Designation: A 595/A 595M – 06

Standard Specification for Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use[1]

This standard is issued under the fixed designation A 595/A 595M; 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.

This standard has been approved for use by agencies of the 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.

1.2 This tubing is produced in welded sizes in a range of diameters from 2 ⅜ 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 indepedently 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]

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 588/A 588M Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance

A 606 Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

G 101 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.

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 A 751.

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 G 101, shall be 6.0 or higher.

NOTE 1—The user is cautioned that the Guide G 101 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.

[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.**

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TABLE 1 Chemical Requirements

Elements	Composition by Heat Analysis, %												
	Grade A				Grade B				Grade C				
	Carbon Steel	HSLA SS	HSLAS Cl1	HSLAS Cl2	Carbon Steel	HSLA SS	HSLAS Cl1	HSLAS Cl2	A 606	A 588/A	A 588/B	A 588/C	A 588/K
Carbon	0.015–0.25	0.25 max	0.23 max	0.15 max	0.015–0.25	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
Phosporous	0.035 max	0.035 max	0.04 max	0.04 max	0.035 max	0.035 max	0.04 max	0.04 max	[A]	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	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.040 max[B]	[A]	0.30–0.65	0.15–0.50	0.15–0.40	0.25–0.50
Copper[C,D]	...	0.20 max	0.20 max	0.20 max	...	0.20 max	0.20 max	0.20 max	[A]	0.25–0.40	0.20–0.40	0.20–0.50	0.30–0.50
Chromium[C,E]	...	0.15 max	0.15 max	0.15 max	...	0.15 max	0.15 max	0.15 max	[A]	0.40–0.65	0.40–0.70	0.30–0.50	0.40–0.70
Nickel[C]	...	0.20 max	0.20 max	0.20 max	...	0.20 max	0.20 max	0.20 max	[A]	0.40 max	0.50 max	0.25–0.50	0.40 max
Molybdenum[C,E]	...	0.06 max	0.06 max	0.06 max	...	0.06 max	0.06 max	0.06 max	...	[A]	[A]	[A]	0.10 max
Vanadium[F]	...	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	[A]
Columbium[F]	...	0.008 max	0.005 min	0.005 min	...	0.008 max	0.005 min	0.005 min	...	[A]	[A]	[A]	0.005–0.05
Nitrogen	...	[A]	[A]	[A]	...	[A]	[A]	[A]	...	...	...	...	...
Aluminum[B]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	...	...	...	...	...

[A]There is no limit; however, the analysis shall be reported.

[B]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 %.

[C]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.

[D]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.

[E]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.

[F]For HSLA steels vanadium and columbium minimums may be satisfied separately or by combining their values, in which event the sum shall exceed the combined minimums.

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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

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 A 370. The yield strength corresponding to a permanent offset of 0.2 % of the gage length of the specimen or to a total extension of 0.5% of the gage length under load shall be determined in accordance with Test Methods and Definitions A 370.

7.1.4.2 The ultimate tensile strength shall be determined in accordance with the Tensile Strength of Test Methods and Definitions A 370.

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 +¾ in. [19 mm] or −¼ in. [6 mm].

8.2 *Diameter*—The outside diameter shall conform to the specified dimensions with a tolerance of ±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.

9.2 Imperfections in the outer surface, such as cracks, scabs, or excessive weld projections, shall be classed as injurious defects when their depth or projection exceeds 15 % of the wall thickness or when the imperfections materially affect the appearance of the tube.

9.2.1 Injurious defects having a depth not in excess of 33⅓ % of the specified wall thickness may be repaired by welding subject to the following conditions: (*1*) scabs shall be completely removed by chipping or grinding to sound metal, and (*2*) the repair weld shall be made using suitable electrodes.

9.2.2 Excessive projected weld metal shall be removed to produce a commercial finish.

10. Inspection

10.1 Inspection of material shall be made as agreed upon between the purchaser and the seller as part of the purchase contract.

11. Rejection and Rehearing

11.1 Each length of tubing received from the manufacturer may be inspected by the purchaser, and if it does not meet the requirements of this specification based on the inspection and test method as outlined in the specification, the length may be rejected and the manufacturer shall be notified. Disposition of rejected tubing shall be a matter of agreement between the manufacturer and the purchaser.

