



Designation: A240/A240M – 15

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

This standard is issued under the fixed designation A240/A240M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This specification<sup>2</sup> covers chromium, chromium-nickel, and chromium-manganese-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications.

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

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

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

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

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A480/A480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip](#)

[A923 Test Methods for Detecting Detrimental Intermetallic Phase in Duplex Austenitic/Ferritic Stainless Steels](#)  
[E112 Test Methods for Determining Average Grain Size](#)  
[E527 Practice for Numbering Metals and Alloys in the Unified Numbering System \(UNS\)](#)

2.2 *SAE Standard:*<sup>4</sup>

[J 1086 Practice for Numbering Metals and Alloys \(UNS\)](#)

## 3. General Requirements

3.1 The following requirements for orders for material furnished under this specification shall conform to the applicable requirements of the current edition of Specification [A480/A480M](#).

- 3.1.1 Definitions;
- 3.1.2 General requirements for delivery;
- 3.1.3 Ordering information;
- 3.1.4 Process;
- 3.1.5 Special tests;
- 3.1.6 Heat treatment;
- 3.1.7 Dimensions and permissible variations;
- 3.1.8 Workmanship, finish and appearance;
- 3.1.9 Number of tests/test methods;
- 3.1.10 Specimen preparation;
- 3.1.11 Retreatment;
- 3.1.12 Inspection;
- 3.1.13 Rejection and reheating;
- 3.1.14 Material test report;
- 3.1.15 Certification; and
- 3.1.16 Packaging, marking, and loading.

## 4. Chemical Composition

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

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.17 on Flat-Rolled and Wrought Stainless Steel.

