



## Designation: **A240/A240M-09e** Designation: **A240/A240M - 10**

# Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications<sup>1</sup>

This standard is issued under the fixed designation A240/A240M; 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 Department of Defense.*

## 1. Scope\*

- 1.1 This specification<sup>2</sup> covers chromium, chromium-nickel, and chromium-manganese-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications.
- 1.2 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 of the other. Combining values from the two systems may result in non-conformance with the standard.
- 1.3 This specification is expressed in both inch-pound and SI units. However, unless the order specifies the applicable “M” specification designation (SI units), the material shall be furnished in inch-pound units.
- 1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

- 2.1 *ASTM Standards*:<sup>3</sup>
  - A370 Test Methods and Definitions for Mechanical Testing of Steel Products
  - A480/A480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
  - A923 Test Methods for Detecting Detrimental Intermetallic Phase in Duplex Austenitic/Ferritic Stainless Steels
  - E112 Test Methods for Determining Average Grain Size
  - E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
- 2.2 *SAE Standard*:<sup>4</sup>
  - J 1086 Practice for Numbering Metals and Alloys (UNS)

## 3. General Requirements

- 3.1 The following requirements for orders for material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A480/A480M.
  - 3.1.1 Definitions;
  - 3.1.2 General requirements for delivery;
  - 3.1.3 Ordering information;
  - 3.1.4 Process;
  - 3.1.5 Special tests;
  - 3.1.6 Heat treatment;
  - 3.1.7 Dimensions and permissible variations;
  - 3.1.8 Workmanship, finish and appearance;
  - 3.1.9 Number of tests/test methods;

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

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SA-240 in Section II of that Code.

<sup>3</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.

<sup>4</sup> Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

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

- 3.1.10 Specimen preparation;
- 3.1.11 Retreatment;
- 3.1.12 Inspection;
- 3.1.13 Rejection and reheating;
- 3.1.14 Material test report;
- 3.1.15 Certification; and
- 3.1.16 Packaging, marking, and loading.

#### **4. Chemical Composition**

4.1 The steel shall conform to the requirements as to chemical composition specified in Table 1 and shall conform to applicable requirements specified in Specification A480/A480M.

#### **5. Mechanical Properties**

- 5.1 The material shall conform to the mechanical properties specified in Table 2.
- 5.2 When specified by the purchaser, Charpy impact tests shall be performed in accordance with Supplementary Requirement S1.

#### **6. Materials for High-Temperature Service**

- 6.1 The austenitic *H* Types shall conform to an average grain size of ASTM No. 7 or coarser as measured by Test Methods E112.
- 6.2 Supplementary Requirement S2 shall be invoked when non-H grade austenitic stainless steels are ordered for ASME Code applications for service above 1000°F [540°C].
- 6.3 Grade S31060, unless otherwise specified in the purchase order, shall conform to an average grain size of ASTM No. 7 or coarser, as measured by Test Methods E112.

#### **7. Keywords**

7.1 chromium; chromium-nickel stainless steel; chromium-manganese-nickel stainless steel; pressure vessels

