



Designation: **A193/A193M – 15a** A193/A193M – 16

Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications¹

This standard is issued under the fixed designation A193/A193M; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification² covers alloy and stainless steel bolting materials and bolting components for pressure vessels, valves, flanges, and fittings for high temperature or high pressure service, or other special purpose applications. See Specification [A962/A962M](#) for the definition of bolting. Bars and wire shall be hot-wrought and may be further processed by centerless grinding or by cold drawing. Austenitic stainless steel may be carbide solution treated or carbide solution treated and strain-hardened. When strain hardened austenitic stainless steel is ordered, the purchaser should take special care to ensure that [Appendix X1](#) is thoroughly understood.

1.2 Several grades are covered, including ferritic steels and austenitic stainless steels designated B5, B8, and so forth. Selection will depend upon design, service conditions, mechanical properties, and high temperature characteristics.

1.3 The following referenced general requirements are indispensable for application of this specification: Specification [A962/A962M](#).

NOTE 1—The committee formulating this specification has included several steel types that have been rather extensively used for the present purpose. Other compositions will be considered for inclusion by the committee from time to time as the need becomes apparent.

NOTE 2—For grades of alloy-steel bolting suitable for use at the lower range of high temperature applications, reference should be made to Specification [A354](#).

NOTE 3—For grades of alloy-steel bolting suitable for use in low temperature applications, reference should be made to Specification [A320/A320M](#).

1.4 Nuts for use with bolting are covered in Section [13](#).

1.5 Supplementary Requirements are provided for use at the option of the purchaser. The supplementary requirements shall apply only when specified in the purchase order or contract.

1.6 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.

1.7 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:³

[A153/A153M](#) Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

[A194/A194M](#) Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

[A320/A320M](#) Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service

[A354](#) Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

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 [A01.22](#) on Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications.

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² For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-193 in Section II of that Code.

³ 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



- A788/A788M Specification for Steel Forgings, General Requirements
 - A962/A962M Specification for Common Requirements for Bolting Intended for Use at Any Temperature from Cryogenic to the Creep Range
 - B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - B695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
 - B696 Specification for Coatings of Cadmium Mechanically Deposited
 - B766 Specification for Electrodeposited Coatings of Cadmium
 - E18 Test Methods for Rockwell Hardness of Metallic Materials
 - E21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials
 - E112 Test Methods for Determining Average Grain Size
 - E139 Test Methods for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
 - E150 Recommended Practice for Conducting Creep and Creep-Rupture Tension Tests of Metallic Materials Under Conditions of Rapid Heating and Short Times (Withdrawn 1984)⁴
 - E151 Recommended Practice for Tension Tests of Metallic Materials at Elevated Temperatures with Rapid Heating and Conventional or Rapid Strain Rates (Withdrawn 1984)⁴
 - E292 Test Methods for Conducting Time-for-Rupture Notch Tension Tests of Materials
 - E328 Test Methods for Stress Relaxation for Materials and Structures
 - E566 Practice for Electromagnetic (Eddy Current) Sorting of Ferrous Metals
 - E709 Guide for Magnetic Particle Testing
 - F606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets (Metric) F0606_F0606M
 - F1940 Test Method for Process Control Verification to Prevent Hydrogen Embrittlement in Plated or Coated Fasteners
 - F1941 Specification for Electrodeposited Coatings on Threaded Fasteners (Metric) F1941_F1941M
 - F2329 Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- 2.2 *ASME Standards*:⁵
- B18.2.1 Square and Hex Bolts and Screws
 - B18.2.3.3M Metric Heavy Hex Screws
 - B18.3 Hexagon Socket and Spline Socket Screws
 - B18.3.1M Metric Socket Head Cap Screws
- 2.3 *AIAG Standard*:⁶
- AIAG B-5 02.00 Primary Metals Identification Tag Application Standard

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3. General Requirements and Ordering Information A193/A193M-16

