



Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels¹

This standard is issued under the fixed designation A 479/A 479M; 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 specification² covers hot- and cold-finished bars of stainless steel, including rounds, squares, and hexagons, and hot-rolled or extruded shapes such as angles, tees, and channels for use in boiler and pressure vessel construction.²

NOTE 1—There are standards covering high nickel, chromium, austenitic corrosion, and heat-resisting alloy materials. These standards are under the jurisdiction of ASTM Subcommittee B02.07 and may be found in *Annual Book of ASTM Standards*, Vol 02.04.

1.2 The values stated in either inch-pound units or SI (metric) units are to be regarded separately as standards; within the text and tables, the SI units are shown in [brackets]. The values stated in each system are not exact equivalents; therefore, each system must be used independent of the other. Combining values from the two systems may result in nonconformance with the specification.

1.3 Unless the order specifies the applicable “M” specification designation, the material shall be furnished to the inch-pound units.

2. Referenced Documents

2.1 ASTM Standards:³

- A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products
- A 484/A 484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
- A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

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 A01.17 on Flat-Rolled and Wrought Stainless Steel.

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² For ASME Boiler and Pressure Vessel Code applications see related Specification SA-479/SA-479M 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.

- E 112 Test Methods for Determining Average Grain Size
- E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 Other Document:

- SAE J 1086 Recommended Practice for Numbering Metals and Alloys⁴

3. Ordering Information

3.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may include, but are not limited to, the following:

- 3.1.1 Quantity (weight or number of pieces);
- 3.1.2 Dimensions, including diameter or thickness (and width), shape or form, applicable prints or sketches, length, etc.;
- 3.1.3 Type or UNS designation (Table 1);
- 3.1.4 ASTM designation and edition year if other than latest edition;
- 3.1.5 Heat treated condition (Section 4);
- 3.1.6 Finish (see Manufacture section of Specification A 484/A 484M);
- 3.1.7 Supplementary Requirements invoked for special services (described at the end of this specification);
- 3.1.8 Whether bars are to be rolled as bars or cut from strip or plate;
- 3.1.9 Preparation for delivery (see Preparation for Delivery section of Specification A 484/A 484M);
- 3.1.10 Marking requirements (see Marking section of Specification A 484/A 484M);
- 3.1.11 Surface preparation of shapes (see Manufacture section of Specification A 484/A 484M); and
- 3.1.12 The intended use of the material, if the purchaser considers this useful information.

NOTE 2—A typical ordering description is as follows: 5000 lb [2000 kg]; 1.000 in. [25 mm] round bar by 10 to 12 ft [3 to 4 m]; Type 304 or UNS S30400; to Specification A 479 [A 479M]; annealed; centerless ground; plus any optional supplementary requirements, such as, for

⁴ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

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

example, special marking instructions.

4. Heat Treatment

4.1 Austenitic Grades:

4.1.1 Except for the strain-hardened grade (see 4.1.3) and the hot-rolled grade (see 4.1.4), all austenitic grades of stainless steel shall be furnished in the solution-annealed condition, with subsequent light cold drawing and straightening permitted. (See Supplementary Requirement S5 if annealing must be the final operation.) Solution annealing for all grades, except the H grades (see 4.1.2), N08367 (see 4.1.8), S31254 (see 4.1.5), S32050 (see 4.1.5), S33228 (see 4.1.7), S34565 (see 4.1.6), and S35315 (see 4.1.9), shall consist of (1) heating the material to a temperature of 1900°F [1040°C] minimum so that grain boundary carbides enter into solution, and cooling rapidly to prevent grain boundary carbide precipitation; or alternatively⁵ (2) (except for the columbium and titanium stabilized grades 309Cb, 310Cb, 316Cb, 316Ti, 321, 347, and 348) immediately following hot working while the temperature is above 1750°F [955°C] so that grain boundary carbides are in solution, cooling rapidly to prevent grain boundary carbide precipitation. When Supplementary Requirement S2 is invoked, all austenitic grades except S30815 shall pass the intergranular corrosion test requirements described in S2.

