



# Standard Specification for Stainless Steel Bars and Shapes<sup>1</sup>

This standard is issued under the fixed designation A 276; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This specification covers hot-finished or cold-finished bars except bars for reforging (**Note 1**). It includes rounds, squares, and hexagons, and hot-rolled or extruded shapes, such as angles, tees, and channels in the more commonly used types of stainless steels. The free-machining types (**Note 2**) for general corrosion resistance and high-temperature service are covered in a separate specification.

NOTE 1—For bars for reforging, see Specification A 314.

NOTE 2—For free-machining stainless bars designed especially for optimum machinability, see Specification A 582/A 582M.

NOTE 3—There are standards covering high nickel, chromium, austenitic corrosion, and heat resisting alloy materials. These standards are under the jurisdiction of ASTM Subcommittee B02.07 and may be found in *Annual Book of ASTM Standards*, Vol. 02.04.

1.2 The values stated in inch-pound units are to be regarded as the standard.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

A 314 Specification for Stainless Steel Billets and Bars for Forging

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

A 484/A 484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings

A 582/A 582M Specification for Free-Machining Stainless Steel Bars

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

E 527 Practice for Numbering Metals and Alloys (UNS)

### 2.2 SAE Document:<sup>3</sup>

SAE J 1086 Recommended Practice for Numbering Metals and Alloys

## 3. Ordering Information

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

3.1.1 Quantity (weight or number of pieces),

3.1.2 Name of material: stainless steel,

3.1.3 Form (bars, angles, etc.),

3.1.4 Condition (Section 4.1),

3.1.5 Finish (Section 8 of Specification A 484/A 484M),

3.1.6 Surface preparation of shapes (Section 8 of Specification A 484/A 484M),

3.1.7 Applicable dimensions including size, thickness, width, and length,

1

3.1.8 Cross section (round, square, etc.),

3.1.9 Type or UNS designation (**Table 1**),

3.1.10 ASTM designation and date of issue, and

3.1.11 Whether bars are to be rolled as bars or cut from strip or plate.

3.1.12 Test for magnetic permeability when specified by customer purchase order when ordering Types 201 and 205.

3.1.13 Special requirements.

NOTE 4—A typical ordering description is as follows: 5000 lb (2268 kg) Stainless Steel Bars, Annealed and Centerless Ground, 1½ in. (38.10 mm) Round, 10 to 12 ft (3.05 to 3.66 m) in length, Type 304, ASTM Specification A 276 dated \_\_\_\_\_. End use: machined valve parts.

## 4. Manufacture

### 4.1 Condition:

4.1.1 Bars shall be furnished in one of the following conditions listed in the Mechanical Requirements table:

4.1.1.1 Condition A—Annealed

<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.

Current edition approved March 1, 2006. Published March 2006. Originally approved in 1944. Last previous edition approved in 2005 as A 276 – 05a.

<sup>2</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>3</sup> Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