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

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

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



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>                           |
|------------------------------|--------------------|---------------------|-------------|------------|--------|-----------|-----------|-----------|------------|-----------|-----------|--|
|                              |                    |                     |             |            |        |           |           |           |            |           |           |  |
| N08020                       | ...                | 0.07                | 2.00        | 0.045      | 0.035  | 1.00      | 19.0-21.0 | 32.0-38.0 | 2.00-3.00  | ...       | 3.00-4.00 | Cb 8xC min, 1.00 max                                     |
| N08367                       | ...                | 0.030               | 2.00        | 0.040      | 0.030  | 1.00      | 20.0-22.0 | 23.5-25.5 | 6.0-7.0    | 0.18-0.25 | 0.75      | ...  |
| N08700                       | ...                | 0.04                | 2.00        | 0.040      | 0.030  | 1.00      | 19.0-23.0 | 24.0-26.0 | 4.3-5.0    | ...       | 0.50      | Cb 8xC min 0.40 max                                      |
| N08800                       | 800 <sup>G</sup>   | 0.10                | 1.50        | 0.045      | 0.015  | 1.00      | 19.0-23.0 | 30.0-35.0 | ...        | ...       | 0.75      | Fe <sup>H</sup> 39.5 min<br>Al 0.15-0.60<br>Ti 0.15-0.60 |
| N08810                       | 800H <sup>G</sup>  | 0.05-0.10           | 1.50        | 0.045      | 0.015  | 1.00      | 19.0-23.0 | 30.0-35.0 | ...        | ...       | 0.75      | Fe <sup>H</sup> 39.5 min<br>Al 0.15-0.60<br>Ti 0.15-0.60 |
| N08811                       | ...                | 0.06-0.10           | 1.50        | 0.040      | 0.015  | 1.00      | 19.0-23.0 | 30.0-35.0 | ...        | ...       | 0.75      | Fe <sup>H</sup> 39.5 min<br>Ti 0.25-0.60<br>Al 0.25-0.60 |
| N08904                       | 904L <sup>G</sup>  | 0.020               | 2.00        | 0.045      | 0.035  | 1.00      | 19.0-23.0 | 23.0-28.0 | 4.00-5.00  | 0.10      | 1.00-2.00 | ...  |
| N08925                       | ...                | 0.020               | 1.00        | 0.045      | 0.030  | 0.50      | 19.0-21.0 | 24.0-26.0 | 6.00-7.00  | 0.10-0.20 | 0.80-1.50 | ...  |
| N08926                       | ...                | 0.020               | 2.00        | 0.030      | 0.010  | 0.50      | 19.0-21.0 | 24.0-26.0 | 6.00-7.00  | 0.15-0.25 | 0.50-1.50 | ...  |
| S20100                       | 201                | 0.15                | 5.50-7.50   | 0.060      | 0.030  | 1.00      | 16.0-18.0 | 3.5-5.5   | ...        | 0.25      | ...       | ...  |
| S20103                       | ...                | 0.03                | 5.50-7.50   | 0.045      | 0.030  | 0.75      | 16.0-18.0 | 3.5-5.5   | ...        | 0.25      | ...       | ...  |
| S20153                       | ...                | 0.03                | 6.40-7.50   | 0.045      | 0.015  | 0.75      | 16.0-17.5 | 4.0-5.0   | ...        | 0.10-0.25 | 1.00      | ...  |
| S20161                       | ...                | 0.15                | 4.00-6.00   | 0.040      | 0.040  | 3.00-4.00 | 15.0-18.0 | 4.0-6.0   | ...        | 0.08-0.20 | ...       | ...  |
| S20200                       | 202                | 0.15                | 7.50-10.00  | 0.060      | 0.030  | 1.00      | 17.0-19.0 | 4.0-6.0   | ...        | 0.25      | ...       | ...  |
| S20430                       | ...                | 0.030               | 7.00-9.00   | 0.040      | 0.030  | 1.00      | 15.0-17.0 | 1.50-3.00 | ...        | 0.15-0.30 | ...       | ...  |
| S20431                       | ...                | 0.12                | 5.00-7.00   | 0.045      | 0.030  | 1.00      | 17.0-18.0 | 2.0-4.0   | ...        | 0.10-0.25 | 1.50-3.50 | ...  |
| S20432                       | ...                | 0.08                | 3.00-5.00   | 0.045      | 0.030  | 1.00      | 17.0-18.0 | 4.0-6.0   | ...        | 0.05-0.20 | 2.00-3.00 | ...  |
| S20433                       | ...                | 0.08                | 5.50-7.50   | 0.045      | 0.030  | 1.00      | 17.0-18.0 | 3.5-5.5   | ...        | 0.10-0.25 | 1.50-3.50 | ...  |
| S20910                       | XM-19 <sup>I</sup> | 0.06                | 4.00-6.00   | 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>I</sup> | 0.12                | 14.00-16.00 | 0.045      | 0.030  | 0.30-1.00 | 17.0-18.5 | 1.00      | ...        | 0.35 min  | ...       | ...  |
| S21600                       | XM-17 <sup>I</sup> | 0.08                | 7.50-9.00   | 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>I</sup> | 0.03                | 7.50-9.00   | 0.045      | 0.030  | 0.75      | 17.5-22.0 | 5.0-7.0   | 2.00-3.00  | 0.25-0.50 | ...       | ...  |