4.1.2 For H grades, the minimum solution annealing temperatures shall be as follows:

4.1.2.1 When hot finished, 1900°F [1040°C] for Types 304H, 309H, 310H, and 316H; 1925°F [1050°C] for Types 321H, 347H, and 348H,

4.1.2.2 When cold worked prior to solution annealing, 1900°F [1040°C] for Types 304H, 309H, 310H, and 316H; 2000°F [1095°C] for Types 321H, 347H, and 348H.

NOTE 3—Solution annealing temperatures above 1950°F [1065°C] may impair the resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in the stabilized grades, Types 321, 321 H, 347, 347 H, 348 and 348 H. When intergranular corrosion is of concern, the purchaser should specify the corrosion test of S2 (to be conducted on sensitized specimens). The manufacturer may, if necessary, use a lower temperature resolution anneal or a stabilization anneal after a high temperature solution anneal in order to meet corrosion test requirements. Consideration should be given to the corrosive media before using a stabilization anneal at less than 1800°F [980°C], as such a treatment may not be fully effective for all media.

NOTE 4—Grain size requirements for the H grades are described in Section 7.

4.1.3 *Strain-Hardened Austenitic Type 316*—When Type 316 is desired with increased mechanical properties, the strain-hardened condition may be specified and is produced by solution annealing, as described in 4.1.1, followed by strain hardening sufficient to meet the required mechanical properties. Solution-annealed and strain-hardened material shall be capable of meeting the intergranular corrosion test of Supplementary Requirement S2.

4.1.3.1 Two strain hardened conditions have been established for different applications: Level 1 and Level 2 (see Table 2).

4.1.4 High tensile Type XM-19 shall be in the hot-rolled or strain-hardened condition and shall be capable of meeting the mechanical property requirements of Table 2 and passing the intergranular corrosion test prescribed in S2. The strain hardened condition is achieved by solution annealing followed by cold working sufficient to develop the required mechanical properties.

4.1.5 Solution annealing of S31254, S32050, and S32654 shall consist of heating the material to a temperature of 2100°F [1150°C] minimum for an appropriate time, followed by water quenching or rapidly cooling by other means.

4.1.6 Solution annealing of S34565 shall consist of heating the material in the range of temperature from 2050°F [1120°C] to 2140°F [1170°C] for an appropriate time, followed by water quenching or rapidly cooling by other means.

4.1.7 Solution annealing of S33228 shall consist of heating the material in the temperature range 2050 to 2160°F [1120 to 1180°C] for an appropriate time, followed by water quenching or rapid cooling by other means.

4.1.8 Solution annealing of N08367 shall consist of heating the material to a temperature of 2025°F [1105°C] minimum for an appropriate time, followed by water quenching or rapidly cooling by other means.

4.1.9 Solution annealing of S35315 shall consist of heating the material to a temperature of 2100°F [1150°C] minimum for an appropriate time, followed by water quenching or rapidly cooling by other means.

4.1.10 Solution annealing of S31727 and S32053 shall consist of heating the material to a temperature of 1975 to 2155°F [1080 to 1180°C] for an appropriate time, followed by water quenching or rapidly cooling by other means.

4.2 Austenitic-Ferritic Grades:

4.2.1 S31803, S32205, and S32550 shall be furnished in the annealed condition with subsequent straightening permitted. The annealing treatment of S31803 and S32550 shall consist of heating the material to a temperature of 1900°F [1040°C] minimum for an appropriate time followed by water quenching or rapid cooling by other means. The annealing treatment for S32205 shall consist of heating the material to a temperature of 1900°F [1040°C] minimum for an appropriate time, followed by water quenching.

4.2.2 S32101 shall be annealed by heating the material to a temperature of 1870°F [1020°C] minimum for an appropriate time followed by water quenching or rapid cooling by other means.

4.2.3 S32950 shall be annealed by heating the material to a temperature of 1825°F [995°C] to 1875°F [1025°C] for an appropriate time, followed by water quenching or rapid cooling by other means.

4.2.4 S32750 shall be annealed by heating the material to a temperature of 1880°F [1025°C] to 2060°F [1125°C] for an appropriate time, followed by water quenching or rapid cooling by other means. Subsequent straightening shall be permitted.