TABLE 1 Chemical Requirements<sup>A</sup>

| UNS Designation <sup>B</sup> | Type              | Composition, % |           |            |        |           |           |           |            |           |                                     |
|------------------------------|-------------------|----------------|-----------|------------|--------|-----------|-----------|-----------|------------|-----------|-------------------------------------|
|                              |                   | Carbon         | Manganese | Phosphorus | Sulfur | Silicon   | Chromium  | Nickel    | Molybdenum | Nitrogen  | Other Elements                      |
| Austenitic Grades            |                   |                |           |            |        |           |           |           |            |           |                                     |
| 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 | Cu 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    | ...       | Cu 0.50<br>Cb 8 × C min<br>0.40 max |
| S20100                       | 201               | 0.15           | 5.5–7.5   | 0.060      | 0.030  | 1.00      | 16.0–18.0 | 3.5–5.5   | ...        | 0.25      | ...                                 |
| S20161                       | ...               | 0.15           | 4.0–6.0   | 0.045      | 0.030  | 3.0–4.0   | 15.0–18.0 | 4.0–6.0   | ...        | 0.08–0.20 | ...                                 |
| S20162                       | ...               | 0.15           | 4.0–8.0   | 0.040      | 0.040  | 2.5–4.5   | 16.5–21.0 | 6.0–10.0  | 0.50–2.50  | 0.05–0.25 | ...                                 |
| S20200                       | 202               | 0.15           | 7.5–10.0  | 0.060      | 0.030  | 1.00      | 17.0–19.0 | 4.0–6.0   | ...        | 0.25      | ...                                 |
| S20500                       | 205               | 0.12–0.25      | 14.0–15.5 | 0.060      | 0.030  | 1.00      | 16.5–18.0 | 1.0–1.7   | ...        | 0.32–0.40 | ...                                 |
| S20910                       | XM-19             | 0.06           | 4.0–6.0   | 0.045      | 0.030  | 1.00      | 20.5–23.5 | 11.5–13.5 | 1.50–3.00  | 0.20–0.40 | Cb 0.10–0.30,<br>V 0.10–0.30        |
| 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 | ...                                 |
| S21900                       | XM-10             | 0.08           | 8.0–10.0  | 0.045      | 0.030  | 1.00      | 19.0–21.5 | 5.5–7.5   | ...        | 0.15–0.40 | ...                                 |
| S21904                       | XM-11             | 0.04           | 8.0–10.0  | 0.045      | 0.030  | 1.00      | 19.0–21.5 | 5.5–7.5   | ...        | 0.15–0.40 | ...                                 |
| S24000                       | XM-29             | 0.08           | 11.5–14.5 | 0.060      | 0.030  | 1.00      | 17.0–19.0 | 2.3–3.7   | ...        | 0.20–0.40 | ...                                 |
| S24100                       | XM-28             | 0.15           | 11.0–14.0 | 0.045      | 0.030  | 1.00      | 16.5–19.0 | 0.50–2.50 | ...        | 0.20–0.45 | ...                                 |
| S28200                       | ...               | 0.15           | 17.0–19.0 | 0.045      | 0.030  | 1.00      | 17.0–19.0 | ...       | 0.75–1.25  | 0.40–0.60 | Cu 0.75–1.25                        |
| S30200                       | 302               | 0.15           | 2.00      | 0.045      | 0.030  | 1.00      | 17.0–19.0 | 8.0–10.0  | ...        | 0.10      | ...                                 |
| S30215                       | 302B              | 0.15           | 2.00      | 0.045      | 0.030  | 2.00–3.00 | 17.0–19.0 | 8.0–10.0  | ...        | 0.10      | ...                                 |
| S30400                       | 304               | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 8.0–11.0  | ...        | ...       | ...                                 |
| S30403                       | 304L <sup>C</sup> | 0.030          | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 8.0–12.0  | ...        | ...       | ...                                 |
| S30451                       | 304N              | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 8.0–11.0  | ...        | 0.10–0.16 | ...                                 |
| S30452                       | XM-21             | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 8.0–10.0  | ...        | 0.16–0.30 | ...                                 |
| S30453                       | 304LN             | 0.030          | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 8.0–11.0  | ...        | 0.10–0.16 | ...                                 |
| S30454                       | ...               | 0.03           | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 8.0–11.0  | ...        | 0.16–0.30 | ...                                 |
| S30500                       | 305               | 0.12           | 2.00      | 0.045      | 0.030  | 1.00      | 17.0–19.0 | 11.0–13.0 | ...        | ...       | ...                                 |
| S30800                       | 308               | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 19.0–21.0 | 10.0–12.0 | ...        | ...       | ...                                 |
| 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                        |
| S30900                       | 309               | 0.20           | 2.00      | 0.045      | 0.030  | 1.00      | 22.0–24.0 | 12.0–15.0 | ...        | ...       | ...                                 |
| S30908                       | 309S              | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 22.0–24.0 | 12.0–15.0 | ...        | ...       | ...                                 |