| S21640                       | ...                | 0.08                | 3.50-6.50   | 0.060      | 0.030  | 1.00      | 17.5-19.5 | 4.0-6.5   | 0.50-2.00  | 0.08-0.30 | ...       | ...  |
| S21800                       | ...                | 0.10                | 7.00-9.00   | 0.060      | 0.030  | 3.5-4.5   | 16.0-18.0 | 8.0-9.0   | ...        | 0.08-0.18 | ...       | Cb 0.10-1.00   |
| S21904                       | XM-11 <sup>I</sup> | 0.04                | 8.00-10.00  | 0.060      | 0.030  | 0.75      | 19.0-21.5 | 5.5-7.5   | ...        | 0.15-0.40 | ...       | ...  |
| S24000                       | XM-29 <sup>I</sup> | 0.08                | 11.50-14.50 | 0.060      | 0.030  | 0.75      | 17.0-19.0 | 2.3-3.7   | ...        | 0.20-0.40 | ...       | ...  |
| S30100                       | 301                | 0.15                | 2.00        | 0.045      | 0.030  | 1.00      | 16.0-18.0 | 6.0-8.0   | ...        | 0.10      | ...       | ...  |
| S30103                       | 301L <sup>G</sup>  | 0.03                | 2.00        | 0.045      | 0.030  | 1.00      | 16.0-18.0 | 6.0-8.0   | ...        | 0.20      | ...       | ...  |
| S30153                       | 301LN <sup>G</sup> | 0.03                | 2.00        | 0.045      | 0.030  | 1.00      | 16.0-18.0 | 6.0-8.0   | ...        | 0.07-0.20 | ...       | ...  |
| S30200                       | 302                | 0.15                | 2.00        | 0.045      | 0.030  | 0.75      | 17.0-19.0 | 8.0-10.0  | ...        | 0.10      | ...       | ...  |
| S30400                       | 304                | 0.07                | 2.00        | 0.045      | 0.030  | 0.75      | 17.5-19.5 | 8.0-10.5  | ...        | 0.10      | ...       | ...  |
| S30403                       | 304L               | 0.030               | 2.00        | 0.045      | 0.030  | 0.75      | 17.5-19.5 | 8.0-12.0  | ...        | 0.10      | ...       | ...  |
| S30409                       | 304H               | 0.04-0.10           | 2.00        | 0.045      | 0.030  | 0.75      | 18.0-20.0 | 8.0-10.5  | ...        | ...       | ...       | ...  |
| S30415                       | ...                | 0.04-0.06           | 0.80        | 0.045      | 0.030  | 1.00-2.00 | 18.0-19.0 | 9.0-10.0  | ...        | 0.12-0.18 | ...       | Ce 0.03-0.08   |
| S30435                       | ...                | 0.08                | 2.00        | 0.045      | 0.030  | 1.00      | 16.0-18.0 | 7.0-9.0   | ...        | ...       | 1.50-3.00 | ...  |
| S30441                       | ...                | 0.08                | 2.00        | 0.045      | 0.030  | 1.0-2.0   | 17.5-19.5 | 8.0-10.5  | ...        | 0.10      | 1.5-2.5   | Cb 0.1-0.5<br>W 0.2-0.8                                  |
| 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>I</sup> | 0.08                | 2.00        | 0.045      | 0.030  | 0.75      | 18.0-20.0 | 8.0-10.5  | ...        | 0.16-0.30 | ...       | ...  |
| S30453                       | 304LN              | 0.030               | 2.00        | 0.045      | 0.030  | 0.75      | 18.0-20.0 | 8.0-12.0  | ...        | 0.10-0.16 | ...       | ...  |
| S30500                       | 305                | 0.12                | 2.00        | 0.045      | 0.030  | 0.75      | 17.0-19.0 | 10.5-13.0 | ...        | ...       | ...       | ...  |
| S30530                       | ...                | 0.08                | 2.00        | 0.045      | 0.030  | 0.50-2.50 | 17.0-20.5 | 8.5-11.5  | 0.75-1.50  | ...       | 0.75-3.50 | ...  |
| S30600                       | ...                | 0.018               | 2.00        | 0.020      | 0.020  | 3.7-4.3   | 17.0-18.5 | 14.0-15.5 | 0.20       | ...       | 0.50      | ...  |
| S30601                       | ...                | 0.015               | 0.50-0.80   | 0.030      | 0.013  | 5.0-5.6   | 17.0-18.0 | 17.0-18.0 | 0.20       | 0.05      | 0.35      | ...  |
| S30615                       | ...                | 0.16-0.24           | 2.00        | 0.030      | 0.030  | 3.2-4.0   | 17.0-19.5 | 13.5-16.0 | ...        | ...       | ...       | Al 0.80-1.50   |
| S30815                       | ...                | 0.05-0.10           | 0.80        | 0.040      | 0.030  | 1.40-2.00 | 20.0-22.0 | 10.0-12.0 | ...        | 0.14-0.20 | ...       | Ce 0.03-0.08   |
| S30908                       | 309S               | 0.08                | 2.00        | 0.045      | 0.030  | 0.75      | 22.0-24.0 | 12.0-15.0 | ...        | ...       | ...       | ...  |
| S30909                       | 309H <sup>G</sup>  | 0.04-0.10           | 2.00        | 0.045      | 0.030  | 0.75      | 22.0-24.0 | 12.0-15.0 | ...        | ...       | ...       | ...  |



