



Designation: A519/A519M – 23

Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing¹

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1. Scope*

1.1 This specification covers several grades of carbon and alloy steel seamless mechanical tubing. The grades are listed in [Tables 1-3](#). When welding is used for joining the weldable mechanical tube grades, the welding procedure shall be suitable for the grade, the condition of the components, and the intended service.

1.2 This specification covers both seamless hot-finished mechanical tubing and seamless cold-finished mechanical tubing in sizes up to and including 12 $\frac{3}{4}$ in. [325 mm] outside diameter for round tubes with wall thicknesses as required.

1.3 The tubes shall be furnished in the following shapes, as specified by the purchaser: round, square, rectangular, and special sections.

1.4 Supplementary requirements of an optional nature are provided and when desired shall be so stated in the order.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. Within the text, the SI units are shown in brackets or parentheses. 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. The inch-pound units shall apply unless the “M” designation of this specification is specified in the order. In this specification hard or rationalized conversions apply to diameter, lengths and tensile properties. Soft conversion applies to other SI measurements.

1.6 *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.*

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. Referenced Documents

2.1 ASTM Standards:²

[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:

[MIL-STD-129 Marking for Shipment and Storage³](#)

[MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage³](#)

2.3 Federal Standard:

[Fed. Std. No. 123 Marking for Shipment \(Civil Agencies\)³](#)

3. Terminology

3.1 *Definitions of Terms*—For definitions of terms used in this standard refer to:

3.1.1 Terminology [A941](#) for general steel terminology,

3.1.2 Test Methods and Definitions [A370](#) or Test Methods [A1058](#) for mechanical testing of steel products terminology, and

3.1.3 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 desired material adequately:

4.1.1 Quantity (feet, weight, or number of pieces),

4.1.2 Name of material (seamless carbon or alloy steel mechanical tubing),

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.

³ 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 of Low-Carbon Steels

Grade Designation	Chemical Composition Limits, %			
	Carbon ^A	Manganese ^B	Phosphorous, ^B max	Sulfur, ^B max
MT 1010	0.05–0.15	0.30–0.60	0.040	0.050
MT 1015	0.10–0.20	0.30–0.60	0.040	0.050
MT X 1015	0.10–0.20	0.60–0.90	0.040	0.050
MT 1020	0.15–0.25	0.30–0.60	0.040	0.050
MT X 1020	0.15–0.25	0.70–1.00	0.040	0.050

^A Limits apply to heat and product analyses.

^B Limits apply to heat analysis; except as required by 7.1, product analyses are subject to the applicable additional tolerances given in Table 5.

TABLE 2 Chemical Requirements of Other Carbon Steels

Grade Designation	Chemical Composition Limits, % ^A			
	Carbon	Manganese	Phosphorous, max	Sulfur, max
1008	0.10 max	0.30–0.50	0.040	0.050
1010	0.08–0.13	0.30–0.60	0.040	0.050
1012	0.10–0.15	0.30–0.60	0.040	0.050
1015	0.13–0.18	0.30–0.60	0.040	0.050
1016	0.13–0.18	0.60–0.90	0.040	0.050
1017	0.15–0.20	0.30–0.60	0.040	0.050
1018	0.15–0.20	0.60–0.90	0.040	0.050
1019	0.15–0.20	0.70–1.00	0.040	0.050
1020	0.18–0.23	0.30–0.60	0.040	0.050
1021	0.18–0.23	0.60–0.90	0.040	0.050
1022	0.18–0.23	0.70–1.00	0.040	0.050
1025	0.22–0.28	0.30–0.60	0.040	0.050
1026	0.22–0.28	0.60–0.90	0.040	0.050
1030	0.28–0.34	0.60–0.90	0.040	0.050
1035	0.32–0.38	0.60–0.90	0.040	0.050
1040	0.37–0.44	0.60–0.90	0.040	0.050
1045	0.43–0.50	0.60–0.90	0.040	0.050
1050	0.48–0.55	0.60–0.90	0.040	0.050
1518	0.15–0.21	1.10–1.40	0.040	0.050
1524	0.19–0.25	1.35–1.65	0.040	0.050
1541	0.36–0.44	1.35–1.65	0.040	0.050

^A The ranges and limits given in this table apply to heat analysis; except as required by 7.1, product analyses are subject to the applicable additional tolerances given in Table 5.