| S30940                       | 309Cb             | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 22.0–24.0 | 12.0–16.0 | ...        | ...       | Cb 10×C-1.10                        |
| S31000                       | 310               | 0.25           | 2.00      | 0.045      | 0.030  | 1.50      | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...                                 |
| S31008                       | 310S              | 0.08           | 2.00      | 0.045      | 0.030  | 1.50      | 24.0–26.0 | 19.0–22.0 | ...        | ...       | ...                                 |
| S31040                       | 310Cb             | 0.08           | 2.00      | 0.045      | 0.030  | 1.50      | 24.0–26.0 | 19.0–22.0 | ...        | ...       | Cb 10×C-1.10                        |
| S31254                       | ...               | 0.020          | 1.00      | 0.030      | 0.010  | 0.80      | 19.5–20.5 | 17.5–18.5 | 6.0–6.5    | 0.18–0.22 | Cu 0.50–1.00                        |
| S31400                       | 314               | 0.25           | 2.00      | 0.045      | 0.030  | 1.50–3.00 | 23.0–26.0 | 19.0–22.0 | ...        | ...       | ...                                 |
| S31600                       | 316               | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | ...       | ...                                 |
| S31603                       | 316L <sup>C</sup> | 0.030          | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | ...       | ...                                 |
| S31635                       | 316Ti             | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10      | Ti 5×(C+N)-0.70                     |
| S31640                       | 316Cb             | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10      | Cb 10×C-1.10                        |
| S31651                       | 316N              | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–14.0 | 2.00–3.00  | 0.10–0.16 | ...                                 |
| S31653                       | 316LN             | 0.030          | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–13.0 | 2.00–3.00  | 0.10–0.16 | ...                                 |
| S31654                       | ...               | 0.03           | 2.00      | 0.045      | 0.030  | 1.00      | 16.0–18.0 | 10.0–13.0 | 2.00–3.00  | 0.16–0.30 | ...                                 |
| S31700                       | 317               | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 11.0–15.0 | 3.0–4.0    | 0.10      | ...                                 |
| S31725                       | ...               | 0.030          | 2.00      | 0.045      | 0.030  | 1.00      | 18.0–20.0 | 13.5–17.5 | 4.0–5.0    | 0.20      | ...                                 |
| S31726                       | ...               | 0.030          | 2.00      | 0.045      | 0.030  | 1.00      | 17.0–20.0 | 14.5–17.5 | 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 | Cu 2.8–4.0                          |
| 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  | 1.00      | 17.0–19.0 | 9.0–12.0  | ...        | ...       | Ti 5×(C+N)-0.70 <sup>D</sup>        |
| S32654                       | ...               | 0.020          | 2.0–4.0   | 0.030      | 0.005  | 0.50      | 24.0–25.0 | 21.0–23.0 | 7.0–8.0    | 0.45–0.55 | Cu 0.30–0.60                        |
| S34565                       | ...               | 0.030          | 5.0–7.0   | 0.030      | 0.010  | 1.00      | 23.0–25.0 | 16.0–18.0 | 4.0–5.0    | 0.40–0.60 | Cb 0.10                             |
| S34700                       | 347               | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 17.0–19.0 | 9.0–12.0  | ...        | ...       | Cb 10×C–1.10                        |
| S34800                       | 348               | 0.08           | 2.00      | 0.045      | 0.030  | 1.00      | 17.0–19.0 | 9.0–12.0  | ...        | ...       | Cb 10×C–1.10,<br>Ta 0.10<br>Co 0.20 |
| Austenitic-Ferritic Grades   |                   |                |           |            |        |           |           |           |            |           |                                     |
| S31100                       | XM-26             | 0.06           | 1.00      | 0.045      | 0.030  | 1.00      | 25.0–27.0 | 6.0–7.0   | ...        | ...       | Ti 0.25                             |
| 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 | ...                                 |
| 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 | Cu 0.10–0.80                        |
| S32205                       | ...               | 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                       | ...               | 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 | Cu 0.05–0.60                        |
| S32506                       | ...               | 0.030          | 1.00      | 0.040      | 0.015  | 0.90      | 24.0–26.0 | 5.5–7.2   | 3.0–3.5    | 0.08–0.20 | W 0.05–0.30                         |
| S32550                       | ...               | 0.04           | 1.50      | 0.040      | 0.030  | 1.0       | 24.0–27.0 | 4.5–6.5   | 2.9–3.9    | 0.10–0.25 | Cu 1.50–2.50                        |
| S32760 <sup>E</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 | Cu 0.50–1.00<br>W 0.50–1.00         |
| Ferritic Grades              |                   |                |           |            |        |           |           |           |            |           |                                     |
| S40500                       | 405               | 0.08           | 1.00      | 0.040      | 0.030  | 1.00      | 11.5–14.5 | 0.50      | ...        | ...       | Al 0.10–0.30                        |