TABLE 1 Chemical Composition Requirements, %<sup>A</sup>

| UNS Designation <sup>B</sup>                             | Type <sup>C</sup>  | Carbon <sup>D</sup> | Manganese | Phosphorus | Sulfur | Silicon   | Chromium  | Nickel    | Molybdenum | Nitrogen  | Copper    | Other Elements <sup>E,F</sup>                            |
|--|--------------------|---------------------|-----------|------------|--------|-----------|-----------|-----------|------------|-----------|-----------|--|
| Austenitic (Chromium-Nickel) (Chromium-Manganese-Nickel) |                    |                     |           |            |        |           |           |           |            |           |           |  |
| N08020   | ...                | 0.07                | 2.00      | 0.045      | 0.035  | 1.00      | 19.0–21.0 | 32.0–38.0 | 2.00–3.00  | ...       | 3.0–4.0   | Cb 8×C min, 1.00 max                                     |
| N08367   | ...                | 0.030               | 2.00      | 0.040      | 0.030  | 1.00      | 20.0–22.0 | 23.5–25.5 | 6.0–7.0    | 0.18–0.25 | 0.75      | ...  |
| N08700   | ...                | 0.04                | 2.00      | 0.040      | 0.030  | 1.00      | 19.0–23.0 | 24.0–26.0 | 4.3–5.0    | ...       | 0.50      | Cb 8×C min 0.40 max                                      |
| N08800   | 800 <sup>G</sup>   | 0.10                | 1.50      | 0.045      | 0.015  | 1.00      | 19.0–23.0 | 30.0–35.0 | ...        | ...       | 0.75      | Fe <sup>H</sup> 39.5 min<br>Al 0.15–0.60<br>Ti 0.15–0.60 |
| N08810   | 800H <sup>G</sup>  | 0.05–0.10           | 1.50      | 0.045      | 0.015  | 1.00      | 19.0–23.0 | 30.0–35.0 | ...        | ...       | 0.75      | Fe <sup>H</sup> 39.5 min<br>Al 0.15–0.60<br>Ti 0.15–0.60 |
| N08811   | ...                | 0.06–0.10           | 1.50      | 0.040      | 0.015  | 1.00      | 19.0–23.0 | 30.0–35.0 | ...        | ...       | 0.75      | Fe <sup>H</sup> 39.5 min<br>Ti 0.15–0.60<br>Al 0.15–0.60 |
| N08904   | 904L <sup>G</sup>  | 0.020               | 2.00      | 0.045      | 0.035  | 1.00      | 19.0–23.0 | 23.0–28.0 | 4.0–5.0    | 0.10      | 1.0–2.0   | ...  |
| N08926   | ...                | 0.020               | 2.00      | 0.030      | 0.010  | 0.50      | 19.0–21.0 | 24.0–26.0 | 6.0–7.0    | 0.15–0.25 | 0.5–1.5   | ...  |
| S20100   | 201                | 0.15                | 5.5–7.5   | 0.060      | 0.030  | 1.00      | 16.0–18.0 | 3.5–5.5   | ...        | 0.25      | ...       | ...  |
| S20103   | ...                | 0.03                | 5.5–7.5   | 0.045      | 0.030  | 0.75      | 16.0–18.0 | 3.5–5.5   | ...        | 0.25      | ...       | ...  |
| S20153   | ...                | 0.03                | 6.4–7.5   | 0.045      | 0.015  | 0.75      | 16.0–17.5 | 4.0–5.0   | ...        | 0.10–0.25 | 1.00      | ...  |
| S20161   | ...                | 0.15                | 4.0–6.0   | 0.040      | 0.040  | 3.0–4.0   | 15.0–18.0 | 4.0–6.0   | ...        | 0.08–0.20 | ...       | ...  |
| S20200   | 202                | 0.15                | 7.5–10.0  | 0.060      | 0.030  | 1.00      | 17.0–19.0 | 4.0–6.0   | ...        | 0.25      | ...       | ...  |
| S20400   | ...                | 0.030               | 7.0–9.0   | 0.040      | 0.030  | 1.00      | 15.0–17.0 | 1.50–3.00 | ...        | 0.15–0.30 | ...       | ...  |
| S20431   | ...                | 0.12                | 5.0–7.0   | 0.045      | 0.030  | 1.00      | 17.0–18.0 | 2.0–4.0   | ...        | 0.10–0.25 | 1.5–3.5   | ...  |
| S20432   | ...                | 0.08                | 3.0–5.0   | 0.045      | 0.030  | 1.00      | 17.0–18.0 | 4.0–6.0   | ...        | 0.05–0.20 | 2.00–3.00 | ...  |
| S20433   | ...                | 0.08                | 5.5–7.5   | 0.045      | 0.030  | 1.00      | 17.0–18.0 | 3.5–5.5   | ...        | 0.10–0.25 | 1.5–3.5   | ...  |
| S20910   | XM-19 <sup>J</sup> | 0.06                | 4.0–6.0   | 0.040      | 0.030  | 0.75      | 20.5–23.5 | 11.5–13.5 | 1.50–3.00  | 0.20–0.40 | ...       | Cb 0.10–0.30<br>V 0.10–0.30                              |