4.1.3 Form (round, square, rectangular or special shapes, Section 1),

4.1.4 Dimensions (round, outside diameters and wall thickness, Section 9; square and rectangular, outside dimensions and wall thickness, Section 10; other, specify),

4.1.5 Length (specific or random, mill lengths, see 9.5 and 10.5),

4.1.6 Manufacture (hot finished or cold finished, 5.5 and 5.6),

4.1.7 Grade (Section 6),

4.1.8 Condition (sizing method and thermal treatment, Section 13),

4.1.9 Surface finish (special pickling, shot blasting, or ground outside surface, if required),

4.1.10 ASTM Specification designation, and year of issue.

4.1.11 Individual supplementary requirements, if required,

4.1.12 End use, if known,

4.1.13 Packaging,

4.1.14 Product analysis and chemical analysis, if required (Section 7 and Section 8),

4.1.15 Specific requirements, or exceptions to this specification,

4.1.16 Special marking (Section 16), and

4.1.17 Special packing (Section 17).

5. Materials and Manufacture

5.1 The steel may 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 electroslag 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 a seamless process and shall be either hot finished or cold finished, as specified.

5.6 Seamless tubing is a tubular product made without a welded seam. It is manufactured usually by hot working steel and, if necessary, by subsequently cold finishing the hot-worked tubular product to produce the desired shape, dimensions and properties.

6. Chemical Composition

6.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 1 (Low Carbon MT Grades), Table 2 (Higher Carbon Steels), Table 3 (Alloy Standard Steels (see Guide A1040)) and Table 4 (Resulfurized or Rephosphorized, or Both, Carbon Steels (see Guide A1040)).

6.2 Grade MT1015 or MTX1020 will be supplied at the producer's option, when no grade is specified.

6.3 When a carbon steel 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.

6.4 Analyses of steels other than those listed are available. To determine their availability, the purchaser should contact the producer.

7. Heat Analysis

7.1 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 heat analysis shall be obtained from one remelted ingot or the product of one remelted ingot of each primary melt. The heat analysis shall conform to the requirements specified, except that where the heat identity has not been maintained or where the analysis is not sufficiently complete to permit conformance to be determined, the chemical composition determined from a product analysis made by the tubular manufacturer shall conform to the requirements specified for heat analysis. When requested in the order or contract, a report of such analyses shall be furnished to the purchaser.

TABLE 3 Chemical Requirements for Alloy Steels

NOTE 1—The ranges and limits in this table apply to steel not exceeding 200 in.² [1300 cm²] in cross-sectional area.

NOTE 2—Small quantities of certain elements are present in alloy steels which are not specified or required. These elements are considered as incidental and may be present to the following maximum amounts: copper, 0.35 %; nickel, 0.25 %; chromium, 0.20 %; molybdenum, 0.10 %.

NOTE 3—The ranges and limits given in this table apply to heat analysis; except as required by 7.1, product analyses are subject to the applicable additional tolerances given in Table 5.