**TABLE 1** *Continued*

| UNS Designation <sup>B</sup> | Type               | Composition, %     |           |            |        |         |           |           |            |                    |                                                                         |
|------------------------------|--------------------|--------------------|-----------|------------|--------|---------|-----------|-----------|------------|--------------------|-------------------------------------------------------------------------|
|                              |                    | Carbon             | Manganese | Phosphorus | Sulfur | Silicon | Chromium  | Nickel    | Molybdenum | Nitrogen           | Other Elements                                                          |
| S40976                       | ...                | 0.030              | 1.00      | 0.040      | 0.030  | 1.00    | 10.5–11.7 | 0.75–1.00 | ...        | 0.040              | Cb 10×(C+N)-0.80                                                        |
| S42900                       | 429                | 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 | ...       | ...        | ...                | ...                                                                     |
| 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)-0.80                                               |
| S44600                       | 446                | 0.20               | 1.50      | 0.040      | 0.030  | 1.00    | 23.0–27.0 | 0.75      | ...        | 0.25               | ...                                                                     |
| S44627                       | XM-27 <sup>F</sup> | 0.010 <sup>G</sup> | 0.40      | 0.020      | 0.020  | 0.40    | 25.0–27.5 | 0.50      | 0.75–1.50  | 0.015 <sup>G</sup> | Cu 0.20<br>Cb 0.05–0.20<br>C+N 0.025<br>Cu 0.15<br>C+N 0.025<br>Cu 0.15 |
| S44700                       | ...                | 0.010              | 0.30      | 0.025      | 0.020  | 0.20    | 28.0–30.0 | 0.15      | 3.5–4.2    | 0.020              | ...                                                                     |
| 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              | ...                                                                     |
| Martensitic Grades           |                    |                    |           |            |        |         |           |           |            |                    |                                                                         |
| S40300                       | 403                | 0.15               | 1.00      | 0.040      | 0.030  | 0.50    | 11.5–13.0 | ...       | ...        | ...                | ...                                                                     |
| S41000                       | 410                | 0.08–0.15          | 1.00      | 0.040      | 0.030  | 1.00    | 11.5–13.5 | ...       | ...        | ...                | ...                                                                     |
| S41040                       | XM-30              | 0.18               | 1.00      | 0.040      | 0.030  | 1.00    | 11.0–13.0 | ...       | ...        | ...                | Cb 0.05–0.30                                                            |
| S41400                       | 414                | 0.15               | 1.00      | 0.040      | 0.030  | 1.00    | 11.5–13.5 | 1.25–2.50 | ...        | ...                | ...                                                                     |
| S41425                       | ...                | 0.05               | 0.50–1.00 | 0.020      | 0.005  | 0.50    | 12.0–15.0 | 4.0–7.0   | 1.50–2.00  | 0.06–0.12          | Cu 0.30                                                                 |
| S41500                       | H                  | 0.05               | 0.50–1.00 | 0.030      | 0.030  | 0.60    | 11.5–14.0 | 3.5–5.5   | 0.50–1.00  | ...                | ...                                                                     |
| S42000                       | 420                | 0.15 min           | 1.00      | 0.040      | 0.030  | 1.00    | 12.0–14.0 | ...       | ...        | ...                | ...                                                                     |
| S42010                       | ...                | 0.15–0.30          | 1.00      | 0.040      | 0.030  | 1.00    | 13.5–15.0 | 0.35–0.85 | 0.40–0.85  | ...                | ...                                                                     |
| S43100                       | 431                | 0.20               | 1.00      | 0.040      | 0.030  | 1.00    | 15.0–17.0 | 1.25–2.50 | ...        | ...                | ...                                                                     |
| S44002                       | 440A               | 0.60–0.75          | 1.00      | 0.040      | 0.030  | 1.00    | 16.0–18.0 | ...       | 0.75       | ...                | ...                                                                     |
| S44003                       | 440B               | 0.75–0.95          | 1.00      | 0.040      | 0.030  | 1.00    | 16.0–18.0 | ...       | 0.75       | ...                | ...                                                                     |
| S44004                       | 440C               | 0.95–1.20          | 1.00      | 0.040      | 0.030  | 1.00    | 16.0–18.0 | ...       | 0.75       | ...                | ...                                                                     |