| S21400   | XM-31 <sup>J</sup> | 0.12                | 14.0–16.0 | 0.045      | 0.030  | 0.30–1.00 | 17.0–18.5 | 1.00      | ...        | 0.35 min  | ...       | ...  |
| S21600   | XM-17 <sup>J</sup> | 0.08                | 7.5–9.0   | 0.045      | 0.030  | 0.75      | 17.5–22.0 | 5.0–7.0   | 2.00–3.00  | 0.25–0.50 | ...       | ...  |
| S21603   | XM-18 <sup>J</sup> | 0.03                | 7.5–9.0   | 0.045      | 0.030  | 0.75      | 17.5–22.0 | 5.0–7.0   | 2.00–3.00  | 0.25–0.50 | ...       | ...  |
| S21640   | ...                | 0.08                | 3.5–6.5   | 0.060      | 0.030  | 1.00      | 17.5–19.5 | 4.0–6.5   | 0.50–2.00  | 0.08–0.30 | ...       | Cb 0.10–1.00   |
| 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 <sup>J</sup> | 0.04                | 8.0–10.0  | 0.060      | 0.030  | 0.75      | 19.0–21.5 | 5.5–7.5   | ...        | 0.15–0.40 | ...       | ...  |
| S24000   | XM-29 <sup>J</sup> | 0.08                | 11.5–14.5 | 0.060      | 0.030  | 0.75      | 17.0–19.0 | 2.3–3.7   | ...        | 0.20–0.40 | ...       | ...  |
| S30100   | 301                | 0.15                | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 6.0–8.0   | ...        | 0.10      | ...       | ...  |
| S30103   | 301L <sup>G</sup>  | 0.03                | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 6.0–8.0   | ...        | 0.20      | ...       | ...  |
| S30153   | 301LN <sup>G</sup> | 0.03                | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 6.0–8.0   | ...        | 0.07–0.20 | ...       | ...  |
| S30200   | 302                | 0.15                | 2.00      | 0.045      | 0.030  | 0.75      | 17.0–19.0 | 8.0–10.0  | ...        | 0.10      | ...       | ...  |
| S30400   | 304                | 0.07                | 2.00      | 0.045      | 0.030  | 0.75      | 17.5–19.5 | 8.0–10.5  | ...        | 0.10      | ...       | ...  |
| S30403   | 304L               | 0.030               | 2.00      | 0.045      | 0.030  | 0.75      | 17.5–19.5 | 8.0–12.0  | ...        | 0.10      | ...       | ...  |
| S30409   | 304H               | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 8.0–10.5  | ...        | ...       | ...       | ...  |
| S30415   | ...                | 0.04–0.06           | 0.80      | 0.045      | 0.030  | 1.00–2.00 | 18.0–19.0 | 9.0–10.0  | ...        | 0.12–0.18 | ...       | Ce 0.03–0.08   |
| S30451   | 304N               | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 8.0–10.5  | ...        | 0.10–0.16 | ...       | ...  |
| S30452   | XM-21 <sup>J</sup> | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 8.0–10.5  | ...        | 0.16–0.30 | ...       | ...  |
| S30453   | 304LN              | 0.030               | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 8.0–12.0  | ...        | 0.10–0.16 | ...       | ...  |
| S30500   | 305                | 0.12                | 2.00      | 0.045      | 0.030  | 0.75      | 17.0–19.0 | 10.5–13.0 | ...        | ...       | ...       | ...  |
| S30530   | ...                | 0.08                | 2.00      | 0.045      | 0.030  | 0.50–2.50 | 17.0–20.5 | 8.5–11.5  | 0.75–1.50  | ...       | 0.75–3.5  | ...  |
| S30600   | ...                | 0.018               | 2.00      | 0.020      | 0.020  | 3.7–4.3   | 17.0–18.5 | 14.0–15.5 | 0.20       | ...       | 0.50      | ...  |
| S30601   | ...                | 0.015               | 0.50–0.80 | 0.030      | 0.013  | 5.0–5.6   | 17.0–18.0 | 17.0–18.0 | 0.20       | 0.05      | 0.35      | ...  |
| S30615   | ...                | 0.16–0.24           | 2.00      | 0.030      | 0.030  | 3.2–4.0   | 17.0–19.5 | 13.5–16.0 | ...        | ...       | ...       | Al 0.80–1.50   |
| 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  | 0.75      | 22.0–24.0 | 12.0–15.0 | ...        | ...       | ...       | ...  |
| S30909   | 309H <sup>G</sup>  | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 22.0–24.0 | 12.0–15.0 | ...        | ...       | ...       | ...  |

