



Designation: **A595/A595M – 14** **A595/A595M – 18**

## Standard Specification for Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use<sup>1</sup>

This standard is issued under the fixed designation A595/A595M; 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 three grades of seam-welded, round, tapered steel tubes for structural use. Grades A and B are of low-carbon steel or high-strength low-alloy steel composition and Grade C is of weather-resistant steel composition.

1.1.1 The product may be modified from its round cross section into other shapes without subsequent retesting.

1.2 This tubing is produced in welded sizes in a range of diameters from 2  $\frac{3}{8}$  to 30 in. [60 to 762 mm] inclusive. Wall thicknesses range from 0.1046 to 0.375 in. [2.66 to 9.53 mm]. Tapers are subject to agreement with the manufacturer.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used ~~independently~~independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 *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>

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A588/A588M Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi \[345 MPa\] Minimum Yield Point, with Atmospheric Corrosion Resistance](#)

[A606/A606M Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance](#)

[A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products](#)

[G101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels](#)

### 3. Ordering Information

3.1 The inquiry and order should indicate the following:

3.1.1 Large and small diameters (in.) [mm], length (ft) [m], wall thickness (in.) [mm], taper (in./ft) [mm/m];

3.1.2 (see [Table 1](#) and [Table 2](#));

3.1.3 Extra test material requirements, if any; and

3.1.4 Supplementary requirements, if any.

### 4. General Requirements for Delivery

4.1 Required date of shipment or date of receipt, and

4.2 Special shipping instructions, if any.

<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](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.

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

**TABLE 1 Chemical Requirements**

Elements	Composition by Heat Analysis, %												
	Grade A				Grade B				Grade C				
	Carbon Steel	HSLA SS	HSLAS C11	HSLAS C12	Carbon Steel	HSLA SS	HSLAS C11	HSLAS C12	A 606	A 588/A	A 588/B	A 588/C	A 588/K
Carbon	0.15–0.25	0.25 max	0.23 max	0.15 max	0.15–0.25	0.25 max	0.26 max	0.15 max	0.22 max	0.19 max	0.20 max	0.15 max	0.17 max
Manganese	0.30–0.90	1.35 max	1.35 max	1.35 max	0.40–1.35	1.35 max	1.50 max	1.50 max	1.25 max	0.80–1.25	0.75–1.35	0.80–1.35	0.50–1.20
Phosphorous	0.035 max	0.035 max	0.04 max	0.04 max	0.035 max	0.035 max	0.04 max	0.04 max	<sup>A</sup>	0.04 max	0.04 max	0.04 max	0.04 max
Sulfur	0.035 max	0.04 max	0.04 max	0.04 max	0.035 max	0.04 max	0.04 max	0.04 max	0.04 max	0.05 max	0.05 max	0.05 max	0.05 max
Silicon	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	0.060 max <sup>B</sup>	<sup>A</sup>	0.30–0.65	0.15–0.50	0.15–0.40	0.25–0.50
Copper <sup>C,D</sup>	...	0.20 max	0.20 max	0.20 max	...	0.20 max	0.20 max	0.20 max	<sup>A</sup>	0.25–0.40	0.20–0.40	0.20–0.50	0.30–0.50
Chromium <sup>C,E</sup>	...	0.15 max	0.15 max	0.15 max	...	0.15 max	0.15 max	0.15 max	<sup>A</sup>	0.40–0.65	0.40–0.70	0.30–0.50	0.40–0.70
Nickel <sup>C</sup>	...	0.20 max	0.20 max	0.20 max	...	0.20 max	0.20 max	0.20 max	<sup>A</sup>	0.40 max	0.50 max	0.25–0.50	0.40 max
Molybdenum <sup>C,E</sup>	...	0.06 max	0.06 max	0.06 max	...	0.06 max	0.06 max	0.06 max	...	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	0.10 max
Vanadium <sup>F</sup>	...	0.008 max	0.01 min	0.01 min	...	0.008 max	0.01 min	0.01 min	...	0.02–0.10	0.01–0.10	0.01–0.10	<sup>A</sup>
Columbium <sup>E</sup>	...	0.008 max	0.005 min	0.005 min	...	0.008 max	0.005 min	0.005 min	...	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	0.005–0.05
Niobium <sup>F,G</sup>	...	0.008 max	0.005 min	0.005 min	...	0.008 max	0.005 min	0.005 min	...	–	–	–	0.005–0.05
Nitrogen	...	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	...	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	...	...	...	...	...
Aluminum <sup>B</sup>	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	<sup>A</sup>	...	...	...	...	...

<sup>A</sup>There is no limit; however, the analysis shall be reported.