<sup>A</sup> Maximum, unless range or minimum is indicated.

<sup>B</sup> Designations established in accordance with Practice E 527 and SAE J 1086.

<sup>C</sup> For some applications, the substitution of Type 304L for Type 304, or Type 316L for Type 316 may be undesirable because of design, fabrication, or service requirements. In such cases, the purchaser should so indicate on the order.

<sup>D</sup> Nitrogen content is to be reported for this grade.

<sup>E</sup> % Cr + 3.3 × % Mo + 16 × % N ≥ 40.

<sup>F</sup> Nickel plus copper shall be 0.50 % max.

<sup>G</sup> Product analysis tolerance over the maximum limit for carbon and nitrogen shall be 0.002 %.

<sup>H</sup> Wrought version of CA 6NM.

4.1.1.2 *Condition H*—Hardened and tempered at a relatively low temperature

4.1.1.3 *Condition T*—Hardened and tempered at a relatively high temperature

4.1.1.4 *Condition S—Strain Hardened*—Relatively light cold work

4.1.1.5 *Condition B*—Relatively severe cold work

## 5. Chemical Composition

5.1 The steel shall conform to the requirements for chemical composition specified in Table 1.

5.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A 751.

## 6. Mechanical Properties Requirements

6.1 The material shall conform to the mechanical test requirements specified in Table 2.

6.2 The martensitic grades shall be capable of meeting the hardness requirements after heat treating as specified in Table 3.

6.3 Hardness measurements, when required, shall be made at a location midway between the surface and the center of the cross section.

## 7. Magnetic Permeability

7.1 When required by the purchase order, the magnetic permeability of Types 201 and 205 in the annealed condition shall not exceed 1.2 as tested by a Severn-type indicator.

## 8. General Requirements

8.1 In addition to the requirements of this specification, all requirements of the current edition of Specification A 484/A 484M shall apply. Failure to comply with the general requirements of Specification A 484/A 484M constitutes non-conformance to this specification.

## 9. Certification

9.1 Upon request of the purchaser in the contract or order, the producer's certification that the material was manufactured and tested in accordance with this specification, together with a certified report of the test results shall be furnished at the time of the shipment.

## 10. Keywords

10.1 austenitic stainless steel; austenitic-ferritic duplex stainless steel; ferritic stainless steel; martensitic stainless steel; stainless steel bars; stainless steel shapes



