



Designation: A512/A512M – 24

# Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing<sup>1</sup>

This standard is issued under the fixed designation A512/A512M; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This specification covers cold-drawn furnace-buttweld carbon steel tubes for use as mechanical tubing.

1.2 This specification covers round, square, rectangular, and special shape mechanical tubing.

1.3 Round tube size ranges covered are outside diameters up to 3 1/2 in. [90 mm] and wall thickness from 0.035 to 0.500 in. [0.89 to 12.70 mm].

1.4 Optional supplementary requirements are provided and, when desired, shall be so stated in the order.

1.5 This product is available in various grades (Section 7 Tables 1 and 2 and conditions (Section 6).

1.6 *Units*—This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order or contract specifies the applicable M specification designation (SI units), the inch-pound units shall apply. The values stated in either inch-pound units or SI 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 nonconformance with the standard. The values stated in inch-pound units are to be regarded as standard. The values given in brackets are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 *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.*

<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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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A751 Test Methods and Practices for Chemical Analysis of Steel Products

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A1040 Guide for Specifying Harmonized Standard Grade Compositions for Wrought Carbon, Low-Alloy, and Alloy Steels

A1058 Test Methods for Mechanical Testing of Steel Products—Metric

### 2.2 Military Standards:<sup>3</sup>

MIL-STD-129 Marking for Shipment and Storage

### 2.3 Federal Standard:

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)<sup>3</sup>

## 3. Terminology

3.1 *Definitions of Terms*—See Terminology A941 for general steel terminology, Test Methods and Definitions A370 or Test Methods A1058 for mechanical testing of steel products terminology, and Test Methods and Practices A751 for chemical analysis of steel products terminology.

## 4. Ordering Information

4.1 Orders for material under this specification should include the following, as required, to describe the required material adequately:

4.1.1 Quantity (feet [meters], weight [mass] (Note 1), or number of lengths),

NOTE 1—The term “weight” is temporarily used in this specification because of established trade usage. The word is used to mean both “force” and “mass,” and care must be taken to determine which is meant in each case (SI unit for force = newton and for mass = kilogram).

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

<sup>3</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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

**TABLE 1 Chemical Requirements<sup>A</sup>**

| Grade Designation | Chemical Composition Limits, % |           |                 |             |
|-------------------|--------------------------------|-----------|-----------------|-------------|
|                   | Carbon                         | Manganese | Phosphorus, max | Sulfur, max |
| MT 1010           | 0.05–0.15                      | 0.30–0.60 | 0.04            | 0.045       |
| MT 1015           | 0.10–0.20                      | 0.30–0.60 | 0.04            | 0.045       |
| MT X 1015         | 0.10–0.20                      | 0.60–0.90 | 0.04            | 0.045       |
| MT 1020           | 0.15–0.25                      | 0.30–0.60 | 0.04            | 0.045       |
| MT X 1020         | 0.15–0.25                      | 0.70–1.00 | 0.04            | 0.045       |

<sup>A</sup> Rimmed or capped steels which 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.

**TABLE 2 Chemical Requirements for Other Carbon Grades<sup>A</sup>**

| Grade Designation <sup>B</sup> | Chemical Composition Limits, % |           |                 |                    |
|--------------------------------|--------------------------------|-----------|-----------------|--------------------|
|                                | Carbon                         | Manganese | Phosphorus, max | Sulfur, max        |
| 1008                           | 0.10 max                       | 0.30–0.50 | 0.040           | 0.045              |
| 1010                           | 0.08–0.13                      | 0.30–0.60 | 0.040           | 0.045              |
| 1012                           | 0.10–0.15                      | 0.30–0.60 | 0.040           | 0.045              |
| 1015                           | 0.13–0.18                      | 0.30–0.60 | 0.040           | 0.045              |
| 1016                           | 0.13–0.18                      | 0.60–0.90 | 0.040           | 0.045              |
| 1018                           | 0.15–0.20                      | 0.60–0.90 | 0.040           | 0.045              |
| 1019                           | 0.15–0.20                      | 0.70–1.00 | 0.040           | 0.045              |
| 1020                           | 0.18–0.23                      | 0.30–0.60 | 0.040           | 0.045              |
| 1021                           | 0.18–0.23                      | 0.60–0.90 | 0.040           | 0.045              |
| 1025                           | 0.22–0.28                      | 0.30–0.60 | 0.040           | 0.045              |
| 1026                           | 0.22–0.28                      | 0.60–0.90 | 0.040           | 0.045              |
| 1030                           | 0.28–0.34                      | 0.60–0.90 | 0.040           | 0.045              |
| 1035                           | 0.32–0.38                      | 0.60–0.90 | 0.040           | 0.045              |
| 1110                           | 0.08–0.13                      | 0.30–0.60 | 0.040           | 0.130 <sup>C</sup> |
| 1115                           | 0.13–0.20                      | 0.60–0.90 | 0.040           | 0.130 <sup>C</sup> |
| 1117                           | 0.14–0.20                      | 1.00–1.30 | 0.040           | 0.130 <sup>C</sup> |

