



# 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 A 240/A 240M; 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.*

<sup>ε1</sup> NOTE—Tables 1 and 2 were editorially corrected in March 2004.

## 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 inch-pound units or SI units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

1.3 This specification is expressed in both inch-pound and SI units. However, unless otherwise specified, the applicable “M” specification designation (SI units), the material shall be furnished in inch-pound units.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

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

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A 923 Test Methods for Determining Intermetallic Phase in Wrought Duplex Austenitic/Ferritic Stainless Steels

E 112 Test Methods for Determining Average Grain Size

E 527 Practice for Numbering Metals and Alloys (UNS)

### 2.2 SAE Standard:

J 1086 Practice for Numbering Metals and Alloys (UNS)<sup>4</sup>

## 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 A 480/A 480M.

- 3.1.1 Conditions;
- 3.1.2 Grading elements 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;
- 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 A 480/A 480M.

## 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.

<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, 400 Commonwealth Dr., Warrendale, PA 15096.

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

## 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 E 112.

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 E 112.



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    | ...                                                      |
| 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>Al 0.15–0.60<br>Ti 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      | 0.15   | 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 | ...     | ...                                                      |
| 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 | ...     | ...                                                      |
| 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 | ...     | ...                                                      |
| 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                 | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 8.0–10.5  | ...        | 0.10      | ...     | ...                                                      |
| S30403                                                   | 304L                | 0.030               | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 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 | ...        | ...       | ...     | ...                                                      |
| 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 | ...        | ...       | ...     | ...                                                      |
| 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, 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, 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, 1.10 max                                    |



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>                        |
|------------------------------|-----------------------|---------------------|-----------|------------|--------|-----------|-----------|-----------|------------|-----------|-----------|------------------------------------------------------|
| 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, 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      | 0.030  | 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                                         |
| 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 | ...       | Ti 0.15-0.60                                         |
| S34700                       | 347                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 17.0-19.0 | 9.0-13.0  | ...        | ...       | ...       | Cb 0.10<br>Cb 10 × C min, 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, 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                      |
| S34809                       | 348H                  | 0.04-0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 17.0-19.0 | 9.0-13.0  | ...        | ...       | ...       | 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      | (Cb + Ta) 8×C<br>min, 1.00 max<br>Ta 0.10<br>Co 0.20 |
| 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      | Al 0.15-0.60<br>Ti 0.15-0.60                         |
| 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 | ...       | Ti 0.40-1.00                                         |
| 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 | ...        | ...       | ...       | Ce 0.03-0.10                                         |
| 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 | ...                                                  |



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>                     |
|------------------------------------|-------------------|---------------------|-----------|------------|--------|---------|-----------|-----------|------------|-------------------|-----------|---------------------------------------------------|
| 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 | ...                                               |
| 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 | W 0.05–0.30                                       |
| 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         | ...       | ...                                               |
| 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  | 0.50    | 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 <sup>†</sup>                | ...               | 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                                       |
| 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 (C+N) 0.030 | ...       | Cb 12×(C+N) min, 0.15–0.50 Al 0.10–0.30           |
| S40500                             | 405               | 0.08                | 1.00      | 0.040      | 0.030  | 1.00    | 11.5–14.5 | 0.60      | ...        | ...               | ...       | Ti 6×(C+N) min, 0.50 max; Cb 0.17                 |
| S40900 <sup>L</sup>                | 409 <sup>L</sup>  | 0.030               | 1.00      | 0.040      | 0.020  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030             | ...       | Ti 8×(C+N) min, Ti 0.15–0.50; Cb 0.10             |
| S40910                             | ...               | 0.030               | 1.00      | 0.040      | 0.020  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030             | ...       | (Ti+Cb) [0.08+8×(C+N)] min, 0.75 max; Ti 0.05 min |
| S40920                             | ...               | 0.030               | 1.00      | 0.040      | 0.020  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030             | ...       | Cb 0.18–0.40 Ti 0.05–0.20                         |
| S40930                             | ...               | 0.030               | 1.00      | 0.040      | 0.020  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030             | ...       | Ti 6×(C+N) min, 0.75 max                          |
| S40945                             | ...               | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030             | ...       | ...                                               |
| S40975                             | ...               | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 10.5–11.7 | 0.50–1.00 | ...        | 0.030             | ...       | ...                                               |
| 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                              |