4.2.5 S32760 shall be annealed by heating the material to a temperature of 2010°F [1100°C] to 2085°F [1140°C] for an appropriate time, followed by water quenching or rapid cooling by other means.

⁵ For explanation see Appendix X1.

4.2.6 UNS S32906 shall be annealed by heating the material to a temperature of 1900°F (1040°C) to 1980°F (1080°C) for an appropriate time followed by rapid cooling in air or water. Subsequent straightening shall be permitted.

4.2.7 S39277 shall be annealed by heating the material to 1940°F [1060°C] to 2060°F [1125°C] for an appropriate time, followed by water quenching or rapid cooling by other means. Subsequent straightening shall be permitted.

4.2.8 S32506 shall be annealed by heating the material to 1870° to 2050°F [1020 to 1120°C] for an appropriate time, followed by water quenching or rapid cooling by other means. Subsequent straightening shall be permitted.

4.3 *Ferritic Grades*—Ferritic grades shall be annealed to meet the requirements of **Table 2**.

4.4 Martensitic Grades:

4.4.1 All grades of martensitic steels shall be supplied in either the annealed condition or in the tempered condition as specified by the purchaser (see 3.1.3). Tempered material shall be normalized, or shall be liquid quenched from 1700°F [925°C] minimum, followed by tempering in accordance with 4.4.2, 4.4.3, or 4.4.5.

4.4.2 Types 403 and 410 tempered material shall be held at tempering temperature for at least 1 h/in. [25.4 mm] of cross section as follows:

TABLE 1 Chemical Requirements

| UNS Designation ^A | Type | Composition, % ^B | | | | | | | | | |
|------------------------------|--------------------|-----------------------------|------------|-------------|--------|-----------|-----------|-----------|-----------|------------|---|
| | | Carbon | Man-ganese | Phos-phorus | Sulfur | Silicon | Chromium | Nickel | Nitrogen | Molybdenum | Other Elements ^C |
| Austenitic Grades | | | | | | | | | | | |
| N08367 | ... | 0.030 | 2.00 | 0.040 | 0.030 | 1.00 | 20.0–22.0 | 23.5–25.5 | 0.18–0.25 | 6.0–7.0 | Cu 0.75 |
| S20161 | ... | 0.15 | 4.0–6.0 | 0.045 | 0.030 | 3.0–4.0 | 15.0–18.0 | 4.0–6.0 | 0.08–0.20 | ... | ... |
| S20910 | XM-19 | 0.06 | 4.0–6.0 | 0.045 | 0.030 | 1.00 | 20.5–23.5 | 11.5–13.5 | 0.20–0.40 | 1.50–3.00 | Cb 0.10–0.30; V 0.10–0.30 |
| S21600 | XM-17 | 0.08 | 7.5–9.0 | 0.045 | 0.030 | 1.00 | 17.5–20.5 | 5.0–7.0 | 0.25–0.50 | 2.00–3.00 | ... |
| S21603 | XM-18 | 0.03 | 7.5–9.0 | 0.045 | 0.030 | 1.00 | 17.5–20.5 | 5.0–7.0 | 0.25–0.50 | 2.00–3.00 | ... |
| S21800 | ... | 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 | ... | ... |
| S21904 | XM-11 | 0.04 | 8.0–10.0 | 0.045 | 0.030 | 1.00 | 19.0–21.5 | 5.5–7.5 | 0.15–0.40 | ... | ... |
| S24000 | XM-29 | 0.08 | 11.5–14.5 | 0.060 | 0.030 | 1.00 | 17.0–19.0 | 2.3–3.7 | 0.20–0.40 | ... | ... |
| S30200 | 302 | 0.15 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 8.0–10.0 | 0.10 | ... | ... |
| S30400 | 304 | 0.08 ^C | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–10.5 | ... | ... | ... |
| S30403 | 304L | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–12.0 | ... | ... | ... |
| S30409 | 304H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–10.5 | ... | ... | ... |
| S30451 | 304N | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–12.0 | 0.10–0.16 | ... | ... |
| S30453 | 304LN | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 8.0–11.0 | 0.10–0.16 | ... | ... |
| S30600 | ... | 0.018 | 2.00 | 0.020 | 0.020 | 3.7–4.3 | 17.0–18.5 | 14.0–15.5 | ... | 0.20 | Cu 0.50 |
| S30815 | ... | 0.05–0.10 | 0.80 | 0.040 | 0.030 | 1.40–2.00 | 20.0–22.0 | 10.0–12.0 | 0.14–0.20 | ... | Ce 0.03–0.08 |
| S30908 | 309S | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 22.0–24.0 | 12.0–15.0 | ... | ... | ... |
| S30909 | 309H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 22.0–24.0 | 12.0–15.0 | ... | ... | ... |
| S30940 | 309Cb | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 22.0–24.0 | 12.0–16.0 | ... | ... | Cb 10×C- 1.10 |
| S30880 | ER308 ^D | 0.08 | 1.00–2.50 | 0.030 | 0.030 | 0.25–0.60 | 19.5–22.0 | 9.0–11.0 | ... | ... | ... |
| S31008 | 310S | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | ... | ... |
| S31009 | 310H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | ... | ... |
| S31040 | 310Cb | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 24.0–26.0 | 19.0–22.0 | ... | ... | Cb 10×C-1.10 |
| S31254 | ... | 0.020 | 1.00 | 0.030 | 0.010 | 0.80 | 19.5–20.5 | 17.5–18.5 | 0.18–0.22 | 6.0–6.5 | Cu 0.50–1.00 |
| S31600 | 316 | 0.08 ^C | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | ... | 2.00–3.00 | ... |
| S31603 | 316L | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | ... | 2.00–3.00 | ... |
| S31609 | 316H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | ... | 2.00–3.00 | ... |
| S31635 | 316Ti | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | 0.10 | 2.00–3.00 | Ti 5×(C+N)- 0.70 |
| S31640 | 316Cb | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | 0.10 | 2.00–3.00 | Cb 10×C- 1.10 |
| S31651 | 316N | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | 0.10–0.16 | 2.00–3.00 | ... |
| S31653 | 316LN | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 16.0–18.0 | 10.0–14.0 | 0.10–0.16 | 2.00–3.00 | ... |
| S31700 | 317 | 0.08 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 11.0–15.0 | ... | 3.0–4.0 | ... |
| S31725 | ... | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 18.0–20.0 | 13.5–17.5 | 0.20 | 4.0–5.0 | ... |
| S31726 | ... | 0.030 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–20.0 | 14.5–17.5 | 0.10–0.20 | 4.0–5.0 | ... |
| S31727 | ... | 0.030 | 1.00 | 0.030 | 0.030 | 1.00 | 17.5–19.0 | 14.5–16.5 | 0.15–0.21 | 3.8–4.5 | Cu 2.8–4.0 |
| S32050 | ... | 0.030 | 1.50 | 0.035 | 0.020 | 1.00 | 22.0–24.0 | 20.0–23.0 | 0.21–0.32 | 6.0–6.8 | Cu 0.40 |
| S32053 | ... | 0.030 | 1.00 | 0.030 | 0.010 | 1.00 | 22.0–24.0 | 24.0–26.0 | 0.17–0.22 | 5.0–6.0 | ... |
| S32100 | 321 | 0.08 ^E | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | Ti 5×(C+N)- 0.70 ^F |
| S32109 | 321H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | Ti 4×(C+N)- 0.70 ^F |
| S32615 | ... | 0.07 | 2.00 | 0.045 | 0.030 | 4.8–6.0 | 16.5–19.5 | 19.0–22.0 | ... | 0.30–1.50 | ... |
| S32654 | ... | 0.020 | 2.0–4.0 | 0.030 | 0.005 | 0.50 | 24.0–25.0 | 21.0–23.0 | 7.0–8.0 | 0.45–0.55 | Cu 0.30–0.60 |
| S33228 | ... | 0.04–0.08 | 1.00 | 0.020 | 0.015 | 0.30 | 26.0–28.0 | 31.0–33.0 | ... | ... | Cb 0.60–1.00; Ce 0.05–0.10; Al 0.025 Cb 0.10 |
| S34565 | ... | 0.030 | 5.0–7.0 | 0.030 | 0.010 | 1.00 | 23.0–25.0 | 16.0–18.0 | 0.40–0.60 | 4.0–5.0 | Cb 10×C–1.10 |
| S34700 | 347 | 0.08 ^E | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | Cb 8×C–1.10 |
| S34709 | 347H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | ... |