TABLE 1 Continued

| UNS Designation <sup>B</sup> | Type <sup>C</sup>     | Carbon <sup>D</sup> | Manganese | Phosphorus | Sulfur | Silicon   | Chromium  | Nickel    | Molybdenum | Nitrogen  | Copper    | Other Elements <sup>E, F</sup> |
|------------------------------|-----------------------|---------------------|-----------|------------|--------|-----------|-----------|-----------|------------|-----------|-----------|--------------------------------|
| S30940                       | 309Cb <sup>G</sup>    | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 22.0–24.0 | 12.0–16.0 | ...        | ...       | ...       | Cb 10xC 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 10xC 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 | ...        | ...       | ...       | Cb 10xC min, 1.10 max          |
| S31040                       | 310Cb <sup>G</sup>    | 0.08                | 2.00      | 0.045      | 0.030  | 1.50      | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...       | ...                            |
| 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 10xC 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 | ...       | Ce + La                        |
| 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 | ...       | 0.025–0.070                    |
| S31254                       | ...                   | 0.020               | 1.00      | 0.030      | 0.010  | 0.80      | 19.5–20.5 | 17.5–18.5 | 6.0–6.5    | 0.18–0.25 | 0.50–1.00 | B 0.001–0.010                  |
| S31266                       | ...                   | 0.030               | 2.00–4.00 | 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 x (C + N)                 |
| 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      | ...       | min, 0.70 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 | ...       | Cb 10 x C                      |
| 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 | ...       | min, 1.10 max                  |
| 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 | 2.80–4.00 | ...                            |
| S31730                       | ...                   | 0.030               | 2.00      | 0.040      | 0.010  | 1.00      | 17.0–19.0 | 15.0–16.5 | 3.0–4.0    | 0.045     | 4.0–5.0   | ...                            |
| S31753                       | 317LN <sup>G</sup>    | 0.030               | 2.00      | 0.045      | 0.030  | 0.75      | 18.0–20.0 | 11.0–15.0 | 3.0–4.0    | 0.10–0.22 | ...       | ...                            |
| S32050                       | ...                   | 0.030               | 1.50      | 0.035      | 0.020  | 1.00      | 22.0–24.0 | 20.0–23.0 | 6.0–6.8    | 0.21–0.32 | 0.40      | ...                            |
| S32053                       | ...                   | 0.030               | 1.00      | 0.030      | 0.010  | 1.00      | 22.0–24.0 | 24.0–26.0 | 5.0–6.0    | 0.17–0.22 | ...       | ...                            |
| S32100                       | 321                   | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 17.0–19.0 | 9.0–12.0  | ...        | 0.10      | ...       | Ti 5 x (C + N)                 |
| S32109                       | 321H                  | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 17.0–19.0 | 9.0–12.0  | ...        | ...       | ...       | min, 0.70 max                  |
| S32615                       | ...                   | 0.07                | 2.00      | 0.045      | 0.030  | 4.80–6.00 | 16.5–19.5 | 19.0–22.0 | 0.30–1.50  | ...       | 1.50–2.50 | ...                            |
| S32654                       | ...                   | 0.020               | 2.00–4.00 | 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                   |
| S33400                       | 334 <sup>G</sup>      | 0.08                | 1.00      | 0.030      | 0.015  | 1.00      | 18.0–20.0 | 19.0–21.0 | ...        | ...       | ...       | Cb 0.6–1.0                     |
| S33425                       | ...                   | 0.08                | 1.50      | 0.045      | 0.020  | 1.00      | 21.0–23.0 | 20.0–23.0 | 2.00–3.00  | ...       | ...       | Al 0.025                       |
| S33550                       | ...                   | 0.04–0.10           | 1.50      | 0.040      | 0.030  | 1.00      | 25.0–28.0 | 16.5–20.0 | ...        | 0.18–0.25 | ...       | Al 0.15–0.60                   |
| S34565                       | ...                   | 0.030               | 5.00–7.00 | 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  | ...        | ...       | ...       | Al 0.15–0.60                   |
| S34709                       | 347H                  | 0.04–0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 17.0–19.0 | 9.0–13.0  | ...        | ...       | ...       | Ti 0.15–0.60                   |
|                              |                       |                     |           |            |        |           |           |           |            |           |           | Cb 0.05–0.15                   |