TABLE 1 Continued

| UNS Designation <sup>B</sup> | Type <sup>C</sup>     | Carbon <sup>D</sup> | Manganese | Phosphorus | Sulfur | Silicon | Chromium  | Nickel    | Molybdenum | Nitrogen  | Copper    | Other Elements <sup>E,F</sup>                         |
|------------------------------|-----------------------|---------------------|-----------|------------|--------|---------|-----------|-----------|------------|-----------|-----------|---|
| S30940                       | 309Cb <sup>G</sup>    | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 22.0–24.0 | 12.0–16.0 | ...        | ...       | ...       | Cb 10×C min,<br>1.10 max                              |
| S30941                       | 309HCb <sup>G</sup>   | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75    | 22.0–24.0 | 12.0–16.0 | ...        | ...       | ...       | Cb 10×C min,<br>1.10 max                              |
| S31008                       | 310S                  | 0.08                | 2.00      | 0.045      | 0.030  | 1.50    | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...       | ...   |
| S31009                       | 310H <sup>G</sup>     | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75    | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...       | ...   |
| S31040                       | 310Cb <sup>G</sup>    | 0.08                | 2.00      | 0.045      | 0.030  | 1.50    | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...       | Cb 10×C min,<br>1.10 max                              |
| S31041                       | 310HCb <sup>G</sup>   | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75    | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...       | Cb 10×C min,<br>1.10 max                              |
| S31050                       | 310 MoLN <sup>G</sup> | 0.020               | 2.00      | 0.030      | 0.010  | 0.50    | 24.0–26.0 | 20.5–23.5 | 1.60–2.60  | 0.09–0.15 | ...       | ...   |
| S31060                       | ...                   | 0.05–0.10           | 1.00      | 0.040      | 0.030  | 0.50    | 22.0–24.0 | 10.0–12.5 | ...        | 0.18–0.25 | ...       | Ce + La<br>0.025–0.070<br>B 0.001–0.010               |
| S31254                       | ...                   | 0.020               | 1.00      | 0.030      | 0.010  | 0.80    | 19.5–20.5 | 17.5–18.5 | 6.0–6.5    | 0.18–0.22 | 0.50–1.00 | ...   |
| S31266                       | ...                   | 0.030               | 2.0–4.0   | 0.035      | 0.020  | 1.00    | 23.0–25.0 | 21.0–24.0 | 5.2–6.2    | 0.35–0.60 | 1.00–2.50 | W 1.50–2.50   |
| S31277                       | ...                   | 0.020               | 3.00      | 0.030      | 0.010  | 0.50    | 20.5–23.0 | 26.0–28.0 | 6.5–8.0    | 0.30–0.40 | 0.50–1.50 | ...   |
| S31600                       | 316                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10      | ...       | ...   |
| S31603                       | 316L                  | 0.030               | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10      | ...       | ...   |
| S31609                       | 316H                  | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | ...       | ...       | ...   |
| S31635                       | 316Ti <sup>G</sup>    | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10      | ...       | Ti 5 × (C + N)<br>min, 0.70 max                       |
| S31640                       | 316Cb <sup>G</sup>    | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10      | ...       | Cb 10 × C<br>min, 1.10 max                            |
| S31651                       | 316N                  | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10–0.16 | ...       | ...   |
| S31653                       | 316LN                 | 0.030               | 2.00      | 0.045      | 0.030  | 0.75    | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10–0.16 | ...       | ...   |
| S31700                       | 317                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 18.0–20.0 | 11.0–15.0 | 3.0–4.0    | 0.10      | ...       | ...   |
| S31703                       | 317L                  | 0.030               | 2.00      | 0.045      | 0.030  | 0.75    | 18.0–20.0 | 11.0–15.0 | 3.0–4.0    | 0.10      | ...       | ...   |
| S31725                       | 317LM <sup>G</sup>    | 0.030               | 2.00      | 0.045      | 0.030  | 0.75    | 18.0–20.0 | 13.5–17.5 | 4.0–5.0    | 0.20      | ...       | ...   |
| S31726                       | 317LMN <sup>G</sup>   | 0.030               | 2.00      | 0.045      | 0.030  | 0.75    | 17.0–20.0 | 13.5–17.5 | 4.0–5.0    | 0.10–0.20 | ...       | ...   |
| S31727                       | ...                   | 0.030               | 1.00      | 0.030      | 0.030  | 1.00    | 17.5–19.0 | 14.5–16.5 | 3.8–4.5    | 0.15–0.21 | 2.8–4.0   | ...   |
| S31753                       | 317LN <sup>G</sup>    | 0.030               | 2.00      | 0.045      | 0.030  | 0.75    | 18.0–20.0 | 11.0–15.0 | 3.0–4.0    | 0.10–0.22 | ...       | ...   |
| S32050                       | ...                   | 0.030               | 1.50      | 0.035      | 0.020  | 1.00    | 22.0–24.0 | 20.0–23.0 | 6.0–6.8    | 0.21–0.32 | 0.40      | ...   |
| S32053                       | ...                   | 0.030               | 1.00      | 0.030      | 0.010  | 1.00    | 22.0–24.0 | 24.0–26.0 | 5.0–6.0    | 0.17–0.22 | ...       | ...   |
| S32100                       | 321                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 17.0–19.0 | 9.0–12.0  | ...        | 0.10      | ...       | Ti 5 × (C + N)<br>min, 0.70 max                       |
| S32109                       | 321H                  | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75    | 17.0–19.0 | 9.0–12.0  | ...        | ...       | ...       | Ti 4 × (C + N)<br>min, 0.70 max                       |
| 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  | ...       | 1.50–2.50 | ...   |
| 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 | 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 | ...        | ...       | ...       | Ce 0.05–0.10<br>Cb 0.6–1.0<br>Al 0.025                |
| S33400                       | 334 <sup>G</sup>      | 0.08                | 1.00      | 0.030      | 0.015  | 1.00    | 18.0–20.0 | 19.0–21.0 | ...        | ...       | ...       | Al 0.15–0.60<br>Ti 0.15–0.60                          |
| S34565                       | ...                   | 0.030               | 5.0–7.0   | 0.030      | 0.010  | 1.00    | 23.0–25.0 | 16.0–18.0 | 4.0–5.0    | 0.40–0.60 | ...       | Cb 0.10   |
| S34700                       | 347                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 17.0–19.0 | 9.0–13.0  | ...        | ...       | ...       | Cb 10 × C min,<br>1.00 max                            |
| S34709                       | 347H                  | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75    | 17.0–19.0 | 9.0–13.0  | ...        | ...       | ...       | Cb 8 × C min,<br>1.00 max                             |
| S34800                       | 348                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75    | 17.0–19.0 | 9.0–13.0  | ...        | ...       | ...       | (Cb + Ta) 10×C<br>min, 1.00 max<br>Ta 0.10<br>Co 0.20 |