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>                |
|------------------------------|--------------------|---------------------|-----------|------------|--------|---------|-----------|-----------|------------|--------------------|-----------|----------------------------------------------|
| 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             |
| 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                    |
| S44500                       | ...                | 0.020               | 1.00      | 0.040      | 0.012  | 1.00    | 19.0–21.0 | 0.60      | ...        | 0.03               | 0.30–0.60 | min, 0.80 max Cb 10×(C+N)                    |
| 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      | min, 0.80 max Ti 0.20–1.00;                  |
| 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      | Ti 7(C+N) min                                |
| 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              | ...       | Cb 0.05–0.20 (Ni + Cu) 0.50                  |
| 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+4(C+N)] min, 0.80 max          |
| 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      | (Ti+Cb) 0.20 – 1.00, Ti + Cb                 |
| S44735                       | ...                | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 28.0–30.0 | 1.00      | 3.6–4.2    | 0.045              | ...       | 6×(C+N) min (Ti+Cb)                          |
| 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      | 0.20–1.00, (Ti+Cb) 6×                        |
| S46800                       | ...                | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 18.0–20.0 | 0.50      | ...        | 0.030              | ...       | (C+N) min (C+N) 0.025                        |
|                              |                    |                     |           |            |        |         |           |           |            |                    |           | Ti 0.07–0.30 Cb 0.10–0.60                    |
|                              |                    |                     |           |            |        |         |           |           |            |                    |           | (Ti+Cb) [0.20+4(C+N)] min, 0.80 max          |

<sup>A</sup> Maximum, unless range or minimum is indicated.<sup>B</sup> Designation established in accordance with Practice E 527 and SAE J 1086.<sup>C</sup> Unless otherwise indicated, a grade designation originally assigned by the American Iron and Steel Institute (AISI).<sup>D</sup> Carbon analysis shall be reported to nearest 0.01 % except for the low-carbon types, which shall be reported to nearest 0.001 %.<sup>E</sup> The terms Columbium (Cb) and Niobium (Nb) both relate to the same element.<sup>F</sup> When two minimums or two maximums are listed for a single type, as in the case of both a value from a formula and an absolute value, the higher minimum or lower maximum shall apply.<sup>G</sup> Common name, not a trademark, widely used, not associated with any one producer.<sup>H</sup> Iron shall be determined arithmetically by difference of 100 minus the sum of the other specified elements.<sup>I</sup> (Al + Ti) 0.85–1.20.<sup>J</sup> Naming system developed and applied by ASTM.<sup>K</sup> Cr + 3.3 Mo + 16 N = 40 min.<sup>L</sup> S40900 (Type 409) has been replaced by S40910, S40920, and S40930. Unless otherwise specified in the ordering information, an order specifying S40900 or Type 409 shall be satisfied by any one of S40910, S40920, or S40930 at the option of the seller. Material meeting the requirements of S40910, S40920, or S40930, may at the option of the manufacturer be certified as S40900.<sup>M</sup> Plate version of CA-6NM.<sup>N</sup> Product (check or verification) analysis tolerance over the maximum limit for C and N in XM-27 shall be 0.002 %.<sup>†</sup> UNS number was editorially corrected.