|                              |                       |                     |           |            |        |           |           |           |            |           |           | La + Ce                        |
|                              |                       |                     |           |            |        |           |           |           |            |           |           | 0.025–0.070                    |
|                              |                       |                     |           |            |        |           |           |           |            |           |           | Cb 0.10                        |
|                              |                       |                     |           |            |        |           |           |           |            |           |           | Cb 10 x C min, 1.00 max        |
|                              |                       |                     |           |            |        |           |           |           |            |           |           | Cb 8 x C min, 1.00 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>  |
|------------------------------------|---------------------|---------------------|-----------|------------|--------|-----------|-----------|-----------|------------|----------------------|-----------|---|
| S34751                             | 347LN               | 0.005-0.020         | 2.00      | 0.045      | 0.030  | 1.00      | 17.0-19.0 | 9.0-13.0  | ...        | 0.06-0.10            | ...       | Cb 0.20-0.50,<br>15 x C min<br>(Cb + Ta) 10xC<br>min, 1.00 max<br>Ta 0.10 |
| S34800                             | 348                 | 0.08                | 2.00      | 0.045      | 0.030  | 0.75      | 17.0-19.0 | 9.0-13.0  | ...        | ...                  | ...       | Co 0.20<br>(Cb + Ta) 8xC<br>min, 1.00 max<br>Ta 0.10<br>Co 0.20           |
| S34809                             | 348H                | 0.04-0.10           | 2.00      | 0.045      | 0.030  | 0.75      | 17.0-19.0 | 9.0-13.0  | ...        | ...                  | ...       | (Cb + Ta) 8xC<br>min, 1.00 max<br>Ta 0.10<br>Co 0.20                      |
| S35045                             | ...                 | 0.06-0.10           | 1.50      | 0.045      | 0.015  | 1.00      | 25.0-29.0 | 32.0-37.0 | ...        | ...                  | 0.75      | Al 0.15-0.60<br>Ti 0.15-0.60  |
| S35115                             | ...                 | 0.030               | 1.00      | 0.045      | 0.015  | 0.50-1.50 | 23.0-25.0 | 19.0-22.0 | 1.50-2.50  | 0.20-0.30            | ...       | ...   |
| S35125                             | ...                 | 0.10                | 1.00-1.50 | 0.045      | 0.015  | 0.50-1.50 | 20.0-23.0 | 19.0-22.0 | 2.00-3.00  | ...                  | ...       | Cb 0.25-0.60  |
| S35135                             | ...                 | 0.08                | 1.00      | 0.045      | 0.015  | 0.60-1.00 | 20.0-25.0 | 30.0-38.0 | 4.0-4.8    | ...                  | 0.75      | Ti 0.40-1.00  |
| S35140                             | ...                 | 0.10                | 1.00-3.00 | 0.045      | 0.030  | 0.75      | 20.0-22.0 | 25.0-27.0 | 1.00-2.00  | 0.08-0.20            | ...       | Cb 0.25-0.75  |
| S35315                             | ...                 | 0.04-0.08           | 2.00      | 0.040      | 0.030  | 1.20-2.00 | 24.0-26.0 | 34.0-36.0 | ...        | 0.12-0.18            | ...       | Ce 0.03-0.10  |
| S38100                             | XM-15 <sup>V</sup>  | 0.08                | 2.00      | 0.030      | 0.030  | 1.50-2.50 | 17.0-19.0 | 17.5-18.5 | ...        | ...                  | ...       | ...   |
| S38815                             | ...                 | 0.030               | 2.00      | 0.040      | 0.020  | 5.50-6.50 | 13.0-15.0 | 13.0-17.0 | 0.75-1.50  | ...                  | 0.75-1.50 | Al 0.30   |
| Duplex (Austenitic-Ferritic)       |                     |                     |           |            |        |           |           |           |            |                      |           |   |
| S31200                             | ...                 | 0.030               | 2.00      | 0.045      | 0.030  | 1.00      | 24.0-26.0 | 5.5-6.5   | 1.20-2.00  | 0.14-0.20            | ...       | ...   |
| S31260                             | ...                 | 0.03                | 1.00      | 0.030      | 0.030  | 0.75      | 24.0-26.0 | 5.5-7.5   | 2.5-3.5    | 0.10-0.30            | 0.20-0.80 | W 0.10-0.50   |
| S31803                             | ...                 | 0.030               | 2.00      | 0.030      | 0.020  | 1.00      | 21.0-23.0 | 4.5-6.5   | 2.5-3.5    | 0.08-0.20            | ...       | ...   |
| S32001                             | ...                 | 0.030               | 4.00-6.00 | 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               | 4.00-6.00 | 0.040      | 0.030  | 1.00      | 21.0-22.0 | 1.35-1.70 | 0.10-0.80  | 0.20-0.25            | 0.10-0.80 | ...   |