TABLE 1 Continued

| UNS Designation <sup>B</sup>       | Type <sup>C</sup>  | Carbon <sup>D</sup> | Manganese | Phosphorus | Sulfur | Silicon   | Chromium  | Nickel    | Molybdenum | Nitrogen             | Copper    | Other Elements <sup>E,F</sup>                               |
|------------------------------------|--------------------|---------------------|-----------|------------|--------|-----------|-----------|-----------|------------|----------------------|-----------|---|
| S34809                             | 348H               | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 17.0–19.0 | 9.0–13.0  | ...        | ...                  | ...       | (Cb + Ta) 8×C min, 1.00 max<br>Ta 0.10<br>Co 0.20           |
| S35045                             | ...                | 0.06–0.10           | 1.50      | 0.045      | 0.015  | 1.00      | 25.0–29.0 | 32.0–37.0 | ...        | ...                  | 0.75      | Al 0.15–0.60<br>Ti 0.15–0.60                                |
| S35115                             | 865                | 0.030               | 1.00      | 0.045      | 0.015  | 0.50–1.50 | 23.0–25.0 | 19.0–22.0 | 1.50–2.50  | 0.20–0.30            | ...       | ...   |
| S35115                             | ...                | 0.030               | 1.00      | 0.045      | 0.015  | 0.50–1.50 | 23.0–25.0 | 19.0–22.0 | 1.50–2.50  | 0.20–0.30            | ...       | ...   |
| S35125                             | ...                | 0.10                | 1.00–1.50 | 0.045      | 0.015  | 0.50      | 20.0–23.0 | 31.0–35.0 | 2.00–3.00  | ...                  | ...       | Cb 0.25–0.60  |
| S35135                             | ...                | 0.08                | 1.00      | 0.045      | 0.015  | 0.60–1.00 | 20.0–25.0 | 30.0–38.0 | 4.0–4.8    | ...                  | 0.75      | Ti 0.40–1.00  |
| S35140                             | ...                | 0.10                | 1.0–3.0   | 0.045      | 0.030  | 0.75      | 20.0–22.0 | 25.0–27.0 | 1.00–2.00  | 0.08–0.20            | ...       | Cb 0.25–0.75  |
| 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 0.03–0.10  |
| S38100                             | XM-15 <sup>J</sup> | 0.08                | 2.00      | 0.030      | 0.030  | 1.50–2.50 | 17.0–19.0 | 17.5–18.5 | ...        | ...                  | ...       | ...   |
| S38815                             | ...                | 0.030               | 2.00      | 0.040      | 0.020  | 5.5–6.5   | 13.0–15.0 | 13.0–17.0 | 0.75–1.50  | ...                  | 0.75–1.50 | Al 0.30   |
| Duplex (Austenitic-Ferritic)       |                    |                     |           |            |        |           |           |           |            |                      |           |   |
| S31200                             | ...                | 0.030               | 2.00      | 0.045      | 0.030  | 1.00      | 24.0–26.0 | 5.5–6.5   | 1.20–2.00  | 0.14–0.20            | ...       | ...   |
| S31260                             | ...                | 0.03                | 1.00      | 0.030      | 0.030  | 0.75      | 24.0–26.0 | 5.5–7.5   | 2.5–3.5    | 0.10–0.30            | 0.20–0.80 | W 0.10–0.50   |
| S31803                             | ...                | 0.030               | 2.00      | 0.030      | 0.020  | 1.00      | 21.0–23.0 | 4.5–6.5   | 2.5–3.5    | 0.08–0.20            | ...       | ...   |
| S32001                             | ...                | 0.030               | 4.0–6.0   | 0.040      | 0.030  | 1.00      | 19.5–21.5 | 1.00–3.00 | 0.60       | 0.05–0.17            | 1.00      | ...   |
| S32003                             | ...                | 0.030               | 2.00      | 0.030      | 0.020  | 1.00      | 19.5–22.5 | 3.0–4.0   | 1.50–2.00  | 0.14–0.20            | ...       | ...   |
| S32101                             | ...                | 0.040               | 4.0–6.0   | 0.040      | 0.030  | 1.00      | 21.0–22.0 | 1.35–1.70 | 0.10–0.80  | 0.20–0.25            | 0.10–0.80 | ...   |
| S32202                             | ...                | 0.030               | 2.00      | 0.040      | 0.010  | 1.00      | 21.5–24.0 | 1.00–2.80 | 0.45       | 0.18–0.26            | ...       | ...   |
| S32205                             | 2205 <sup>G</sup>  | 0.030               | 2.00      | 0.030      | 0.020  | 1.00      | 22.0–23.0 | 4.5–6.5   | 3.0–3.5    | 0.14–0.20            | ...       | ...   |