TABLE 2 Mechanical Test Requirements

| UNS Designation                                          | Type <sup>A</sup>   | Tensile Strength, min |     | Yield Strength, <sup>B</sup> min |                  | Elongation in<br>2 in. or 50 mm,<br>min, % | Hardness, max <sup>C</sup> |                 | Cold Bend <sup>D</sup> |  |
|----------------------------------------------------------|---------------------|-----------------------|-----|----------------------------------|------------------|--------------------------------------------|----------------------------|-----------------|------------------------|--|
|                                                          |                     | ksi                   | MPa | ksi                              | MPa              |                                            | Brinell                    | Rockwell B      |                        |  |
|                                                          |                     |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Austenitic (Chromium-Nickel) (Chromium-Manganese-Nickel) |                     |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| N08020                                                   | ...                 | 80                    | 550 | 35                               | 240              | 30 <sup>E</sup>                            | 217                        | 95              | not required           |  |
| N08367                                                   |                     |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Sheet and Strip                                          |                     | 100                   | 690 | 45                               | 310              | 30                                         | ...                        | 100             | not required           |  |
| Plate                                                    |                     | 95                    | 655 | 45                               | 310              | 30                                         | 241                        | ...             | not required           |  |
| N08800                                                   | 800 <sup>F</sup>    | 75                    | 520 | 30 <sup>G</sup>                  | 205 <sup>G</sup> | 30 <sup>H</sup>                            | ...                        | ...             | not required           |  |
| N08810                                                   | 800H <sup>F</sup>   | 65                    | 450 | 25 <sup>G</sup>                  | 170 <sup>G</sup> | 30                                         | ...                        | ...             | not required           |  |
| N08811                                                   | ...                 | 65                    | 450 | 25                               | 170              | 30                                         | ...                        | ...             | not required           |  |
| N08904                                                   | 904L <sup>F</sup>   | 71                    | 490 | 31                               | 220              | 35                                         | ...                        | 90              | not required           |  |
| N08926                                                   | ...                 | 94                    | 650 | 43                               | 295              | 35                                         | ...                        | ...             | not required           |  |
| S20100                                                   | 201-1/ <sup>I</sup> | 75                    | 515 | 38                               | 260              | 40                                         | 217                        | 95              | ...                    |  |
| S20100                                                   | 201-2/ <sup>I</sup> | 95                    | 655 | 45                               | 310              | 40                                         | 241                        | 100             | ...                    |  |
| S20103                                                   | 201L <sup>F</sup>   | 95                    | 655 | 38                               | 260              | 40                                         | 217                        | 95              | not required           |  |
| S20153                                                   | 201LN <sup>F</sup>  | 95                    | 655 | 45                               | 310              | 45                                         | 241                        | 100             | not required           |  |
| S20161                                                   | ...                 | 125                   | 860 | 50                               | 345              | 40                                         | 255                        | 25 <sup>J</sup> | not required           |  |
| S20200                                                   | 202                 | 90                    | 620 | 38                               | 260              | 40                                         | 241                        | ...             | ...                    |  |
| S20400                                                   | ...                 | 95                    | 655 | 48                               | 330              | 35                                         | 241                        | 100             | not required           |  |
| S20910                                                   | XM-19 <sup>K</sup>  |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Sheet and Strip                                          |                     | 105                   | 725 | 60                               | 415              | 30                                         | 241                        | 100             | not required           |  |
| Plate                                                    |                     | 100                   | 690 | 55                               | 380              | 35                                         | 241                        | 100             | not required           |  |
| S21600                                                   | XM-17 <sup>J</sup>  |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Sheet and Strip                                          |                     | 100                   | 690 | 60                               | 415              | 40                                         | 241                        | 100             | not required           |  |
| Plate                                                    |                     | 90                    | 620 | 50                               | 345              | 40                                         | 241                        | 100             | not required           |  |
| S21603                                                   | XM-18 <sup>K</sup>  |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Sheet and Strip                                          |                     | 100                   | 690 | 60                               | 415              | 40                                         | 241                        | 100             | not required           |  |