| S32202                             | ...                 | 0.030               | 2.00      | 0.040      | 0.010  | 1.00      | 21.5-24.0 | 1.00-2.80 | 0.45       | 0.18-0.26            | ...       | ...   |
| S32205                             | 2205 <sup>G</sup>   | 0.030               | 2.00      | 0.030      | 0.020  | 1.00      | 22.0-23.0 | 4.5-6.5   | 3.0-3.5    | 0.14-0.20            | ...       | ...   |
| S32304                             | 2304 <sup>G</sup>   | 0.030               | 2.50      | 0.040      | 0.030  | 1.00      | 21.5-24.5 | 3.0-5.5   | 0.05-0.60  | 0.05-0.20            | 0.05-0.60 | ...   |
| S32520                             | ...                 | 0.030               | 1.50      | 0.035      | 0.020  | 1.00      | 24.0-26.0 | 5.5-7.2   | 3.0-3.5    | 0.08-0.20            | ...       | W 0.05-0.30   |
| S32550                             | 255 <sup>G</sup>    | 0.04                | 1.50      | 0.040      | 0.030  | 0.90      | 24.0-26.0 | 5.5-8.0   | 3.0-4.0    | 0.20-0.35            | 0.50-2.00 | ...   |
| S32750                             | 2507 <sup>G,O</sup> | 0.030               | 1.20      | 0.035      | 0.020  | 1.00      | 24.0-27.0 | 4.5-6.5   | 2.9-3.9    | 0.10-0.25            | 1.50-2.50 | ...   |
| S32760 <sup>K</sup>                | ...                 | 0.030               | 1.00      | 0.030      | 0.010  | 1.00      | 24.0-26.0 | 6.0-8.0   | 3.0-5.0    | 0.24-0.32            | 0.50      | ...   |
| S32808                             | ...                 | 0.030               | 1.10      | 0.030      | 0.010  | 0.50      | 27.0-27.9 | 7.0-8.2   | 0.80-1.2   | 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  | 0.30-0.40            | ...       | W 2.10-2.50   |
| S32906                             | ...                 | 0.030               | 0.80-1.50 | 0.030      | 0.030  | 0.80      | 28.0-30.0 | 5.8-7.5   | 1.50-2.60  | ...                  | 0.80      | ...   |
| S32950                             | ...                 | 0.030               | 2.00      | 0.035      | 0.010  | 0.60      | 26.0-29.0 | 3.5-5.2   | 1.00-2.50  | 0.15-0.35            | ...       | ...   |
| S39274                             | ...                 | 0.030               | 1.00      | 0.030      | 0.020  | 0.80      | 24.0-26.0 | 6.0-8.0   | 2.5-3.5    | 0.24-0.32            | 0.20-0.80 | W 1.50-2.50   |
| S81921                             | ...                 | 0.030               | 2.00-4.00 | 0.040      | 0.030  | 1.00      | 19.0-22.0 | 2.0-4.0   | 1.00-2.00  | 0.14-0.20            | ...       | ...   |
| S82011                             | ...                 | 0.030               | 2.00-3.00 | 0.040      | 0.020  | 1.00      | 20.5-23.5 | 1.0-2.0   | 0.10-1.00  | 0.15-0.27            | 0.50      | ...   |
| S82012                             | ...                 | 0.05                | 2.00-4.00 | 0.040      | 0.005  | 0.80      | 19.0-20.5 | 0.8-1.5   | 0.10-0.60  | 0.16-0.26            | 1.00      | ...   |
| S82031                             | ...                 | 0.05                | 2.50      | 0.040      | 0.005  | 1.00      | 19.0-22.0 | 2.0-4.0   | 0.60-1.40  | 0.14-0.24            | 1.00      | ...   |
| S82121                             | ...                 | 0.035               | 1.00-2.50 | 0.040      | 0.010  | 0.80      | 21.0-23.0 | 2.0-4.0   | 0.30-1.30  | 0.15-0.25            | 0.20-1.20 | ...   |
| S82122                             | ...                 | 0.030               | 2.0-4.0   | 0.040      | 0.020  | 0.75      | 20.5-21.5 | 1.5-2.5   | 0.60       | 0.15-0.20            | 0.50-1.50 | ...   |
| S82441                             | ...                 | 0.030               | 2.50-4.00 | 0.035      | 0.005  | 0.70      | 23.0-25.0 | 3.0-4.5   | 1.00-2.00  | 0.20-0.30            | 0.10-0.80 | ...   |
| Ferritic or Martensitic (Chromium) |                     |                     |           |            |        |           |           |           |            |                      |           |   |
| S32803                             | ...                 | 0.015               | 0.50      | 0.020      | 0.0035 | 0.55      | 28.0-29.0 | 3.0-4.0   | 1.80-2.50  | 0.020<br>(C+N) 0.030 | ...       | Cb 12x(C+N)<br>min,<br>0.15-0.50  |
| S40300                             | 403                 | 0.15                | 1.00      | 0.040      | 0.030  | 0.50      | 11.5-13.0 | 0.60      | ...        | ...                  | ...       | 0.15-0.50   |
| S40500                             | 405                 | 0.08                | 1.00      | 0.040      | 0.030  | 1.00      | 11.5-14.5 | 0.60      | ...        | ...                  | ...       | Al 0.10-0.30  |
| S40900 <sup>L</sup>                | 409 <sup>L</sup>    | 0.030               | 1.00      | 0.040      | 0.020  | 1.00      | 10.5-11.7 | 0.50      | ...        | 0.030                | ...       | Ti 6x(C+N) min,<br>0.50 max; Cb<br>0.17                                   |