TABLE 1 *Continued*

| UNS Designation ^A | Type | Composition, % ^B | | | | | | | | | |
|------------------------------|-------|-----------------------------|-----------|------------|--------|-----------|-----------|-----------|--------------------|------------|--|
| | | Carbon | Manganese | Phosphorus | Sulfur | Silicon | Chromium | Nickel | Nitrogen | Molybdenum | Other Elements ^C |
| S34800 | 348 | 0.08 ^E | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | (Cb+Ta) 10×C–1.10; Ta 0.10; Co 0.20 |
| S34809 | 348H | 0.04–0.10 | 2.00 | 0.045 | 0.030 | 1.00 | 17.0–19.0 | 9.0–12.0 | ... | ... | (Cb + Ta) 8×C–1.10; Co 0.20; Ta 0.10 |
| S35315 | ... | 0.04–0.08 | 2.00 | 0.040 | 0.030 | 1.20–2.00 | 24.0–26.0 | 34.0–36.0 | 0.12–0.18 | ... | Ce 0.03–0.08 |
| S38815 | ... | 0.030 | 2.00 | 0.040 | 0.020 | 5.50–6.50 | 13.0–15.0 | 15.0–17.0 | ... | 0.75–1.50 | Al 0.30; Cu 0.75–1.50 |
| Austenitic-Ferritic Grades | | | | | | | | | | | |
| S31803 | ... | 0.030 | 2.00 | 0.030 | 0.020 | 1.00 | 21.0–23.0 | 4.5–6.5 | 0.08–0.20 | 2.5–3.5 | ... |
| S32101 | ... | 0.040 | 4.0–6.0 | 0.040 | 0.030 | 1.00 | 21.0–22.0 | 1.35–1.70 | 0.20–0.25 | 0.10–0.80 | Cu 0.10–0.80 |
| S32205 | ... | 0.030 | 2.00 | 0.030 | 0.020 | 1.00 | 22.0–23.0 | 4.5–6.5 | 0.14–0.20 | 3.0–3.5 | ... |
| S32506 | ... | 0.030 | 1.00 | 0.040 | 0.015 | 0.90 | 24.0–26.0 | 5.5–7.2 | 0.08–0.20 | 3.0–3.5 | W 0.05–0.30 |
| S32550 | ... | 0.04 | 1.50 | 0.040 | 0.030 | 1.00 | 24.0–27.0 | 4.5–6.5 | 0.10–0.25 | 2.9–3.9 | Cu 1.50–2.50 |
| S32750 | ... | 0.030 | 1.20 | 0.035 | 0.020 | 0.80 | 24.0–26.0 | 6.0–8.0 | 0.24–0.32 | 3.0–5.0 | Cu 0.50 |
| S32760 ^G | ... | 0.030 | 1.00 | 0.030 | 0.010 | 1.00 | 24.0–26.0 | 6.0–8.0 | 0.20–0.30 | 3.0–4.0 | Cu 0.50–1.00; W 0.50–1.00 |
| S32906 | ... | 0.030 | 0.80–1.50 | 0.030 | 0.030 | 0.50 | 28.0–30.0 | 5.8–7.5 | 0.30–0.40 | 1.50–2.60 | Cu 0.80 |
| S32950 | ... | 0.03 | 2.00 | 0.035 | 0.010 | 0.60 | 26.0–29.0 | 3.5–5.2 | 0.15–0.35 | 1.00–2.50 | ... |
| S39277 | ... | 0.025 | 0.80 | 0.025 | 0.002 | 0.80 | 24.0–26.0 | 6.5–8.0 | 0.23–0.33 | 3.0–4.0 | Cu 1.20–2.00 W 0.80–1.20 |
| Ferritic Grades | | | | | | | | | | | |
| S40500 | 405 | 0.08 | 1.00 | 0.040 | 0.030 | 1.00 | 11.5–14.5 | 0.50 | ... | ... | Al 0.10–0.30 |
| S43000 | 430 | 0.12 | 1.00 | 0.040 | 0.030 | 1.00 | 16.0–18.0 | ... | ... | ... | ... |