| Plate                                                    |                     | 90                    | 620 | 50                               | 345              | 35                                         | 241                        | 100             | not required           |  |
| S21800                                                   | ...                 | 95                    | 655 | 50                               | 345              |                                            |                            |                 |                        |  |
| S24000                                                   | XM-29 <sup>K</sup>  |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Sheet and Strip                                          |                     | 100                   | 690 | 60                               | 415              | 40                                         | 241                        | 100             | not required           |  |
| Plate                                                    |                     | 100                   | 690 | 55                               | 380              | 40                                         | 241                        | 100             | not required           |  |
| S30100                                                   | 301                 | 75                    | 515 | 30                               | 205              | 40                                         | 217                        | 95              | not required           |  |
| S30103                                                   | 301L <sup>F</sup>   | 80                    | 550 | 32                               | 220              | 45                                         | 241                        | 100             | not required           |  |
| S30153                                                   | 301LN <sup>F</sup>  | 80                    | 550 | 35                               | 240              | 45                                         | 241                        | 100             | not required           |  |
| S30200                                                   | 302                 | 75                    | 515 | 30                               | 205              | 40                                         | 201                        | 92              | not required           |  |
| S30400                                                   | 304                 | 75                    | 515 | 30                               | 205              | 40                                         | 201                        | 92              | not required           |  |
| S30403                                                   | 304L                | 70                    | 485 | 25                               | 170              | 40                                         | 201                        | 92              | not required           |  |
| S30409                                                   | 304H                | 75                    | 515 | 30                               | 205              | 40                                         | 201                        | 92              | not required           |  |
| S30415                                                   | ...                 | 87                    | 600 | 42                               | 290              | 40                                         | 217                        | 95              | not required           |  |
| S30451                                                   | 304N                | 80                    | 550 | 35                               | 240              | 30                                         | 217                        | 95              | not required           |  |
| S30452                                                   | XM-21 <sup>K</sup>  |                       |     |                                  |                  |                                            |                            |                 |                        |  |
| Sheet and Strip                                          |                     | 90                    | 620 | 50                               | 345              | 30                                         | 241                        | 100             | not required           |  |
| Plate                                                    |                     | 85                    | 585 | 40                               | 275              | 30                                         | 241                        | 100             | not required           |  |
| S30453                                                   | 304LN               | 75                    | 515 | 30                               | 205              | 40                                         | 217                        | 95              | not required           |  |
| S30500                                                   | 305                 | 70                    | 485 | 25                               | 170              | 40                                         | 183                        | 88              | not required           |  |
| S30600                                                   | ...                 | 78                    | 540 | 35                               | 240              | 40                                         | ...                        | ...             | ...                    |  |
| S30601                                                   | ...                 | 78                    | 540 | 37                               | 255              | 30                                         | ...                        | ...             | not required           |  |
| S30615                                                   | ...                 | 90                    | 620 | 40                               | 275              | 35                                         | 217                        | 95              | not required           |  |
| S30815                                                   | ...                 | 87                    | 600 | 45                               | 310              | 40                                         | 217                        | 95              | ...                    |  |
| S30908                                                   | 309S                | 75                    | 515 | 30                               | 205              | 40                                         | 217                        | 95              | not required           |  |
| S30909                                                   | 309H <sup>F</sup>   | 75                    | 515 | 30                               | 205              | 40                                         | 217                        | 95              | not required           |  |
| S30940                                                   | 309Cb <sup>F</sup>  | 75                    | 515 | 30                               | 205              | 40                                         | 217                        | 95              | not required           |  |
| S30941                                                   | 309Hcb <sup>F</sup> | 75                    | 515 | 30                               | 205              | 40                                         | 217                        | 95              | not required           |  |