11.2 Tubing found in fabrication or in installation to be unsuitable for the intended use, under the scope and requirements of this specification, may be set aside and the manufacturer notified. Such tubing shall be subject to mutual investigation as to the nature and severity of the deficiency and the forming or installation, or both, conditions involved. Disposition shall be a matter for agreement.

12. Certification and Reports

12.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification together with a report of the chemical and tension tests shall be furnished.

13. Product Marking

13.1 Each tapered tube shall be legibly marked by rolling, die stamping, ink printing, or paint stenciling to show the following information: thickness, taper, large diameter, small diameter, length, and the specification number, Grade A, B, or C.

13.2 *Bar Coding*—In addition to the requirements in 13.1, bar coding is acceptable as a supplemental identification method. The purchaser may specify in the order a specific bar coding system to be used.

14. Keywords

14.1 carbon steel tube; steel tube

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TABLE 3 Chemical Requirements

Elements	Composition by Product Analysis, %												
	Grade A				Grade B				Grade C				
	Carbon Steel	HSLA SS	HSLAS Cl1	HSLAS Cl2	Carbon Steel	HSLA SS	HSLAS Cl1	HSLAS Cl2	A 606	A 588/A	A 588/B	A 588/C	A 588/K
Carbon	0.012–0.29	0.29 max	0.27 max	0.18 max	0.012–0.29	0.29 max	0.29 max	0.18 max	0.26 max	0.23 max	0.24 max	0.18 max	0.21 max
Manganese	0.26–0.94	1.40 max	1.40 max	1.40 max	0.35–1.40	1.40 max	1.40 max	1.40 max	1.3 max	0.72–1.35	0.67–1.45	0.72–1.45	0.42–1.30
Phosphorous	0.045 max	0.045 max	0.05 max	0.05 max	0.45 max	0.45 max	0.05 max	0.05 max	[A]	0.05 max	0.05 max	0.05 max	0.05 max
Sulfur	0.045 max	0.05 max	0.05 max	0.05 max	0.45 max	0.05 max	0.05 max	0.05 max	0.06 max	0.06 max	0.06 max	0.06 max	0.06 max
Silicon	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.040 max[B]	0.40 max[B]	0.40 max[B]	0.40 max[B]	0.40 max[B]	[A]	0.25–0.70	0.15–0.60	0.13–0.43	0.20–0.55
Copper	...	0.22 max	0.22 max	0.22 max	...	0.22 max	0.22 max	0.22 max	[A]	0.22–0.43	0.17–0.43	0.17–0.53	0.27–0.53
Chromium	...	0.19 max	0.19 max	0.19 max	...	0.19 max	0.19 max	0.19 max	[A]	0.36–0.69	0.36–0.74	0.26–0.54	0.36–0.74
Nickel	...	0.23 max	0.23 max	0.23 max	...	0.23 max	0.23 max	0.23 max	[A]	0.43 max	0.53 max	0.22–0.53	0.43 max
Molybdenum	...	0.07 max	0.07 max	0.07 max	...	0.07 max	0.07 max	0.07 max	...	[A]	[A]	[A]	0.11 max
Vanadium[C]	...	0.018 max	0.00 min	0.00 min	...	0.018 max	0.00 min	0.00 min	...	0.01–0.11	0.00–0.11	0.00–0.11	[A]
Columbium[C]	...	0.018 max	0.00 min	0.00 min	...	0.018 max	0.00 min	0.00 min	...	[A]	[A]	[A]	0.055 max
Nitrogen	...	[A]	[A]	[A]	...	[A]	[A]	[A]	...	...	...	...	...
Aluminum[B]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	...	...	...	...	...

[A] There is no limit; however, the analysis shall be reported.
[B] 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 %.
[C] For HSLA steels vanadium and columbium minimums may be satisfied separately or by combining their values, in which event the sum shall exceed the combined minimums.

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TABLE 4 Thickness Class

Class	Thickness	
	in.	mm
1	0.1046 through 0.140	2.66 through 3.56
2	0.141 through 0.190	3.58 through 4.83
3	0.191 through 0.280	4.85 through 7.11
4	0.281 through 0.375	7.14 through 9.53

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this specification since the last issue, A 595 – 04a, that may impact the use of this specification. (Approved March 1, 2006)

(*1*) Revised Sections 1, 3, 7, and 8 to include rationalized SI units, creating a combined standard.

(*2*) Revised the SI Yield point in Table 2 to 425 MPa, SI elongation to [50 mm], and elongation to whole numbers, not tenths of a percent.

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