- 3.1 The inquiry and orders shall include the following, as required, to describe the desired bolting material or bolting components adequately:
- 3.1.1 Heat-treated condition (that is carbide solution treated (Class 1), carbide solution treated after finishing (Class 1A), and carbide solution treated and strain-hardened (Classes 2, 2B and 2C), for the austenitic stainless steels; Classes 1B and 1C apply to the carbide solution-treated nitrogen-bearing stainless steels; Class 1D applies to bolting material that is carbide solution treated by cooling rapidly from the rolling temperature),
 - 3.1.2 Description of items required (that is, bars, bolts, screws, or studs),
 - 3.1.3 Nuts, if required by purchaser, in accordance with 13.1,
 - 3.1.4 Supplementary requirements, if any, and
 - 3.1.5 Special requirements, in accordance with 6.1.5.1, 6.2.6, 8.1, and 13.1.
- 3.2 *Coatings*—Coatings are prohibited unless specified by the purchaser (See Supplementary Requirements S13 and S14). When coated bolting components are ordered the purchaser should take special care to ensure that Appendix X2 is thoroughly understood.

4. Common Requirements

4.1 Bolting materials and bolting components supplied to this specification shall conform to the requirements of Specification A962/A962M. These requirements include test methods, finish, thread dimensions, macroetch (alloy steels only), marking, certification, optional supplementary requirements, and others. Failure to comply with the requirements of Specification

⁴ The last approved version of this historical standard is referenced on www.astm.org.
⁵ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.
⁶ Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48033, <http://www.aiag.org>.



A962/A962M constitutes nonconformance with this specification. In case of conflict between this specification and Specification A962/A962M, this specification shall prevail.

5. Manufacture (Process)

- 5.1 Melting—See Specification A962/A962M for requirements.
- 5.2 Quality—See Specification A962/A962M for requirements.

6. Heat Treatment

6.1 Ferritic Steels:

6.1.1 Ferritic steels shall be allowed to cool to a temperature below the cooling transformation range immediately after rolling or forging. Bolting materials shall then be uniformly reheated to the proper temperature to refine the grain (a group thus reheated being known as a *quenching charge*), quenched in a liquid medium under substantially uniform conditions for each quenching charge, and tempered. The minimum tempering temperature shall be as specified in Tables 2 and 3.