TABLE 2 Continued

| UNS Designation              | Type <sup>A</sup>     | Tensile Strength, min |     | Yield Strength, <sup>B</sup> min |     | Elongation in<br>2 in. or 50 mm,<br>min, % | Hardness, max <sup>C</sup> |                 | Cold Bend <sup>D</sup> |
|------------------------------|-----------------------|-----------------------|-----|----------------------------------|-----|--------------------------------------------|----------------------------|-----------------|------------------------|
|                              |                       | ksi                   | MPa | ksi                              | MPa |                                            | Brinell                    | Rockwell B      |                        |
| S31008                       | 310S                  | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31009                       | 310H <sup>F</sup>     | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31040                       | 310Cb <sup>F</sup>    | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31041                       | 310HCb <sup>F</sup>   | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31050                       | 310 MoLN <sup>F</sup> |                       |     |                                  |     |                                            |                            |                 |                        |
|                              | t ≤ 0.25 in.          | 84                    | 580 | 39                               | 270 | 25                                         | 217                        | 95              | not required           |
|                              | t > 0.25 in.          | 78                    | 540 | 37                               | 255 | 25                                         | 217                        | 95              | not required           |
| S31060                       | ...                   | 87                    | 600 | 41                               | 280 | 40                                         | 217                        | 95              | not required           |
| S31254                       | ...                   |                       |     |                                  |     |                                            |                            |                 |                        |
| Sheet and Strip              |                       |                       |     |                                  |     |                                            |                            |                 |                        |
| Plate                        |                       | 100                   | 690 | 45                               | 310 | 35                                         | 223                        | 96              | not required           |
| S31266                       | ...                   | 95                    | 655 | 45                               | 310 | 35                                         | 223                        | 96              | not required           |
| S31277                       | ...                   | 109                   | 750 | 61                               | 420 | 35                                         | ...                        | ...             | not required           |
| S31600                       | ...                   | 112                   | 770 | 52                               | 360 | 40                                         | ...                        | ...             | not required           |
| S31603                       | 316                   | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31609                       | 316L                  | 70                    | 485 | 25                               | 170 | 40                                         | 217                        | 95              | not required           |
| S31635                       | 316H                  | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31640                       | 316Ti <sup>F</sup>    | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31640                       | 316Cb <sup>F</sup>    | 75                    | 515 | 30                               | 205 | 30                                         | 217                        | 95              | not required           |
| S31651                       | 316N                  | 80                    | 550 | 35                               | 240 | 35                                         | 217                        | 95              | not required           |
| S31653                       | 316LN                 | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31700                       | 317                   | 75                    | 515 | 30                               | 205 | 35                                         | 217                        | 95              | not required           |
| S31703                       | 317L                  | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31725                       | 317LM <sup>F</sup>    | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S31726                       | 317LMN <sup>F</sup>   | 80                    | 550 | 35                               | 240 | 40                                         | 223                        | 96              | not required           |
| S31727                       | ...                   | 80                    | 550 | 36                               | 245 | 35                                         | 217                        | 96              | not required           |
| S31753                       | 317LN                 | 80                    | 550 | 35                               | 240 | 40                                         | 217                        | 95              | not required           |
| S32050                       | ...                   | 98                    | 675 | 48                               | 330 | 40                                         | 250                        | ...             | not required           |
| S32053                       | ...                   | 93                    | 640 | 43                               | 295 | 40                                         | 217                        | 96              | not required           |
| S32100                       | 321                   | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S32109                       | 321H                  | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S32615 <sup>L</sup>          | ...                   | 80                    | 550 | 32                               | 220 | 25                                         | ...                        | ...             | not required           |
| S32654                       | ...                   | 109                   | 750 | 62                               | 430 | 40                                         | 250                        | ...             | not required           |
| S33228                       | ...                   | 73                    | 500 | 27                               | 185 | 30                                         | 217                        | 95              | not required           |
| S33400                       | 334 <sup>F</sup>      | 70                    | 485 | 25                               | 170 | 30                                         | ...                        | ...             | not required           |
| S34565                       | ...                   | 115                   | 795 | 60                               | 415 | 35                                         | 241                        | 100             | not required           |
| S34700                       | 347                   | 75                    | 515 | 30                               | 205 | 40                                         | 201                        | 92              | not required           |
| S34709                       | 347H                  | 75                    | 515 | 30                               | 205 | 40                                         | 201                        | 92              | not required           |
| S34800                       | 348                   | 75                    | 515 | 30                               | 205 | 40                                         | 201                        | 92              | not required           |
| S34809                       | 348H                  | 75                    | 515 | 30                               | 205 | 40                                         | 201                        | 92              | not required           |
| S35045                       | ...                   | 70                    | 485 | 25                               | 170 | 35                                         | ...                        | ...             | not required           |
| S35135                       | ...                   | 80                    | 550 | 30                               | 205 | 30                                         | ...                        | ...             | not required           |
| Plate                        |                       | 75                    | 515 | 30                               | 205 | 30                                         | ...                        | ...             | not required           |
| S35315                       | ...                   | 94                    | 650 | 39                               | 270 | 40                                         | 217                        | 95              | not required           |
| S38100                       | XM-15 <sup>K</sup>    | 75                    | 515 | 30                               | 205 | 40                                         | 217                        | 95              | not required           |
| S38815                       | ...                   | 78                    | 540 | 37                               | 255 | 30                                         | ...                        | ...             | not required           |
| Duplex (Austenitic-Ferritic) |                       |                       |     |                                  |     |                                            |                            |                 |                        |
| S31200                       | ...                   | 100                   | 690 | 65                               | 450 | 25                                         | 293                        | 31 <sup>J</sup> | not required           |
| S31260                       | ...                   | 100                   | 690 | 70                               | 485 | 20                                         | 290                        | ...             | ...                    |
| S31803                       | ...                   | 90                    | 620 | 65                               | 450 | 25                                         | 293                        | 31 <sup>J</sup> | not required           |
| S32001                       | ...                   | 90                    | 620 | 65                               | 450 | 25                                         | ...                        | 25 <sup>J</sup> | not required           |
| S32003                       | ...                   | 90                    | 620 | 65                               | 450 | 25                                         | 293                        | 31 <sup>J</sup> | not required           |
| S32101                       | ...                   |                       |     |                                  |     |                                            |                            |                 |                        |