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>  |
|------------------------------|-------------------|---------------------|-----------|------------|--------|---------|-----------|-----------|------------|----------|-----------|---|
| S40920                       | ...               | 0.030               | 1.00      | 0.040      | 0.020  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030    | ...       | Ti 8x(C+N) min,<br>Ti 0.15–0.50; Cb<br>0.10   |
| S40930                       | ...               | 0.030               | 1.00      | 0.040      | 0.020  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030    | ...       | (Ti+Cb) [0.08+8<br>x(C+N)] min,<br>0.75 max;<br>Ti 0.05 min<br>Cb 0.18–0.40               |
| S40945                       | ...               | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 10.5–11.7 | 0.50      | ...        | 0.030    | ...       | Ti 0.05–0.20<br>Ti 6x(C+N) min,<br>0.75 max   |
| 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 9x(C+N) min,<br>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 | 3.5–6.5   | 0.50–1.00  | ...      | ...       | ...   |
| S42000                       | 420               | 0.15 min            | 1.00      | 0.040      | 0.030  | 1.00    | 12.0–14.0 | 0.75      | 0.50       | ...      | ...       | ...   |
| 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  |
| S42200                       | 422               | 0.20–0.25           | 0.50–1.00 | 0.025      | 0.025  | 0.50    | 11.0–12.5 | 0.50–1.00 | 0.90–1.25  | ...      | ...       | V 0.20–0.30,<br>W 0.90–1.25   |
| 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      | ...        | ...      | ...       | Ti [0.20+4(C+N)]  |
| S43035                       | 439               | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 17.0–19.0 | 0.50      | ...        | 0.030    | ...       | min, 1.10 max; Al<br>0.15   |
| S43100                       | 431               | 0.20                | 1.00      | 0.040      | 0.030  | 1.00    | 15.0–17.0 | 1.25–2.50 | ...        | ...      | ...       | ...   |
| 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 5xC min,<br>0.80 max   |
| S43932                       | ...               | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 17.0–19.0 | 0.50      | ...        | 0.030    | ...       | (Ti+Cb)<br>[0.20+4(C+N)]<br>min, 0.75 max;  |
| S43940                       | ...               | 0.030               | 1.00      | 0.040      | 0.015  | 1.00    | 17.5–18.5 | ...       | ...        | ...      | ...       | Al 0.15   |
| S44100                       | ...               | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 17.5–19.5 | 1.00      | ...        | 0.030    | ...       | Ti 0.10–0.60 Cb<br>[0.30+(3xC)] min<br>Ti 0.1–0.5<br>Cb [0.3 + (9xC)]<br>min,<br>0.90 max |
| S44200                       | 442               | 0.20                | 1.00      | 0.040      | 0.040  | 1.00    | 18.0–23.0 | 0.60      | ...        | ...      | ...       | ...   |
| S44330                       | ...               | 0.025               | 1.00      | 0.040      | 0.030  | 1.00    | 20.0–23.0 | ...       | ...        | 0.025    | 0.30–0.80 | (Ti+Cb)<br>8x(C+N) min,<br>0.80 max   |
| S44400                       | 444               | 0.025               | 1.00      | 0.040      | 0.030  | 1.00    | 17.5–19.5 | 1.00      | 1.75–2.50  | 0.035    | ...       | (Ti+Cb)[0.20+4(C+N)]<br>min, 0.80 max   |
| S44500                       | ...               | 0.020               | 1.00      | 0.040      | 0.012  | 1.00    | 19.0–21.0 | 0.60      | ...        | 0.03     | 0.30–0.60 | Cb 10x(C+N)<br>min, 0.80 max  |
| S44535                       | ...               | 0.030               | 0.30–0.80 | 0.050      | 0.020  | 0.50    | 20.0–24.0 | ...       | ...        | ...      | 0.50      | La 0.04–0.20<br>Ti 0.03–0.20  |
| S44536                       | ...               | 0.015               | 1.00      | 0.040      | 0.030  | 1.00    | 20.0–23.0 | 0.5       | ...        | 0.015    | ...       | Al 0.50<br>(Ti+Cb)<br>8X(C+N)–0.8, Cb<br>min 0.05   |