TABLE 2 Mechanical Requirements

| Type                                                                                                                                     | Condition            | Finish                           | Diameter or Thickness,<br>in. (mm)             | Tensile<br>Strength,<br>min              |                   | Yield Strength, <sup>A</sup><br>min      |                   | Elonga-<br>tion in 2<br>in. (50 mm) <sup>B</sup><br>or 4D<br>min % | Reduc-<br>tion of<br>Area, <sup>C,D</sup><br>min, % | Brinell<br>Hard-<br>ness, <sup>E</sup><br>max |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------|------------------------------------------------|------------------------------------------|-------------------|------------------------------------------|-------------------|--------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------|
|                                                                                                                                          |                      |                                  |                                                | ksi                                      | MPa               | ksi                                      | MPa               |                                                                    |                                                     |                                               |
| Austenitic Grades                                                                                                                        |                      |                                  |                                                |                                          |                   |                                          |                   |                                                                    |                                                     |                                               |
| N08367                                                                                                                                   | A                    | hot-finished or<br>cold-finished | all                                            | 95                                       | 655               | 45                                       | 310               | 30                                                                 | 50                                                  | ...                                           |
| N08700                                                                                                                                   | A                    | hot-finished or<br>cold-finished | all                                            | 80                                       | 550               | 35                                       | 240               | 30                                                                 | 50                                                  | ...                                           |
| 201, 202                                                                                                                                 | A                    | hot-finished or<br>cold-finished | all                                            | 75                                       | 515               | 40                                       | 275               | 40                                                                 | 45                                                  | ...                                           |
| S20161                                                                                                                                   | A                    | hot-finished                     | all                                            | 125                                      | 860               | 50                                       | 345               | 40                                                                 | 40                                                  | 255                                           |
|                                                                                                                                          |                      | cold-finished                    | all                                            | 125                                      | 860               | 50                                       | 345               | 40                                                                 | 40                                                  | 311                                           |
| S20162                                                                                                                                   | A                    | hot-finished or<br>cold finished | all                                            | 100                                      | 690               | 50                                       | 345               | 50                                                                 | 60                                                  | ...                                           |
| 205                                                                                                                                      | A                    | hot-finished or<br>cold-finished | all                                            | 100                                      | 690               | 60                                       | 414               | 40                                                                 | 50                                                  | ...                                           |
| XM-19                                                                                                                                    | A                    | hot-finished or<br>cold-finished | all                                            | 100                                      | 690               | 55                                       | 380               | 35                                                                 | 55                                                  | ...                                           |
|                                                                                                                                          | As<br>hot-<br>rolled | hot-finished or<br>cold-finished | up to 2 (50.8), incl                           | 135                                      | 930               | 105                                      | 725               | 20                                                                 | 50                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 2 to 3 (50.8 to 76.2),<br>incl            | 115                                      | 795               | 75                                       | 515               | 25                                                                 | 50                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 3 to 8 (76.2 to 203.2),<br>incl           | 100                                      | 690               | 60                                       | 415               | 30                                                                 | 50                                                  | ...                                           |
| S21800                                                                                                                                   | A                    | hot-finished or<br>cold-finished | all                                            | 95                                       | 655               | 50                                       | 345               | 35                                                                 | 55                                                  | 241                                           |
| XM-10, XM-11                                                                                                                             | A                    | hot-finished or<br>cold-finished | all                                            | 90                                       | 620               | 50                                       | 345               | 45                                                                 | 60                                                  | ...                                           |
| XM-29                                                                                                                                    | A                    | hot-finished or<br>cold-finished | all                                            | 100                                      | 690               | 55                                       | 380               | 30                                                                 | 50                                                  | ...                                           |
| XM-28                                                                                                                                    | A                    | hot-finished or<br>cold-finished | all                                            | 100                                      | 690               | 55                                       | 380               | 30                                                                 | 50                                                  | ...                                           |
| S24565                                                                                                                                   | A                    | hot-finished or<br>cold-finished | all                                            | 115                                      | 795               | 60                                       | 415               | 35                                                                 | 40                                                  | ...                                           |
| S28200                                                                                                                                   | A                    | hot-finished or<br>cold finished | all                                            | 110                                      | 760               | 60                                       | 410               | 35                                                                 | 55                                                  | ...                                           |
| 302, 302B, 304, 304LN,<br>305, 308, 309, 309S,<br>309Cb, 310, 310S,<br>310Cb, 314, 316,<br>316LN, 316Cb, 316Ti,<br>317, 321, 347,<br>348 | A                    | hot-finished<br>cold-finished    | all<br>up to ½ (12.70) incl<br>over ½ (12.70)  | 75 <sup>F</sup><br>90<br>75 <sup>F</sup> | 515<br>620<br>515 | 30 <sup>F</sup><br>45<br>30 <sup>F</sup> | 205<br>310<br>205 | 40 <sup>G</sup><br>30<br>30                                        | 50<br>40<br>40                                      | ...<br>...<br>...                             |
| 304L, 316L                                                                                                                               | A                    | hot-finished<br>cold-finished    | all<br>up to ½ (12.70) incl.<br>over ½ (12.70) | 70<br>90<br>70                           | 485<br>620<br>485 | 25<br>45<br>25                           | 170<br>310<br>170 | 40 <sup>G</sup><br>30<br>30                                        | 50<br>40<br>40                                      | ...<br>...<br>...                             |
| 304N, 316N                                                                                                                               | A                    | hot-finished or<br>cold-finished | all                                            | 80                                       | 550               | 35                                       | 240               | 30                                                                 | ...                                                 | ...                                           |
| 202, 302, 304, 304N, 316,<br>316N                                                                                                        | B                    | cold-finished                    | up to ¾ (19.05) incl                           | 125                                      | 860               | 100                                      | 690               | 12                                                                 | 35                                                  | ...                                           |
| 304L, 316L                                                                                                                               |                      |                                  | over ¾ (19.05) to<br>1 (25.40)                 | 115                                      | 795               | 80                                       | 550               | 15                                                                 | 35                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 1 (25.40) to 1¼<br>(31.75)                | 105                                      | 725               | 65                                       | 450               | 20                                                                 | 35                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 1¼ (31.75) to 1½<br>(38.10)               | 100                                      | 690               | 50                                       | 345               | 24                                                                 | 45                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 1½ (38.10) to 1¾<br>(44.45)               | 95                                       | 655               | 45                                       | 310               | 28                                                                 | 45                                                  | ...                                           |
| 304, 304N, 316, 316N<br>304L, 316L                                                                                                       | S                    | cold-finished                    | up to 2 (50.8) incl                            | 95                                       | 650               | 75                                       | 515               | 25                                                                 | 40                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 2 to 2½ (50.8 to 63.5)<br>incl            | 90                                       | 620               | 65                                       | 450               | 30                                                                 | 40                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 2½ to 3 (63.5 to 76.2)<br>incl            | 80                                       | 550               | 55                                       | 380               | 30                                                                 | 40                                                  | ...                                           |
| XM-21, S30454,<br>S31654                                                                                                                 | A                    | hot-finished or<br>cold-finished | all                                            | 90                                       | 620               | 50                                       | 345               | 30                                                                 | 50                                                  | ...                                           |
| XM-21, S30454<br>S31654                                                                                                                  | B                    | cold-finished                    | up to 1 (25.40) incl                           | 145                                      | 1000              | 125                                      | 860               | 15                                                                 | 45                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 1 (25.40) to 1¼<br>(31.75)                | 135                                      | 930               | 115                                      | 795               | 16                                                                 | 45                                                  | ...                                           |
|                                                                                                                                          |                      |                                  | over 1¼ (31.75) to 1½<br>(38.10)               | 135                                      | 895               | 105                                      | 725               | 17                                                                 | 45                                                  | ...                                           |