TABLE 2 Continued

| UNS Designation                    | Type <sup>A</sup>        | Tensile Strength, min |     | Yield Strength, <sup>B</sup> min |     | Elongation in<br>2 in. or 50 mm,<br>min, % | Hardness, max <sup>C</sup> |                 | Cold Bend <sup>D</sup> |
|------------------------------------|--------------------------|-----------------------|-----|----------------------------------|-----|--------------------------------------------|----------------------------|-----------------|------------------------|
|                                    |                          | ksi                   | MPa | ksi                              | MPa |                                            | Brinell                    | Rockwell B      |                        |
|                                    | t ≤ 0.25 in.<br>[6.4 mm] | 101                   | 700 | 77                               | 530 | 30                                         | 290                        | ...             | not required           |
|                                    | t > 0.25 in.<br>[6.4 mm] | 94                    | 650 | 65                               | 450 | 30                                         | 290                        | ...             | not required           |
| S32205                             | 2205 <sup>F</sup>        | 95                    | 655 | 65                               | 450 | 25                                         | 293                        | 31 <sup>J</sup> | not required           |
| S32304                             | 2304 <sup>F</sup>        | 87                    | 600 | 58                               | 400 | 25                                         | 290                        | 32 <sup>J</sup> | not required           |
| S32506                             | ...                      | 90                    | 620 | 65                               | 450 | 18                                         | 302                        | 32 <sup>J</sup> | not required           |
| S32520                             | ...                      | 112                   | 770 | 80                               | 550 | 25                                         | 310                        | ...             | not required           |
| S32550                             | 255 <sup>F</sup>         | 110                   | 760 | 80                               | 550 | 15                                         | 302                        | 32 <sup>J</sup> | not required           |
| S32750                             | 2507 <sup>F</sup>        | 116                   | 795 | 80                               | 550 | 15                                         | 310                        | 32 <sup>J</sup> | not required           |
| S32760                             | ...                      | 108                   | 750 | 80                               | 550 | 25                                         | 270                        | ...             | not required           |
| S32900                             | 329                      | 90                    | 620 | 70                               | 485 | 15                                         | 269                        | 28 <sup>J</sup> | not required           |
| S32906                             | ...                      | 116                   | 800 | 94                               | 650 | 25.0                                       | 310                        | 32 <sup>J</sup> | not required           |
|                                    | t < 0.4 in.<br>[1.0 mm]  | 109                   | 750 | 80                               | 550 | 25.0                                       | 310                        | 32 <sup>J</sup> | not required           |
|                                    | t ≥ 0.4 in.<br>[1.0 mm]  | 100                   | 690 | 70                               | 485 | 15                                         | 293                        | 32 <sup>J</sup> | not required           |
| S32950 <sup>M</sup>                | ...                      | 116                   | 800 | 80                               | 550 | 15                                         | 310                        | 32 <sup>J</sup> | not required           |
| S39274†                            | ...                      |                       |     |                                  |     |                                            |                            |                 |                        |
| Ferritic or Martensitic (Chromium) |                          |                       |     |                                  |     |                                            |                            |                 |                        |
| S32803                             | ...                      | 87                    | 600 | 72                               | 500 | 16                                         | 241                        | 100             | not required           |
| S40500                             | 405                      | 60                    | 415 | 25                               | 170 | 20                                         | 179                        | 88              | 180                    |
| S40900 <sup>M</sup>                | 409 <sup>M</sup>         |                       |     |                                  |     |                                            |                            |                 |                        |
| S40910                             | ...                      | 55                    | 380 | 25                               | 170 | 20                                         | 179                        | 88              | 180                    |
| S40920                             | ...                      | 55                    | 380 | 25                               | 170 | 20                                         | 179                        | 88              | 180                    |
| S40930                             | ...                      | 55                    | 380 | 25                               | 170 | 20                                         | 179                        | 88              | 180                    |
| S40945                             | ...                      | 55                    | 380 | 30                               | 205 | 22                                         | ...                        | 80              | 180                    |
| S40975                             | ...                      | 60                    | 415 | 40                               | 275 | 20                                         | 197                        | 92              | 180                    |
| S40977                             | ...                      | 65                    | 450 | 41                               | 280 | 18                                         | 180                        | 88              | not required           |
| S41000                             | 410                      | 65                    | 450 | 30                               | 205 | 20                                         | 217                        | 96              | 180                    |
| S41003                             | ...                      | 66                    | 455 | 40                               | 275 | 18                                         | 223                        | 20 <sup>J</sup> | not required           |
| S41008                             | 410S                     | 60                    | 415 | 30                               | 205 | 22 <sup>O</sup>                            | 183                        | 89              | 180                    |
| S41045                             | ...                      | 55                    | 380 | 30                               | 205 | 22                                         | ...                        | 80              | 180                    |
| S41050                             | ...                      | 60                    | 415 | 30                               | 205 | 22                                         | ...                        | 80              | 180                    |
| S41500                             | ...                      | 115                   | 795 | 90                               | 620 | 15                                         | 302                        | 32 <sup>J</sup> | not required           |
| S42035                             | ...                      | 80                    | 550 | 55                               | 380 | 16                                         | 180                        | 88              | not required           |
| S42900                             | 429 <sup>F</sup>         | 65                    | 450 | 30                               | 205 | 22 <sup>O</sup>                            | 183                        | 89              | 180                    |
| S43000                             | 430                      | 65                    | 450 | 30                               | 205 | 22 <sup>O</sup>                            | 183                        | 89              | 180                    |
| S43035                             | 439                      | 60                    | 415 | 30                               | 205 | 22                                         | 183                        | 89              | 180                    |
| S43400                             | 434                      | 65                    | 450 | 35                               | 240 | 22                                         | ...                        | 89              | 180                    |
| S43600                             | 436                      | 65                    | 450 | 35                               | 240 | 22                                         | ...                        | 89              | 180                    |
| S43932                             | ...                      | 60                    | 415 | 30                               | 205 | 22                                         | 183                        | 89              | 180                    |
| S43940                             | ...                      | 62                    | 430 | 36                               | 250 | 18                                         | 180                        | 88              | not required           |