TABLE 1 Chemical Requirements (Composition, percent)^A

| Type | Ferritic Steels | | | | | | | |
|------------------------------|---|---|--|--|-----------------------|--|-----------|--|
| Grade | B5 | | B6 and B6X | | | | | |
| Description | 5% Chromium | | 12 % Chromium | | | | | |
| UNS Designation | S41000 (410) | | | | | | | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation Over or Under ^B | | | | |
| Carbon | 0.10 min | 0.01 under | 0.08–0.15 | 0.01 over | | | | |
| Manganese, max | 1.00 | 0.03 over | 1.00 | 0.03 over | | | | |
| Phosphorus, max | 0.040 | 0.005 over | 0.040 | 0.005 over | | | | |
| Sulfur, max | 0.030 | 0.005 over | 0.030 | 0.005 over | | | | |
| Silicon | 1.00 max | 0.05 over | 1.00 max | 0.05 over | | | | |
| Chromium | 4.0–6.0 | 0.10 | 11.5–13.5 | 0.15 | | | | |
| Molybdenum | 0.40–0.65 | 0.05 | ... | ... | | | | |
| Type | Ferritic Steels | | | | | | | |
| Grade | B7, B7M | | B16 | | | | | |
| Description | Chromium-Molybdenum ^C | | Chromium-Molybdenum-Vanadium | | | | | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | | | | |
| Carbon | 0.38–0.48 ^D | 0.02 | 0.36–0.47 | 0.02 | | | | |
| Manganese | 0.75–1.00 | 0.04 | 0.45–0.70 | 0.03 | | | | |
| Phosphorus, max | 0.035 | 0.005 over | 0.035 | 0.005 over | | | | |
| Sulfur, max | 0.040 | 0.005 over | 0.040 | 0.005 over | | | | |
| Silicon | 0.15–0.35 | 0.02 | 0.15–0.35 | 0.02 | | | | |
| Chromium | 0.80–1.10 | 0.05 | 0.80–1.15 | 0.05 | | | | |
| Molybdenum | 0.15–0.25 | 0.02 | 0.50–0.65 | 0.03 | | | | |
| Vanadium | ... | ... | 0.25–0.35 | 0.03 | | | | |
| Aluminum, max-% ^E | ... | ... | 0.015 | ... | | | | |
| Type | Austenitic Steels, ^F Classes 1, 1A, 1D, and 2 | | | | | | | |
| Grade | B8, B8A | | B8C, B8CA | | B8M, B8MA, B8M2, B8M3 | | B8P, B8PA | |
| UNS Designation | S30400 (304) | | S34700 (347) | | S31600 (316) | | S30500 | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B |
| Carbon, max | 0.08 | 0.01 over | 0.08 | 0.01 over | 0.08 | 0.01 over | 0.12 | 0.01 over |
| Manganese, max | 2.00 | 0.04 over | 2.00 | 0.04 over | 2.00 | 0.04 over | 2.00 | 0.04 over |
| Phosphorus, max | 0.045 | 0.010 over | 0.045 | 0.010 over | 0.045 | 0.010 over | 0.045 | 0.010 over |
| Sulfur, max | 0.030 | 0.005 over | 0.030 | 0.005 over | 0.030 | 0.005 over | 0.030 | 0.005 over |
| Silicon, max | 1.00 | 0.05 over | 1.00 | 0.05 over | 1.00 | 0.05 over | 1.00 | 0.05 over |
| Chromium | 18.0–20.0 | 0.20 | 17.0–19.0 | 0.20 | 16.0–18.0 | 0.20 | 17.0–19.0 | 0.20 |
| Nickel | 8.0–11.0 | 0.15 | 9.0–12.0 | 0.15 | 10.0–14.0 | 0.15 | 11.0–13.0 | 0.15 |
| Molybdenum | ... | ... | ... | ... | 2.00–3.00 | 0.10 | ... | ... |
| Columbium | ... | ... | 10 x carbon content, min; 1.10 max | 0.05 under | ... | ... | ... | ... |
| Type | Austenitic Steels, ^F Classes 1A, 1B, 1D, and 2 | | | | | | | |
| Grade | B8N, B8NA | | B8MN, B8MNA | | B8MLCuN, B8MLCuNA | | | |
| UNS Designation | S30451 (304N) | | S31651 (316N) | | S31254 | | | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B |
| Carbon, max | 0.08 | 0.01 over | 0.08 | 0.01 over | 0.020 | 0.005 over | 0.020 | 0.005 over |
| Manganese, max | 2.00 | 0.04 over | 2.00 | 0.04 over | 1.00 | 0.03 over | 1.00 | 0.03 over |