| S32304                             | 2304 <sup>G</sup>  | 0.030               | 2.50      | 0.040      | 0.030  | 1.00      | 21.5–24.5 | 3.0–5.5   | 0.05–0.60  | 0.05–0.20            | 0.05–0.60 | ...   |
| S32506                             | ...                | 0.030               | 1.00      | 0.040      | 0.015  | 0.90      | 24.0–26.0 | 5.5–7.2   | 3.0–3.5    | 0.08–0.20            | ...       | W 0.05–0.30   |
| S32520                             | ...                | 0.030               | 1.50      | 0.035      | 0.020  | 0.80      | 24.0–26.0 | 5.5–8.0   | 3.0–4.0    | 0.20–0.35            | 0.50–2.00 | ...   |
| S32550                             | 255 <sup>G</sup>   | 0.04                | 1.50      | 0.040      | 0.030  | 1.00      | 24.0–27.0 | 4.5–6.5   | 2.9–3.9    | 0.10–0.25            | 1.50–2.50 | ...   |
| S32750                             | 2507 <sup>G</sup>  | 0.030               | 1.20      | 0.035      | 0.020  | 0.80      | 24.0–26.0 | 6.0–8.0   | 3.0–5.0    | 0.24–0.32            | 0.50      | ...   |
| S32760 <sup>K</sup>                | ...                | 0.030               | 1.00      | 0.030      | 0.010  | 1.00      | 24.0–26.0 | 6.0–8.0   | 3.0–4.0    | 0.20–0.30            | 0.50–1.00 | W 0.50–1.00   |
| S32900                             | 329                | 0.08                | 1.00      | 0.040      | 0.030  | 0.75      | 23.0–28.0 | 2.0–5.00  | 1.00–2.00  | ...                  | ...       | ...   |
| S32906                             | ...                | 0.030               | 0.80–1.50 | 0.030      | 0.030  | 0.80      | 28.0–30.0 | 5.8–7.5   | 1.50–2.60  | 0.30–0.40            | 0.80      | ...   |
| S32950                             | ...                | 0.030               | 2.00      | 0.035      | 0.010  | 0.60      | 26.0–29.0 | 3.5–5.2   | 1.00–2.50  | 0.15–0.35            | ...       | ...   |
| S39274                             | ...                | 0.030               | 1.00      | 0.030      | 0.020  | 0.80      | 24.0–26.0 | 6.0–8.0   | 2.5–3.5    | 0.24–0.32            | 0.20–0.80 | W 1.50–2.50   |
| S81921                             | ...                | 0.030               | 2.0–4.0   | 0.040      | 0.030  | 1.00      | 19.0–22.0 | 2.0–4.0   | 1.00–2.00  | 0.14–0.20            | ...       | ...   |
| S82011                             | ...                | 0.030               | 2.0–3.0   | 0.040      | 0.020  | 1.00      | 20.5–23.5 | 1.0–2.0   | 0.10–1.00  | 0.15–0.27            | 0.50      | ...   |
| Ferritic or Martensitic (Chromium) |                    |                     |           |            |        |           |           |           |            |                      |           |   |
| S32803                             | ...                | 0.015               | 0.50      | 0.020      | 0.0035 | 0.55      | 28.0–29.0 | 3.0–4.0   | 1.80–2.50  | 0.020<br>(C+N) 0.030 | ...       | Cb 12×(C+N) min,<br>0.15–0.50                               |
| S40500                             | 405                | 0.08                | 1.00      | 0.040      | 0.030  | 1.00      | 11.5–14.5 | 0.60      | ...        | ...                  | ...       | Al 0.10–0.30  |
| S40900 <sup>L</sup>                | 409 <sup>L</sup>   | ...                 | ...       | ...        | ...    | ...       | ...       | ...       | ...        | ...                  | ...       | ...   |
| S40910                             | ...                | 0.030               | 1.00      | 0.040      | 0.020  | 1.00      | 10.5–11.7 | 0.50      | ...        | 0.030                | ...       | Ti 6×(C+N) min,<br>0.50 max; Cb<br>0.17                     |
| S40920                             | ...                | 0.030               | 1.00      | 0.040      | 0.020  | 1.00      | 10.5–11.7 | 0.50      | ...        | 0.030                | ...       | Ti 8×(C+N) min,<br>Ti 0.15–0.50; Cb<br>0.10                 |
| S40930                             | ...                | 0.030               | 1.00      | 0.040      | 0.020  | 1.00      | 10.5–11.7 | 0.50      | ...        | 0.030                | ...       | (Ti+Cb) [0.08+8<br>×(C+N)] min,<br>0.75 max;<br>Ti 0.05 min |
| S40945                             | ...                | 0.030               | 1.00      | 0.040      | 0.030  | 1.00      | 10.5–11.7 | 0.50      | ...        | 0.030                | ...       | Cb 0.18–0.40<br>Ti 0.05–0.20                                |