**TABLE 2 Continued**

| UNS Designation | Type <sup>A</sup>  | Tensile Strength, min |     | Yield Strength, <sup>B</sup> min |     | Elongation in<br>2 in. or 50 mm,<br>min, % | Hardness, max <sup>C</sup> |                 | Cold Bend <sup>D,E</sup> |
|-----------------|--------------------|-----------------------|-----|----------------------------------|-----|--------------------------------------------|----------------------------|-----------------|--------------------------|
|                 |                    | ksi                   | MPa | ksi                              | MPa |                                            | Brinell                    | Rockwell B      |                          |
| S44400          | ...                | 60                    | 415 | 40                               | 275 | 20                                         | 217                        | 96              | 180                      |
| S44500          | ...                | 62                    | 427 | 30                               | 205 | 22                                         | ...                        | 83              | 180                      |
| S44626          | XM-33 <sup>K</sup> | 68                    | 470 | 45                               | 310 | 20                                         | 217                        | 96              | 180                      |
| S44627          | XM-27 <sup>K</sup> | 65                    | 450 | 40                               | 275 | 22                                         | 187                        | 90              | 180                      |
| S44635          | ...                | 90                    | 620 | 75                               | 515 | 20                                         | 269                        | 28 <sup>J</sup> | 180                      |
| S44660          | ...                | 85                    | 585 | 65                               | 450 | 18                                         | 241                        | 100             | 180                      |
| S44700          | ...                | 80                    | 550 | 60                               | 415 | 20                                         | 223                        | 20 <sup>J</sup> | 180                      |
| S44735          | ...                | 80                    | 550 | 60                               | 415 | 18                                         | 255                        | 25 <sup>J</sup> | 180                      |
| S44800          | ...                | 80                    | 550 | 60                               | 415 | 20                                         | 223                        | 20 <sup>J</sup> | 180                      |
| S46800          | ...                | 60                    | 415 | 30                               | 205 | 22                                         | ...                        | 90              | 180                      |

<sup>A</sup> Unless otherwise indicated, a grade designation originally assigned by the American Iron and Steel Institute (AISI).

<sup>B</sup> Yield strength shall be determined by the offset method at 0.2 % in accordance with Test Methods and Definitions A 370. Unless otherwise specified (see Specification A 480/A 480M, paragraph 4.1.11, Ordering Information), an alternative method of determining yield strength may be based on total extension under load of 0.5 %.

<sup>C</sup> Either Brinell or Rockwell B Hardness is permissible.

<sup>D</sup> Bend tests are not required for chromium steels (ferritic or martensitic) thicker than 1 in. [25 mm] or for any austenitic or duplex (austenitic-ferritic) stainless steels regardless of thickness.

<sup>E</sup> Elongation for thickness, less than 0.015 in. (0.38 mm) shall be 20 % minimum, in 1 in. (25.4 mm).

<sup>F</sup> UNS number was editorially corrected.

<sup>G</sup> Common name, not a trademark, widely used, not associated with any one producer.

<sup>H</sup> Yield strength requirements shall not apply to material under 0.020 in [0.50 mm] in thickness.

<sup>I</sup> Not applicable for thicknesses under 0.010 in. [0.25 mm].

<sup>J</sup> Type 201 is generally produced with a chemical composition balanced for rich side (Type 201-1) or lean side (Type 201-2) austenite stability depending on the properties required for specific applications.

<sup>K</sup> Rockwell C scale.

<sup>L</sup> Naming system developed and applied by ASTM.

<sup>M</sup> For S32615, the grain size as determined in accordance with the Test Methods E 112, Comparison Method, Plate II, shall be No. 3 or finer.

<sup>N</sup> Prior to Specification A 240 – 89b, the tensile value for S32950 was 90 ksi.

<sup>O</sup> S40900 (Type 409) has been replaced by S40910, S40920, and S40930. Unless otherwise specified in the ordering information, an order specifying S40900 or Type 409 shall be satisfied by any one of S40910, S40920, or S40930 at the option of the seller. Material meeting the requirements of S40910, S40920, or S40930, may at the option of the manufacturer be certified as S40900.

<sup>P</sup> Material 0.050 in (1.27 mm) and under in thickness shall have a minimum elongation of 20 %.



## SUPPLEMENTARY REQUIREMENTS

A supplementary requirement shall apply only when specified in the purchase order.

### S1. Charpy Impact Testing of Plate

S1.1 Charpy impact tests shall be conducted in accordance with Test Methods and Definitions A 370.

S1.2 *Number of Tests*—One impact test (3 specimens) shall be made from one plate per heat treatment lot in the final heat treated condition.