TABLE 1 Chemical Requirements (Composition, percent)^A

| Ferritic Steels | | | | | | | | | | | | | | | | |
|---|----------------------------------|------------------|------------------------|-----------|------------|--------|-----------|-----------|-----------|------------|--------|----------------|----------|-----------|--------------------|-----------|
| Grade | Description and UNS Designation | Class | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Molybdenum | Copper | Columbium | Titanium | Vanadium | Aluminum | Nitrogen |
| B5 Product Analysis Variation ^B | 5 % Chromium | | 0.10 min | 1.00 | 0.040 | 0.030 | 1.00 | 4.0–6.0 | ... | 0.40–0.65 | ... | ... | ... | ... | ... | ... |
| B6, B6X | 12 % Chromium (410), S41000 | | 0.08–0.15 | 1.00 | 0.040 | 0.030 | 1.00 | 11.5–13.5 | ... | ... | ... | ... | ... | ... | ... | ... |
| Product Analysis Variation ^B | | | 0.01 over | 0.03 | 0.005 | 0.005 | 0.05 | 0.15 | ... | ... | ... | ... | ... | ... | ... | ... |
| B7, B7M | Chromium-Molybdenum ^C | | 0.38–0.48 ^D | 0.75–1.00 | 0.035 | 0.040 | 0.15–0.35 | 0.80–1.10 | ... | 0.15–0.25 | ... | ... | ... | ... | ... | ... |
| Product Analysis Variation ^B | | | 0.02 | 0.04 | 0.005 | 0.005 | 0.02 | 0.05 | ... | 0.02 | ... | ... | ... | ... | ... | ... |
| B16 | Chromium-Molybdenum-Vanadium | | 0.36–0.47 | 0.45–0.70 | 0.035 | 0.040 | 0.15–0.35 | 0.80–1.15 | ... | 0.50–0.65 | ... | ... | ... | 0.25–0.35 | 0.015 ^E | ... |
| Product Analysis Variation ^B | | | 0.02 | 0.03 | 0.005 | 0.005 | 0.02 | 0.05 | ... | 0.03 | ... | ... | ... | 0.03 | ... | ... |
| Austenitic Steels | | | | | | | | | | | | | | | | |
| Grade | Description and UNS Designation | Classes | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Molybdenum | Copper | Columbium | Titanium | Vanadium | Aluminum | Nitrogen |
| B8, B8A | 304, S30400 | 1, 1A, 1D, 2 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–11.0 | ... | ... | ... | ... | ... | ... | ... |
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | ... | ... | ... | ... | ... |
| B8C, B8CA | 347, S34700 | 1, 1A, 1D, 2 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | 10 x C to 1.10 | ... | ... | ... | ... |
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | 0.05 under | ... | ... | ... | ... |
| B8M, B8MA, B8M2, B8M3 | 316, S31600 | 1, 1A, 1D, 2 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | 2.00–3.00 | ... | ... | ... | ... | ... | ... |
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | 0.10 | ... | ... | ... | ... | ... | ... |
| B8P, B8PA | S30500 | 1, 1A, 1D, 2 | 0.12 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 11.0–13.0 | ... | ... | ... | ... | ... | ... | ... |
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | ... | ... | ... | ... | ... |
| B8N, B8NA | 304N, S30451 | 1A, 1B, 1D, 2 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–11.0 | ... | ... | ... | ... | ... | ... | 0.10–0.16 |