**TABLE 2** *Continued*

| Type                       | Condition | Finish                           | Diameter or Thickness,<br>in. (mm) | Tensile<br>Strength,<br>min |     | Yield Strength, <sup>A</sup><br>min |     | Elonga-<br>tion in 2<br>in. (50 mm) <sup>B</sup><br>or 4D<br>min % | Reduc-<br>tion of<br>Area, <sup>C,D</sup><br>min, % | Brinell<br>Hard-<br>ness, <sup>E</sup><br>max |
|----------------------------|-----------|----------------------------------|------------------------------------|-----------------------------|-----|-------------------------------------|-----|--------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------|
|                            |           |                                  |                                    | ksi                         | MPa | ksi                                 | MPa |                                                                    |                                                     |                                               |
|                            |           |                                  | over 1½ (38.10) to 1¾<br>(44.45)   | 125                         | 860 | 100                                 | 690 | 18                                                                 | 45                                                  | ...                                           |
| S30815                     | A         | hot-finished or<br>cold-finished | all                                | 87                          | 600 | 45                                  | 310 | 40                                                                 | 50                                                  | ...                                           |
| S31254                     | A         | hot-finished or<br>cold-finished | all                                | 95                          | 650 | 44                                  | 300 | 35                                                                 | 50                                                  | ...                                           |
| S31725                     | A         | hot-finished or<br>cold-finished | all                                | 75                          | 515 | 30                                  | 205 | 40                                                                 | ...                                                 | ...                                           |
| S31726                     | A         | hot-finished or<br>cold-finished | all                                | 80                          | 550 | 35                                  | 240 | 40                                                                 | ...                                                 | ...                                           |
| S31727                     | A         | hot-finished or<br>cold-finished | all                                | 80                          | 550 | 36                                  | 245 | 35                                                                 | ...                                                 | 217                                           |
| S32053                     | A         | hot-finished or<br>cold-finished | all                                | 93                          | 640 | 43                                  | 295 | 40                                                                 | ...                                                 | 217                                           |
| S32654                     | A         | hot-finished or<br>cold-finished | all                                | 109                         | 750 | 62                                  | 430 | 40                                                                 | 40                                                  | 250                                           |
| Austenitic-Ferritic Grades |           |                                  |                                    |                             |     |                                     |     |                                                                    |                                                     |                                               |
| XM-26                      | A         | hot-finished or<br>cold-finished | all                                | 90                          | 620 | 65                                  | 450 | 20                                                                 | 55                                                  | ...                                           |
| S31803                     | A         | hot-finished or<br>cold-finished | all                                | 90                          | 620 | 65                                  | 448 | 25                                                                 | ...                                                 | 290                                           |
| S32056                     | A         | hot-finished or<br>cold-finished | all                                | 90                          | 620 | 65                                  | 450 | 18                                                                 | ...                                                 | 302                                           |
| S32101                     | A         | hot-finished or<br>cold-finished | all                                | 94                          | 650 | 65                                  | 450 | 30                                                                 | ...                                                 | 290                                           |
| S32205                     | A         | hot-finished or<br>cold-finished | all                                | 95                          | 655 | 65                                  | 450 | 25                                                                 | ...                                                 | 290                                           |
| S32304                     | A         | hot-finished or<br>cold-finished | all                                | 87                          | 600 | 58                                  | 400 | 25                                                                 | ...                                                 | 290                                           |
| S32550                     | A         | hot-finished or<br>cold-finished | all                                | 109                         | 750 | 80                                  | 550 | 25                                                                 | ...                                                 | 290                                           |
| S32550                     | S         | cold-finished                    | all                                | 125                         | 860 | 105                                 | 720 | 16                                                                 | ...                                                 | 335                                           |
| S32760                     | A         | hot-finished or<br>cold-finished | all                                | 109                         | 750 | 80                                  | 550 | 25                                                                 | ...                                                 | 290                                           |
| S32760                     | S         | cold-finished                    | all                                | 125                         | 860 | 105                                 | 720 | 16                                                                 | ...                                                 | 335                                           |
| Ferritic Grades            |           |                                  |                                    |                             |     |                                     |     |                                                                    |                                                     |                                               |
| 405 <sup>H</sup>           | A         | hot-finished                     | all                                | ...                         | ... | ...                                 | ... | ...                                                                | ...                                                 | 207                                           |
|                            |           | cold-finished                    | all                                | ...                         | ... | ...                                 | ... | ...                                                                | ...                                                 | 217                                           |
| 429                        | A         | hot-finished                     | all                                | 70                          | 480 | 40                                  | 275 | 20                                                                 | 45                                                  | ...                                           |
|                            |           | cold-finished                    | all                                | 70                          | 480 | 40                                  | 275 | 16                                                                 | 45                                                  | ...                                           |
| 430                        | A         | hot-finished or<br>cold-finished | all                                | 60                          | 415 | 30                                  | 207 | 20                                                                 | 45                                                  | ...                                           |
| S40976                     | A         | hot-finished or<br>cold-finished | all                                | 60                          | 415 | 20                                  | 140 | 20                                                                 | 45                                                  | 244                                           |
| S44400                     | A         | hot-finished                     | all                                | 60                          | 415 | 45                                  | 310 | 20                                                                 | 45                                                  | 217                                           |
|                            |           | cold-finished                    | all                                | 60                          | 415 | 45                                  | 310 | 16                                                                 | 45                                                  | 217                                           |
| 446, XM-27                 | A         | hot-finished                     | all                                | 65                          | 450 | 40                                  | 275 | 20                                                                 | 45                                                  | 219                                           |
|                            |           | cold-finished                    | all                                | 65                          | 450 | 40                                  | 275 | 16                                                                 | 45                                                  | 219                                           |
| S44700                     | A         | hot-finished                     | all                                | 70                          | 480 | 55                                  | 380 | 20                                                                 | 40                                                  | ...                                           |
|                            |           | cold-finished                    | all                                | 75                          | 520 | 60                                  | 415 | 15                                                                 | 30                                                  | ...                                           |
| S44800                     | A         | hot-finished                     | all                                | 70                          | 480 | 55                                  | 380 | 20                                                                 | 40                                                  | ...                                           |
|                            |           | cold-finished                    | all                                | 75                          | 520 | 60                                  | 415 | 15                                                                 | 30                                                  | ...                                           |
| Martensitic Grades         |           |                                  |                                    |                             |     |                                     |     |                                                                    |                                                     |                                               |
| 403, 410                   | A         | hot-finished                     | all                                | 70                          | 480 | 40                                  | 275 | 20                                                                 | 45                                                  | ...                                           |
|                            |           | cold-finished                    | all                                | 70                          | 480 | 40                                  | 275 | 16                                                                 | 45                                                  | ...                                           |
| 403, 410                   | T         | hot-finished                     | all                                | 100                         | 690 | 80                                  | 550 | 15                                                                 | 45                                                  | ...                                           |
|                            |           | cold-finished                    | all                                | 100                         | 690 | 80                                  | 550 | 12                                                                 | 40                                                  | ...                                           |
| XM-30                      | T         | hot-finished                     | all                                | 125                         | 860 | 100                                 | 690 | 13                                                                 | 45                                                  | 302                                           |
|                            |           | cold-finished                    | all                                | 125                         | 860 | 100                                 | 690 | 12                                                                 | 35                                                  | ...                                           |
| 403, 410                   | H         | hot-finished                     | all                                | 120                         | 830 | 90                                  | 620 | 12                                                                 | 40                                                  | ...                                           |
|                            |           | cold-finished                    | all (rounds only)                  | 120                         | 830 | 90                                  | 620 | 12                                                                 | 40                                                  | ...                                           |
| XM-30                      | A         | hot-finished                     | all                                | 70                          | 480 | 40                                  | 275 | 13                                                                 | 45                                                  | 235                                           |
|                            |           | cold-finished                    | all                                | 70                          | 480 | 40                                  | 275 | 12                                                                 | 35                                                  | ...                                           |
| 414                        | A         | hot-finished or<br>cold-finished | all                                | ...                         | ... | ...                                 | ... | ...                                                                | ...                                                 | 298                                           |
| 414                        | T         | hot-finished or<br>cold-finished | all                                | 115                         | 790 | 90                                  | 620 | 15                                                                 | 45                                                  | ...                                           |