S1.3 *Orientation of Test Specimens*—Unless specified as transverse specimens (long axis of the specimen transverse to the final rolling direction, root of the notch perpendicular to the rolling face) on the purchase order, the orientation of the specimens shall be longitudinal (long axis of the specimen parallel to the final rolling direction, root of the notch perpendicular to the rolling face). The manufacturer is permitted to test transverse specimens provided that such tests meet the acceptance criteria applicable to longitudinal specimens. Unless otherwise specified on the purchase order, the specimens shall be taken so as to include the mid-thickness of the product.

S1.4 *Test Temperature*—The purchaser shall specify the test temperature. The manufacturer is permitted to test specimens at a temperature lower than that specified by the purchaser, provided that such tests shall meet the acceptance criteria applicable to specimens tested at the specified temperature (see Note ).

NOTE —Test Methods A 923, Method B, applicable to some duplex (austenitic-ferritic) stainless steels as listed in Test Methods A 923, uses a Charpy impact test for the purpose of determining the absence of detrimental intermetallic phases. Method B specifies a test temperature and acceptance criterion, expressed as impact energy, for each type of

steel covered. It may be economical for the Charpy impact tests performed on duplex stainless steels covered in both Specification A 240 and Test Methods A 923 to be performed at the lower of the temperatures specified by this supplementary requirement and Test Methods A 923 Method B, with measurement of both lateral expansion and impact energy.

S1.5 *Acceptance Limit*—Unless otherwise specified on the purchase order, each of the three specimens tested shall show a lateral expansion opposite the notch of not less than 0.015 in. [0.38 mm].

S1.6 *Records*—The recorded results shall include the specimen orientation, specimen size, test temperature, absorbed energy values (if required), and lateral expansion opposite the notch.

### S2. Materials for High-Temperature Service

S2.1 Unless an H grade has been ordered, this supplementary requirement shall be specified for ASME Code application for service above 1000°F [540°C].

The user is permitted to use an austenitic stainless steel as the corresponding H grade when the material meets all requirements of the H grade including chemistry, annealing temperature, and grain size (see Section 6).

S2.3 The user is permitted to use an L grade austenitic stainless steel for service above 1000°F [540°C], subject to the applicable allowable stress table of the ASME Code, when the material meets all requirements of this specification and the grain size is ASTM No. 7 or coarser as determined in accordance with Test Method E 112. The grain size shall be reported on a Certified Test Report.

## SUMMARY OF CHANGES

This section identifies the location of selected changes to this standard that have been incorporated since the A 240/A 240M-04 issue. For the convenience of the user, Committee A01 has highlighted those changes that impact the use of this standard. This section may also include descriptions of changes or reasons for changes, or both. (Approved March 1, 2004.)

(1) Added S31727 to Tables 1 and 2.

(2) Added S32053 to Tables 1 and 2.

(3) Added S32506 to Tables 1 and 2.

(4) Added S39274 to Tables 1 and 2.



This section identifies the location of selected changes to this standard that have been incorporated since the A 240/A 240M-03c issue. For the convenience of the user, Committee A01 has highlighted those changes that impact the use of this standard. This section may also include descriptions of changes or reasons for changes, or both. (Approved Jan. 1, 2004.)

(1) Added new grade, UNS S31060, to Section 6 and Tables 1 and 2.

This section identifies the location of selected changes to this standard that have been incorporated since the A 240/A 240M-03b issue. For the convenience of the user, Committee A01 has highlighted those changes that impact the use of this standard. This section may also include descriptions of changes or reasons for changes, or both. (Approved Sept. 10, 2003.)

(1) In Table 2, HBN and HRB for S20100, S30451, and S30453 were reconciled with those in Specification A 666, annealed condition.

This section identifies the location of selected changes to this standard that have been incorporated since the A 240/A 240M-03a issue. For the convenience of the user, Committee A01 has highlighted those changes that impact the use of this standard. This section may also include descriptions of changes or reasons for changes, or both. (Approved May 10, 2003.)

(1) Added new alloy UNS S31277 to Tables 1 and 2.

This section identifies the location of selected changes to this standard that have been incorporated since the A 240/A 240M-03 issue. For the convenience of the user, Committee A01 has highlighted those changes that impact the use of this standard. This section may also include descriptions of changes or reasons for changes, or both. (Approved April 10, 2003.)

(1) Added UNS S32906 to Tables 1 and 2.

(2) Added UNS S32101 to Tables 1 and 2.

This section identifies the location of selected changes to this standard that have been incorporated since the A 240/A 240M-02a issue. For the convenience of the user, Committee A01 has highlighted those changes that impact the use of this standard. This section may also include descriptions of changes or reasons for changes, or both. (Approved February 10, 2003.)

(1) Added a new duplex stainless steel (S32003) to Tables 1 and 2.

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