| S43035 | 439 | 0.07 | 1.00 | 0.040 | 0.030 | 1.00 | 17.0–19.0 | 0.50 | 0.04 | ... | Ti 0.20 + 4 × (C+N) –1.10; Al 0.15 |
| S44400 | 444 | 0.025 | 1.00 | 0.040 | 0.030 | 1.00 | 17.5–19.5 | 1.00 | 0.035 | 1.75–2.50 | (Ti+Cb) 0.20 + 4 × (C+N)–0.80 |
| S44627 | XM-27 | 0.010 ^H | 0.40 | 0.020 | 0.020 | 0.40 | 25.0–27.5 | 0.50 | 0.015 ^H | 0.75–1.50 | Cu 0.20; Cb 0.05–0.20; (Ni+Cu) 0.50 |
| S44700 | ... | 0.010 | 0.30 | 0.025 | 0.020 | 0.20 | 28.0–30.0 | 0.15 | 0.020 | 3.5–4.2 | (C+N) 0.025; Cu 0.15 |
| S44800 | ... | 0.010 | 0.30 | 0.025 | 0.020 | 0.20 | 28.0–30.0 | 2.00–2.50 | 0.020 | 3.5–4.2 | (C+N) 0.025; Cu 0.15 |
| Martensitic Grades | | | | | | | | | | | |
| S40300 | 403 | 0.15 | 1.00 | 0.040 | 0.030 | 0.50 | 11.5–13.0 | ... | ... | ... | ... |
| S41000 | 410 | 0.15 | 1.00 | 0.040 | 0.030 | 1.00 | 11.5–13.5 | ... | ... | ... | ... |
| S41040 | XM-30 | 0.18 | 1.00 | 0.040 | 0.030 | 1.00 | 11.5–13.5 | ... | ... | ... | Cb 0.05–0.30 |
| S41400 | 414 | 0.15 | 1.00 | 0.040 | 0.030 | 1.00 | 11.5–13.5 | 1.25–2.50 | ... | ... | ... |
| S41425 | ... | 0.05 | 0.50–1.00 | 0.020 | 0.005 | 0.50 | 12.0–15.0 | 4.0–7.0 | 0.06–0.12 | 1.50–2.00 | Cu 0.30 |
| S41500 | ... | 0.05 | 0.50–1.00 | 0.030 | 0.030 | 0.60 | 11.5–14.0 | 3.5–5.5 | ... | 0.50–1.00 | ... |
| S43100 | 431 | 0.20 | 1.00 | 0.040 | 0.030 | 1.00 | 15.0–17.0 | 1.25–2.50 | ... | ... | ... |

^A New designations established in accordance with Practice E 527 and SAE J 1086 published jointly by ASTM and SAE. See ASTM DS-56C, available from ASTM Headquarters.

^B Maximum unless otherwise indicated.

^C Except as required for specific alloy type, molybdenum, titanium, nickel, cobalt, tantalum, nitrogen, and copper need not be reported but shall not be present in other than residual amounts, the intent being to prohibit substitution of one alloy type for another due to absence of control of the above named elements in certain alloys.

^D American Welding Society designation.

^E See Supplementary Requirement S1.

^F Nitrogen content is to be reported for this grade.

^G % Cr + 3.3 × % Mo + 16 × % N ≥ 40.

^H Product analysis tolerance over the maximum limit for carbon and nitrogen to be 0.002 %.

^I Wrought version of CA6NM.

4.4.2.1 *Condition 1*—1250°F [675°C] minimum, 1400°F [760°C] maximum.

4.4.2.2 *Condition 2*—1100°F [595°C] minimum, 1400°F [760°C] maximum.

4.4.2.3 *Condition 3*—1050°F [565°C] minimum, 1400°F [760°C] maximum.