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>  |
|------------------------------|--------------------|---------------------|-----------|------------|--------|---------|-----------|-----------|------------|--------------------|--------|---|
| S44537                       | ...                | 0.030               | 0.8       | 0.050      | 0.006  | 0.1-0.6 | 20.0-24.0 | 0.5       | ...        | 0.04               | 0.5    | Al 0.1<br>W 1.0-3.0<br>Cb 0.2-1.0<br>Ti 0.02-0.20<br>La 0.04-0.20<br>Ti 0.20-1.00;<br>Ti 7(C+N) min<br>Cb 0.05-0.20<br>(Ni + Cu) 0.50<br>(Ti+Cb) [0.20+4<br>(C+N)] min, 0.80<br>max |
| 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   |   |
| 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   |   |
| 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              | ...    |   |
| S44600                       | 446                | 0.20                | 1.50      | 0.040      | 0.030  | 1.00    | 23.0-27.0 | 0.75      | ...        | 0.25               | ...    |   |
| 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 -<br>1.00, Ti + Cb<br>6x(C+N) min<br>(C+N) 0.025<br>(Ti+Cb)<br>≥8x(C+N)<br>(Ti+Cb)<br>0.20-1.00,<br>(Ti+Cb) 6x (C+N)<br>min  |
| S44700                       | ...                | 0.010               | 0.30      | 0.025      | 0.020  | 0.20    | 28.0-30.0 | 0.15      | 3.5-4.2    | 0.020              | 0.15   |   |
| S44725                       | ...                | 0.015               | 0.40      | 0.040      | 0.020  | 0.040   | 25.0-28.5 | 0.30      | 1.5-2.5    | 0.018              | ...    |   |
| S44735                       | ...                | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 28.0-30.0 | 1.00      | 3.6-4.2    | 0.045              | ...    |   |
| 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   |   |
| S46800                       | ...                | 0.030               | 1.00      | 0.040      | 0.030  | 1.00    | 18.0-20.0 | 0.50      | ...        | 0.030              | ...    |   |

<sup>A</sup> Maximum, unless range or minimum is indicated. Where ellipses ( . . . ) appear in this table, there is no requirement and the element need not be determined or reported.

<sup>B</sup> Designation established in accordance with Practice E527 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>O</sup> Cr + 3.3 Mo + 16 N = 41 min.