TABLE 1 Continued

| UNS Designation <sup>B</sup> | Type <sup>C</sup>  | Carbon <sup>D</sup> | Manganese | Phosphorus | Sulfur    | Silicon  | Chromium  | Nickel    | Molybdenum | Nitrogen           | Copper    | Other Elements <sup>E,F</sup>                                 |
|------------------------------|--------------------|---------------------|-----------|------------|-----------|----------|-----------|-----------|------------|--------------------|-----------|---|
| S40975                       | ...                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 10.5–11.7 | 0.50–1.00 | ...        | 0.030              | ...       | Ti 6×(C+N) min, 0.75 max                                      |
| S40977                       | ...                | 0.030               | 1.50      | 0.040      | 0.015     | 1.00     | 10.5–12.5 | 0.30–1.00 | ...        | 0.030              | ...       | ...   |
| S41000                       | 410                | 0.08–0.15           | 1.00      | 0.040      | 0.030     | 1.00     | 11.5–13.5 | 0.75      | ...        | ...                | ...       | ...   |
| S41003                       | ...                | 0.030               | 1.50      | 0.040      | 0.030     | 1.00     | 10.5–12.5 | 1.50      | ...        | 0.030              | ...       | ...   |
| S41008                       | 410S               | 0.08                | 1.00      | 0.040      | 0.030     | 1.00     | 11.5–13.5 | 0.60      | ...        | ...                | ...       | ...   |
| S41045                       | ...                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 12.0–13.0 | 0.50      | ...        | 0.030              | ...       | Cb 9×(C+N) min, 0.60 max                                      |
| S41050                       | ...                | 0.04                | 1.00      | 0.045      | 0.030     | 1.00     | 10.5–12.5 | 0.60–1.10 | ...        | 0.10               | ...       | ...   |
| S41500 <sup>M</sup>          | ...                | 0.05                | 0.50–1.00 | 0.030      | 0.030     | 0.60     | 11.5–14.0 | 3.5–5.5   | 0.50–1.00  | ...                | ...       | ...   |
| S42035                       | ...                | 0.08                | 1.00      | 0.045      | 0.030     | 1.00     | 13.5–15.5 | 1.0–2.5   | 0.2–1.2    | ...                | ...       | Ti 0.30–0.50  |
| S42900                       | 429 <sup>G</sup>   | 0.12                | 1.00      | 0.040      | 0.030     | 1.00     | 14.0–16.0 | ...       | ...        | ...                | ...       | ...   |
| S43000                       | 430                | 0.12                | 1.00      | 0.040      | 0.030     | 1.00     | 16.0–18.0 | 0.75      | ...        | ...                | ...       | ...   |
| S43035                       | 439                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 17.0–19.0 | 0.50      | ...        | 0.030              | ...       | Ti [0.20+4(C+N)] min, 1.10 max; Al 0.15                       |
| S43400                       | 434                | 0.12                | 1.00      | 0.040      | 0.030     | 1.00     | 16.0–18.0 | ...       | 0.75–1.25  | ...                | ...       | ...   |
| S43600                       | 436                | 0.12                | 1.00      | 0.040      | 0.030     | 1.00     | 16.0–18.0 | ...       | 0.75–1.25  | ...                | ...       | Cb 5×C min, 0.80 max  |
