, incl | 16 to 10 | 0.065/0.134 | 0.025 | 0.048 |
| Over 6 to 8, incl | 9 to 7 | 0.148/0.180 | 0.025 | 0.059 |
| Over 8 to 10, incl | 16 to 10 | 0.065/0.134 | 0.030 | 0.043 |
| Over 8 to 10, incl | 9 to 7 | 0.148/0.180 | 0.030 | 0.059 |
| Over 10 to 12, incl | 16 to 10 | 0.065/0.134 | 0.035 | 0.041 |
| Over 10 to 12, incl | 9 to 7 | 0.148/0.180 | 0.035 | 0.045 |
| Over 12 to 15, incl | 12 to 10 | 0.109/0.134 | 0.040 | 0.058 |
| Over 12 to 15, incl | 9 to 7 | 0.148/0.180 | 0.040 | 0.060 |

^A Flash controlled to 0.005 in. maximum tubing is produced to outside diameter tolerances and wall thickness tolerances, inside diameter tolerances and wall thickness tolerances, or outside diameter tolerances and inside diameter tolerances, in which the height of the remaining inside welding flash is controlled not to exceed 0.005 in. Any remaining flash is considered to be part of the applicable inside diameter tolerances.

^B Birmingham Wire Gage-Gauge.

^C Flash-in tubing is produced to outside diameter tolerances and wall thickness tolerances only, and the height of the inside welding flash does not exceed the wall thickness or ⅜ in., whichever is less.

^D Flash controlled to 0.010 in. maximum tubing consists of tubing over ⅝ in. outside diameter which is commonly produced to outside diameter tolerances and wall thickness tolerances only, in which the height of the remaining inside welding flash is controlled not to exceed 0.010 in.

^E The ovality shall be within the above tolerances except when the wall thickness is less than 3 % of the outside diameter, in which cases see 12.5.

^F Measured at least 2 in. from the cut end of the tubing.

10. Coating Bath Chemical Composition

10.1 When tubing is produced from precoated sheet steel, the tubing manufacturer shall furnish, upon request, a report stating that the tubing has been manufactured from precoated sheet steel meeting one of the following specifications: A463/A463M, A653/A653M, A792/A792M, and A924/A924M.

10.2 For post-coated tubing the zinc used for coating shall be any grade of zinc conforming to Specification B6.

11. Product Analysis

11.1 When requested on the purchase order, a product analysis shall be made by the supplier. The number and source of samples for a product analysis shall be based on the individual heat or lot identity of one of the following forms:

11.1.1 *Heat Identity Maintained*—One product analysis per heat shall be made on either the flat-rolled stock or tube.

11.1.2 *Heat Identity Not Maintained*—One product analysis shall be made from each 2000 ft [600 m] or fraction thereof for sizes over 3 in. [75 mm] outside diameter, and from each 5000 ft [1525 m] or fraction thereof for sizes 3 in. [75 mm] outside diameter and under.