**TABLE 2** *Continued*

| Type                 | Condition | Finish                           | Diameter or Thickness,<br>in. (mm) | Tensile<br>Strength, <sup>A</sup><br>min |     | Yield Strength, <sup>A</sup><br>min |     | Elonga-<br>tion in 2<br>in. (50 mm) <sup>B</sup><br>or 4D<br>min % | Reduc-<br>tion of<br>Area, <sup>C,D</sup><br>min, % | Brinell<br>Hard-<br>ness, <sup>E</sup><br>max |
|----------------------|-----------|----------------------------------|------------------------------------|------------------------------------------|-----|-------------------------------------|-----|--------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------|
|                      |           |                                  |                                    | ksi                                      | MPa | ksi                                 | MPa |                                                                    |                                                     |                                               |
| S41425               | T         | hot-finished                     | all                                | 120                                      | 825 | 95                                  | 655 | 15                                                                 | 45                                                  | 321                                           |
| S41500               | T         | hot-finished or<br>cold-finished | all                                | 115                                      | 795 | 90                                  | 620 | 15                                                                 | 45                                                  | 295                                           |
| 420                  | A         | hot-finished                     | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 241                                           |
|                      |           | cold-finished                    | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 255                                           |
| S42010               | A         | hot-finished                     | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 235                                           |
|                      |           | cold-finished                    | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 255                                           |
| 431                  | A         | hot-finished or<br>cold-finished | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 285                                           |
| 440A, 440B, and 440C | A         | hot-finished                     | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 269                                           |
|                      |           | cold-finished                    | all                                | ...                                      | ... | ...                                 | ... | ...                                                                | ...                                                 | 285                                           |

<sup>A</sup> Yield strength shall be determined by the 0.2 % offset method in accordance with Test Methods and Definitions A 370. An alternative method of determining yield strength may be used based on a total extension under load of 0.5 %.

<sup>B</sup> For some specific products, it may not be practicable to use a 2-in. or 50-mm gage length. The use of sub-size test specimens, when necessary, is permissible in accordance with Test Methods and Definitions A 370.

<sup>C</sup> Reduction of area does not apply on flat bars  $\frac{3}{16}$  in. (4.76 mm) and under in thickness as this determination is not generally made in this product size.

<sup>D</sup> The material shall be capable of meeting the required reduction of area where listed, but actual measurement and reporting of the reduction of area are not required unless specified in the purchase order.

<sup>E</sup> Or equivalent Rockwell hardness.

<sup>F</sup> For extruded shapes of all Cr-Ni grades of Condition A, the yield strength shall be 25 ksi (170 MPa) min and tensile strength shall be 70 ksi (480 MPa) min.

<sup>G</sup> For shapes having section thickness of  $\frac{1}{2}$  in. (12.5 mm) or less, 30% min. elongation is acceptable.

<sup>H</sup> Material shall be capable of being heat treated to a maximum Brinell hardness of 250 when oil quenched from 1750°F (953°C).

**TABLE 3** **Response to Heat Treatment**

| Type <sup>A</sup> | Heat Treatment<br>Temperature <sup>B</sup><br>°F (°C), min | Quenchant | Hardness<br>HRC, min |
|-------------------|------------------------------------------------------------|-----------|----------------------|
| 403               | 1750 (955)                                                 | Air       | 35                   |
| 410               | 1750 (955)                                                 | Air       | 35                   |
| 414               | 1750 (955)                                                 | Oil       | 42                   |
| 420               | 1825 (995)                                                 | Air       | 50                   |
| S42010            | 1850 (1010)                                                | Oil       | 48                   |
| 431               | 1875 (1020)                                                | Oil       | 40                   |
| 440A              | 1875 (1020)                                                | Air       | 55                   |
| 440B              | 1875 (1020)                                                | Oil       | 56                   |
| 440C              | 1875 (1020)                                                | Air       | 58                   |

<sup>A</sup> Samples for testing shall be in the form of a section not exceeding  $\frac{3}{8}$  in. (9.50 mm) in thickness.

<sup>B</sup> Temperature tolerance is  $\pm 25^\circ\text{F}$  ( $14^\circ\text{C}$ ).

## SUMMARY OF CHANGES

Committee A01.17 has identified the location of selected changes to this standard since the last issue, A 276 – 05a, that may impact the use of this standard. (Approved March 1, 2006.)

(I) Added 304L and 316L to **Table 2** for condition B and condition S.

Committee A01.17 has identified the location of selected changes to this standard since the last issue, A 276 – 05, that may impact the use of this standard. (Approved Sept. 1, 2005.)

(I) Added UNS N08700 to **Table 1** and **Table 2**.

Committee A01.17 has identified the location of selected changes to this standard since the last issue, A 276 – 04, that may impact the use of this standard. (Approved March 1, 2005.)

(I) Added S31727, S32053, and S32506 to **Table 1** and **Table 2**.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or [service@astm.org](mailto:service@astm.org) (e-mail); or through the ASTM website ([www.astm.org](http://www.astm.org)).*