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | ... | ... | ... | ... | 0.01 |
| B8MN, B8MNA | 316N, S31651 | 1A, 1B, 1D, 2 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–13.0 | 2.00–3.00 | ... | ... | ... | ... | ... | 0.10–0.16 |

TABLE 1 Continued

| | | | | | | | | | | | | | | | | |
|---|------------------|------------------|----------------------------------|---------|-------|-------|---------|-----------|-----------|-----------|-----------|--|---------------------------|-----------|-----|-----------|
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | 0.10 | ... | ... | ... | ... | ... | 0.01 |
| M8MLCuN, B8MLCuNA | S31254 | 1A, 1B, 1D, 2 | 0.020 | 1.00 | 0.030 | 0.010 | 0.80 | 19.5–20.5 | 17.5–18.5 | 6.0–6.5 | 0.50–1.00 | ... | ... | ... | ... | 0.18–0.25 |
| Product Analysis Variation ^B | | | 0.005 | 0.03 | 0.005 | 0.002 | 0.05 | 0.20 | 0.15 | 0.10 | ... | ... | ... | ... | ... | 0.02 |
| B8T, B8TA | 321, S32100 | 1, 1A, 2 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | ... | 5 × (C + N) to 0.70 | ... | ... | 0.10 |
| Product Analysis Variation ^B | | | 0.01 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | ... | 0.05 under | ... | ... | ... |
| B8R, B8RA | S20910 | 1C, 1D | 0.06 | 4.0–6.0 | 0.045 | 0.030 | 1.00 | 20.5–23.5 | 11.5–13.5 | 1.50–3.00 | ... | 0.10–0.30 | ... | 0.10–0.30 | ... | 0.20–0.40 |
| Product Analysis Variation ^B | | | 0.01 | 0.05 | 0.005 | 0.005 | 0.05 | 0.25 | 0.15 | 0.10 | ... | 0.05 | ... | 0.02 | ... | 0.02 |
| B8S, B8SA | S21800 | 1C, 1D | 0.10 | 7.0–9.0 | 0.060 | 0.030 | 3.5–4.5 | 16.0–18.0 | 8.0–9.0 | ... | ... | ... | ... | ... | ... | 0.08–0.18 |
| Product Analysis Variation ^B | | | 0.01 | 0.06 | 0.005 | 0.005 | 0.15 | 0.20 | 0.10 | ... | ... | ... | ... | ... | ... | 0.01 |
| B8LN, B8LNA | S30453 | 1, 1A, 1D | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–11.0 | ... | ... | ... | ... | ... | ... | 0.10–0.16 |
| Product Analysis Variation ^B | | | 0.005 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | ... | ... | ... | ... | 0.01 |
| B8MLN, B8MLNA | S31653 | 1, 1A, 1D | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–13.0 | 2.00–3.00 | ... | ... | ... | ... | ... | 0.10–0.16 |
| Product Analysis Variation ^B | | | 0.005 | 0.04 | 0.010 | 0.005 | 0.05 | 0.20 | 0.15 | 0.10 | ... | ... | ... | ... | ... | 0.01 |
| B8CLN, B8CLNA | 347LN, S34751 | 1, 1A, 1D | 0.005– 0.020 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–13.0 | ... | ... | 0.20–0.50; 15 × carbon content, min | ... | ... | ... | 0.06–0.10 |
| Product Analysis Variation ^B | | | 0.002 under, 0.005 over | 0.04 | 0.01 | 0.005 | 0.05 | 0.20 | 0.15 | ... | ... | 0.05 | ... | ... | ... | 0.01 |
| B8ML4CuN, B8ML4CuNA | S31730 | 1, 1A, 1D | 0.030 | 2.00 | 0.040 | 0.010 | 1.00 | 17.0–19.0 | 15.0–16.5 | 3.0–4.0 | 4.0–5.0 | ... | ... | ... | ... | 0.045 |
| Product Analysis Variation ^B | | | 0.005 | 0.04 | 0.005 | 0.002 | 0.05 | 0.20 | 0.15 | 0.10 | 0.15 | ... | ... | ... | ... | 0.01 |