| S43932                       | ...                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 17.0–19.0 | 0.50      | ...        | 0.030              | ...       | (Ti+Cb) [0.20+4(C+N)] min, 0.75 max; Al 0.15                  |
| S43940                       | ...                | 0.030               | 1.00      | 0.040      | 0.015     | 1.00     | 17.5–18.5 | ...       | ...        | ...                | ...       | Ti 0.10–0.60 Cb [0.30+(3×C)] min                              |
| S44330                       | ...                | 0.025 max           | 1.00 max  | 0.040 max  | 0.030 max | 1.00 max | 20.0–23.0 | ...       | ...        | 0.025 max          | 0.30–0.80 | (Ti+Cb) 8×(C+N) min, 0.80 max                                 |
| S44400                       | 444                | 0.025               | 1.00      | 0.040      | 0.030     | 1.00     | 17.5–19.5 | 1.00      | 1.75–2.50  | 0.035              | ...       | (Ti+Cb)[0.20+4(C+N)] min, 0.80 max                            |
| S44500                       | ...                | 0.020               | 1.00      | 0.040      | 0.012     | 1.00     | 19.0–21.0 | 0.60      | ...        | 0.03               | 0.30–0.60 | Cb 10×(C+N) min, 0.80 max                                     |
| S44536                       | ...                | 0.015               | 1.0       | 0.040      | 0.030     | 1.00     | 20.0–23.0 | 0.5       | ...        | 0.015              | ...       | (Ti+Cb) 8X(C+N)–0.8, Cb min 0.05                              |
| S44626                       | XM-33 <sup>J</sup> | 0.06                | 0.75      | 0.040      | 0.020     | 0.75     | 25.0–27.0 | 0.50      | 0.75–1.50  | 0.04               | 0.20      | Ti 0.20–1.00; Ti 7(C+N) min                                   |
| S44627                       | XM-27 <sup>J</sup> | 0.010 <sup>N</sup>  | 0.40      | 0.020      | 0.020     | 0.40     | 25.0–27.5 | 0.50      | 0.75–1.50  | 0.015 <sup>N</sup> | 0.20      | Cb 0.05–0.20 (Ni + Cu) 0.50                                   |
| S44635                       | ...                | 0.025               | 1.00      | 0.040      | 0.030     | 0.75     | 24.5–26.0 | 3.5–4.5   | 3.5–4.5    | 0.035              | ...       | (Ti+Cb) [0.20+4(C+N)] min, 0.80 max                           |
| S44660                       | ...                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 25.0–28.0 | 1.0–3.5   | 3.0–4.0    | 0.040              | ...       | (Ti+Cb) 0.20 – 1.00, Ti + Cb 6×(C+N) min                      |
| S44700                       | ...                | 0.010               | 0.30      | 0.025      | 0.020     | 0.20     | 28.0–30.0 | 0.15      | 3.5–4.2    | 0.020              | 0.15      | (C+N) 0.025   |
| S44735                       | ...                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 28.0–30.0 | 1.00      | 3.6–4.2    | 0.045              | ...       | (Ti+Cb) 0.20–1.00, (Ti+Cb) 6×(C+N) min                        |
| S44800                       | ...                | 0.010               | 0.30      | 0.025      | 0.020     | 0.20     | 28.0–30.0 | 2.00–2.50 | 3.5–4.2    | 0.020              | 0.15      | (C+N) 0.025   |
| S46800                       | ...                | 0.030               | 1.00      | 0.040      | 0.030     | 1.00     | 18.0–20.0 | 0.50      | ...        | 0.030              | ...       | Ti 0.07–0.30 Cb 0.10–0.60 (Ti+Cb) [0.20+4(C+N)] min, 0.80 max |

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