<sup>A</sup> Rimmed or capped steels which 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.

<sup>B</sup> Other analyses are available.

<sup>C</sup> Grades 1110, 1115, and 1117 shall contain 0.08 min % sulfur.

4.1.2 Name of material (furnace-buttweld carbon steel mechanical tubing),

4.1.3 Form (round, square, rectangular, special shape),

4.1.4 Condition, description and code letters (Section 6),

4.1.5 Grade, if required (Section 7),

4.1.6 Dimensions (round, Section 10 or square and rectangular, Section 11),

4.1.7 Length (round length, 10.2; square and rectangular length, 11.5),

4.1.8 Burr removal (Section 12),

4.1.9 Report of chemical analysis and products analysis, if required,

4.1.10 Individual supplementary requirements if required (S1 through S5),

4.1.11 Special requirements,

4.1.12 End use,

4.1.13 Specification designation,

4.1.14 Special marking (Section 16), and

4.1.15 Special packaging (Section 17).

## 5. Materials and Manufacture

5.1 The steel shall be made by any process.

5.2 If a specific type of melting is required by the purchaser, it shall be as stated on the purchase order.

5.3 The primary melting may incorporate separate degassing or refining, and may be followed by secondary melting, such as electroslog or vacuum-arc remelting. If secondary melting is employed, the heat shall be defined as all of the ingots remelted from a single primary heat.

5.4 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.

5.5 Tubes shall be made by the furnace buttweld process.

5.6 Tubes shall be cold finished, either externally only (sunk) or externally and internally (drawn over a mandrel).

## 6. Condition

6.1 The purchaser shall specify in the order one of the following conditions:

DOM (Drawn Over a Mandrel)—No final thermal treatment

SD (Sink Drawn)—No final thermal treatment

DOMSR—Drawn Over a Mandrel and Stress Relieved

SDSR—Sink Drawn and Stress Relieved

DOMSA—Drawn Over a Mandrel and Soft Annealed or normalized

SDSA—Sink Drawn and Soft Annealed or normalized

NORM-DOM-SR—Normalized, Drawn Over a Mandrel, and Stress Relieved

NORM-SD-SR—Normalized, Sink Drawn, and Stress Relieved

## 7. Chemical Composition

7.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 1 or Table 2 (see Specification A1040) and Table 3.

7.2 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 or Table 2 is not permitted.

## 8. Heat Analysis

8.1 An analysis of each heat of steel shall be made by the steel manufacturer to determine the percentages of the elements specified; if secondary melting processes are used, the

**TABLE 3 Tolerances for Product Analysis for Steels Shown in Table 1**

| Element    | Limit, or Maximum of Specified Range, % | Variation, Over Maximum Limit or Under Minimum Limit |              |
|------------|-----------------------------------------|------------------------------------------------------|--------------|
|            |                                         | Under min, %                                         | Over max, %  |
| Carbon     | To 0.15, incl<br>Over 0.15              | 0.02<br>0.03                                         | 0.03<br>0.04 |
| Manganese  | To 0.60, incl<br>Over 0.60              | 0.03<br>0.04                                         | 0.03<br>0.04 |
| Phosphorus | ...                                     | ...                                                  | 0.01         |
| Sulfur     | ...                                     | ...                                                  | 0.01         |