^AValues are maximums unless a range or a minimum is indicated. Where ellipses appear in this table, there is no requirement and the element need not be determined or reported. The intentional addition of Bi, Se, Te, and Pb is not permitted.

^BProduct Analysis—Individual determinations sometimes vary from the specified limits as shown in the tables. The several determinations of any individual element in a heat may not vary both above and below the specified range. Product variation limits are over for maximums, over or under for ranges, and under for minimums, unless otherwise indicated.

^CTypical steel compositions used for this grade include 4140, 4142, 4145, 4140H, 4142H, and 4145H.

^DFor bar sizes over 3½ in. [90 mm], inclusive, the carbon content may be 0.50 % max. For the B7M grade, a minimum carbon of 0.28 % is permitted, provided that the required tensile properties are met in the section sizes involved, the use of AISI 4130 or 4130H is allowed.

^ETotal of soluble and insoluble.



TABLE 1—Continued

| Austenitic Steels, ^F Classes 1A, 1B, 1D, and 2 | | | | | | |
|---|---------------------------|---|---------------------|---|-------------------|---|
| Type | B8N, B8NA | | B8MN, B8MNA | | B8MLCuN, B8MLCuNA | |
| Grade | B8N, B8NA | | B8MN, B8MNA | | B8MLCuN, B8MLCuNA | |
| UNS Designation | S30451 (304N) | | S31651 (316N) | | S31254 | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B |
| Phosphorus, max | 0.045 | 0.010 over | 0.045 | 0.010 over | 0.030 | 0.005 over |
| Sulfur, max | 0.030 | 0.005 over | 0.030 | 0.005 over | 0.010 | 0.002 over |
| Silicon, max | 1.00 | 0.05 over | 1.00 | 0.05 over | 0.80 | 0.05 over |
| Chromium | 18.0–20.0 | 0.20 | 16.0–18.0 | 0.20 | 19.5–20.5 | 0.20 |
| Nickel | 8.0–11.0 | 0.15 | 10.0–13.0 | 0.15 | 17.5–18.5 | 0.15 |
| Molybdenum | ... | ... | 2.00–3.00 | 0.10 | 6.0–6.5 | 0.10 |
| Nitrogen | 0.10–0.16 | 0.01 | 0.10–0.16 | 0.01 | 0.18–0.25 | 0.02 |
| Copper | ... | ... | ... | ... | 0.50–1.00 | ... |
| Austenitic Steels ^F , Classes 1, 1A, and 2 | | | | | | |
| Grade | B8T, B8TA | | | | | |
| UNS Designation | S32100 (321) | | | | | |
| | Range | Product Variation, Over or Under ^B | | | | |
| Carbon, max | 0.08 | 0.01 over | | | | |
| Manganese, max | 2.00 | 0.04 over | | | | |
| Phosphorus, max | 0.045 | 0.010 over | | | | |
| Sulfur, max | 0.030 | 0.005 over | | | | |
| Silicon, max | 1.00 | 0.05 over | | | | |
| Chromium | 17.0–19.0 | 0.20 | | | | |
| Nickel | 9.0–12.0 | 0.15 | | | | |
| Titanium | 5 x (C + N) min, 0.70 max | 0.05 under | | | | |
| Nitrogen | 0.10 max | ... | | | | |
| Austenitic Steels ^F , Classes 1C and 1D | | | | | | |
| Grade | B8R, B8RA | | B8S, B8SA | | | |
| UNS Designation | S20910 | | S21800 | | | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | | |
| Carbon, max | 0.06 | 0.01 over | 0.10 | 0.01 over | | |
| Manganese | 4.0–6.0 | 0.05 | 7.0–9.0 | 0.06 | | |
| Phosphorus, max | 0.045 | 0.005 over | 0.060 | 0.005 over | | |
| Sulfur, max | 0.030 | 0.005 over | 0.030 | 0.005 over | | |
| Silicon | 1.00 max | 0.05 over | 3.5–4.5 | 0.15 | | |
| Chromium | 20.5–23.5 | 0.25 | 16.0–18.0 | 0.20 | | |
| Nickel | 11.5–13.5 | 0.15 | 8.0–9.0 | 0.10 | | |
| Molybdenum | 1.50–3.00 | 0.10 | ... | ... | | |
| Nitrogen | 0.20–0.40 | 0.02 | 0.08–0.18 | 0.01 | | |
| Columbium + tantalum | 0.10–0.30 | 0.05 | ... | ... | | |
| Vanadium | 0.10–0.30 | 0.02 | ... | ... | | |
| Austenitic Steels ^F , Classes 1, 1A and 1D | | | | | | |
| Grade | B8LN, B8LNA | | B8MLN, B8MLNA | | | |
| UNS Designation | S30453 | | S31653 | | | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | | |
| Carbon, max | 0.030 | 0.005 over | 0.030 | 0.005 over | | |
| Manganese | 2.00 | 0.04 over | 2.00 | 0.04 over | | |
| Phosphorus, max | 0.045 | 0.010 over | 0.045 | 0.010 over | | |
| Sulfur, max | 0.030 | 0.005 over | 0.030 | 0.005 over | | |
| Silicon | 1.00 | 0.05 over | 1.00 | 0.05 over | | |
| Chromium | 18.0–20.0 | 0.20 | 16.0–18.0 | 0.20 | | |
| Nickel | 8.0–11.0 | 0.15 | 10.0–13.0 | 0.15 | | |
| Molybdenum | ... | ... | 2.00–3.00 | 0.10 | | |
| Nitrogen | 0.10–0.16 | 0.01 | 0.10–0.16 | 0.01 | | |
| Austenitic Steels ^F , Classes 1, 1A and 1D | | | | | | |
| Grade | B8CLN, B8CLNA | | B8ML4CuN, B8ML4CuNA | | | |
| UNS Designation | S34751 (347LN) | | S31730 | | | |
| | Range | Product Variation, Over or Under ^B | Range | Product Variation, Over or Under ^B | | |
| Carbon, max | 0.005–0.020 | 0.002 under, 0.005 over | 0.030 | 0.005 over | | |
| Manganese, max | 2.00 | 0.04 over | 2.00 | 0.04 over | | |
| Phosphorus, max | 0.045 | 0.01 over | 0.040 | 0.005 over | | |
| Sulfur, max | 0.030 | 0.005 over | 0.010 | 0.002 over | | |
| Silicon, max | 1.00 | 0.05 over | 1.00 | 0.05 over | | |
| Chromium | 17.0–19.0 | 0.20 | 17.0–19.0 | 0.20 | | |