Grade ^{A,B} Designation	Chemical Composition Limits, %							
	Carbon	Manganese	Phosphorus, ^C max	Sulfur, ^{C,D} max	Silicon	Nickel	Chromium	Molybdenum
1330	0.28–0.33	1.60–1.90	0.040	0.040	0.15–0.35	...	...	...
1335	0.33–0.38	1.60–1.90	0.040	0.040	0.15–0.35	...	...	...
1340	0.38–0.43	1.60–1.90	0.040	0.040	0.15–0.35	...	...	...
1345	0.43–0.48	1.60–1.90	0.040	0.040	0.15–0.35	...	...	...
3140	0.38–0.43	0.70–0.90	0.040	0.040	0.15–0.35	1.10–1.40	0.55–0.75	...
E3310	0.08–0.13	0.45–0.60	0.025	0.025	0.15–0.35	3.25–3.75	1.40–1.75	...
4012	0.09–0.14	0.75–1.00	0.040	0.040	0.15–0.35	...	...	0.15–0.25
4023	0.20–0.25	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.20–0.30
4024	0.20–0.25	0.70–0.90	0.040	0.035–0.050	0.15–0.35	...	...	0.20–0.30
4027	0.25–0.30	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.20–0.30
4028	0.25–0.30	0.70–0.90	0.040	0.035–0.050	0.15–0.35	...	...	0.20–0.30
4037	0.35–0.40	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.20–0.30
4042	0.40–0.45	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.20–0.30
4047	0.45–0.50	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.20–0.30
4063	0.60–0.67	0.75–1.00	0.040	0.040	0.15–0.35	...	...	0.20–0.30
4118	0.18–0.23	0.70–0.90	0.040	0.040	0.15–0.35	...	0.40–0.60	0.08–0.15
4130	0.28–0.33	0.40–0.60	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4135	0.32–0.39	0.65–0.95	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4137	0.35–0.40	0.70–0.90	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4140	0.38–0.43	0.75–1.00	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4142	0.40–0.45	0.75–1.00	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4145	0.43–0.48	0.75–1.00	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4147	0.45–0.50	0.75–1.00	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4150	0.48–0.53	0.75–1.00	0.040	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
4320	0.17–0.22	0.45–0.65	0.040	0.040	0.15–0.35	1.65–2.00	0.40–0.60	0.20–0.30
4337	0.35–0.40	0.60–0.80	0.040	0.040	0.15–0.35	1.65–2.00	0.70–0.90	0.20–0.30
E4337	0.35–0.40	0.65–0.85	0.025	0.025	0.15–0.35	1.65–2.00	0.70–0.90	0.20–0.30
4340	0.38–0.43	0.60–0.80	0.040	0.040	0.15–0.35	1.65–2.00	0.70–0.90	0.20–0.30
E4340	0.38–0.43	0.65–0.85	0.025	0.025	0.15–0.35	1.65–2.00	0.70–0.90	0.20–0.30
4422	0.20–0.25	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.35–0.45
4427	0.24–0.29	0.70–0.90	0.040	0.040	0.15–0.35	...	...	0.35–0.45
4520	0.18–0.23	0.45–0.65	0.040	0.040	0.15–0.35	...	...	0.45–0.60
4615	0.13–0.18	0.45–0.65	0.040	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
4617	0.15–0.20	0.45–0.65	0.040	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
4620	0.17–0.22	0.45–0.65	0.040	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
4621	0.18–0.23	0.70–0.90	0.040	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
4718	0.16–0.21	0.70–0.90	0.040	0.040	0.15–0.35	0.90–1.20	0.35–0.55	0.30–0.40
4720	0.17–0.22	0.50–0.70	0.040	0.040	0.15–0.35	0.90–1.20	0.35–0.55	0.15–0.25
4815	0.13–0.18	0.40–0.60	0.040	0.040	0.15–0.35	3.25–3.75	...	0.20–0.30
4817	0.15–0.20	0.40–0.60	0.040	0.040	0.15–0.35	3.25–3.75	...	0.20–0.30
4820	0.18–0.23	0.50–0.70	0.040	0.040	0.15–0.35	3.25–3.75	...	0.20–0.30
5015	0.12–0.17	0.30–0.50	0.040	0.040	0.15–0.35	...	0.30–0.50	...
5046	0.43–0.50	0.75–1.00	0.040	0.040	0.15–0.35	...	0.20–0.35	...
5115	0.13–0.18	0.70–0.90	0.040	0.040	0.15–0.35	...	0.70–0.90	...
5120	0.17–0.22	0.70–0.90	0.040	0.040	0.15–0.35	...	0.70–0.90	...
5130	0.28–0.33	0.70–0.90	0.040	0.040	0.15–0.35	...	0.80–1.10	...
5132	0.30–0.35	0.60–0.80	0.040	0.040	0.15–0.35	...	0.75–1.00	...
5135	0.33–0.38	0.60–0.80	0.040	0.040	0.15–0.35	...	0.80–1.05	...
5140	0.38–0.43	0.70–0.90	0.040	0.040	0.15–0.35	...	0.70–0.90	...
5145	0.43–0.48	0.70–0.90	0.040	0.040	0.15–0.35	...	0.70–0.90	...
5147	0.46–0.51	0.70–0.95	0.040	0.040	0.15–0.35	...	0.85–1.15	...
5150	0.48–0.53	0.70–0.90	0.040	0.040	0.15–0.35	...	0.70–0.90	...
5155	0.51–0.59	0.70–0.90	0.040	0.040	0.15–0.35	...	0.70–0.90	...
5160	0.56–0.64	0.75–1.00	0.040	0.040	0.15–0.35	...	0.70–0.90	...
52100 ^F	0.93–1.05	0.25–0.45	0.025	0.015	0.15–0.35	0.25 max	1.35–1.60	0.10 max
E50100	0.98–1.10	0.25–0.45	0.025	0.025	0.15–0.35	...	0.40–0.60	...
E51100	0.98–1.10	0.25–0.45	0.025	0.025	0.15–0.35	...	0.90–1.15	...