<sup>B</sup>Silicon or silicon in combination with aluminum must be sufficient to ensure uniform mechanical properties. Their sum shall be greater than or equal to 0.020 %.

<sup>C</sup>For HSLA steels the sum of copper, nickel, chromium, and molybdenum shall not exceed 0.50 % on heat analysis. When one of these elements are specified by the purchaser, the sum does not apply, in which case only the individual limits of the remaining elements shall apply.

<sup>D</sup>For HSLA steels when copper is specified, the copper limit is a minimum requirement. When copper steel is not specified, the copper limit is a maximum requirement.

<sup>E</sup>For SS steel the sum of chromium and molybdenum shall not exceed 0.16 % on heat analysis. When one or more of these elements are specified by the purchaser, the sum does not apply, in which case the individual limit on the remaining unspecified element shall apply.

<sup>F</sup>For HSLA steels vanadium and columbium/niobium minimums may be satisfied separately or by combining their values, in which event the sum shall exceed the combined minimums.

<sup>G</sup>Element 41 has been identified as columbium and niobium. A01 considers them interchangeable and both acceptable. Subcommittee A01.09 has chosen to use niobium.





TABLE 2 Tensile Requirements

	Grade A	Grade B	Grade C
Yield point, min, ksi [MPa]	55 [380]	60 [410]	60 [410]
Ultimate tensile strength, min, ksi [MPa]	65 [450]	70 [480]	70 [480]
Elongation in 2 in. [50 mm], min %	23	21	21

## 5. Manufacture

5.1 Tube steel shall be hot-rolled aluminum-semikilled or fine-grained killed sheet or plate manufactured by one or more of the following processes: open-hearth, basic-oxygen, or electric-furnace.

5.2 Tubes shall be made from trapezoidal sheet or plate that is preformed and then seam welded. Tubes shall be brought to final size and properties by roll compressing cold on a hardened mandrel.

## 6. Chemical Composition

6.1 Steel shall conform to the requirements for chemical composition given in Tables 1 and 3. Chemical analysis shall be in accordance with Test Methods, Practices, and Terminology A751.

6.2 For Grade C material, the atmospheric corrosion-resistance index, calculated on the basis of the chemical composition of the steel, as described in Guide G101, shall be 6.0 or higher.

NOTE 1—The user is cautioned that the Guide G101 predictive equation for calculation of an atmospheric corrosion-resistance index has been verified only for the composition limits stated in that guide.

6.3 When required by the purchase order, the manufacturer shall supply guidance concerning corrosion resistance that is satisfactory to the purchaser.

## 7. Mechanical Properties

### 7.1 Tension Test:

7.1.1 *Requirements*—The material, as represented by the test specimens, shall conform to the requirements as to tensile properties given in Table 2.

### 7.1.2 Number of Tests:

7.1.2.1 For coil—One or more tension tests as defined in Table 2 shall be made from the large end of one tube on each 100, or fewer, tubes produced from each coil in the applicable thickness class (see Table 4).

7.1.2.2 For plate—One or more tension tests as defined in Table 2 shall be made from the large end of one tube on a lot produced from a single heat of plate product of uniform thickness.

7.1.3 *Test Locations and Orientations*—Samples shall be taken at least 1 in. [25 mm] from the longitudinal seam weld.

### 7.1.4 Test Method:

7.1.4.1 Tension tests shall be made in accordance with Test Methods and Definitions A370. The yield strength corresponding to a permanent offset of 0.2 % of the gauge length of the specimen or to a total extension of 0.5 % of the gauge length under load shall be determined in accordance with Test Methods and Definitions A370.

7.1.4.2 The ultimate tensile strength shall be determined in accordance with the Tensile Strength of Test Methods and Definitions A370.

7.1.5 Each test shall be identified as to the heat number of the basic material.

## 8. Dimensions and Tolerances

8.1 *Length*—The length shall be the specified length with a tolerance of  $+3/4$  in. [19 mm] or  $-1/4$  in. [6 mm].

8.2 *Diameter*—The outside diameter shall conform to the specified dimensions with a tolerance of  $\pm 1/16$  in. [2 mm] as measured by girthing.

8.3 *Wall Thickness*—The tolerance for wall thickness exclusive of the weld area shall be +10 % or –5 % of the nominal wall thickness specified.

8.4 *Straightness*—The permissible variation for straightness of the tapered tube shall be 0.2 % or less of the total length.

## 9. Rework and Retreatment

9.1 In case any test fails to meet the requirements of Section 7, the manufacturer may elect to retreat, rework, or otherwise eliminate the condition responsible for failure to meet the specified requirements. Thereafter the material remaining from the respective class originally represented may be tested and shall comply with all requirements of this specification.