



Designation: ~~A 276-00a~~ Designation: A 276 - 00a<sup>ε1</sup>

## 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

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<sup>ε1</sup> NOTE—Table 1 was corrected editorially in January 2002.

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### 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 B 02.07 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:

A 314 Specification for Stainless Steel Billets and Bars for Forging<sup>2</sup>

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>2</sup>

A 484/A 484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings<sup>2</sup>

A 582/A 582M Specification for Free-Machining Stainless Steel Bars<sup>2</sup>

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>2</sup>

E 527 Practice for Numbering Metals and Alloys (UNS)<sup>3</sup>

#### 2.2 Other Document:

SAE J 1086 Recommended Practice for Numbering Metals and Alloys<sup>4</sup>

### 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,

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.

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<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 Stainless Steel Products.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.03.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.01.

<sup>4</sup> Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

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

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 Severt-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 nonconformance 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 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                      |
| 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 | ...                          |
| 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 | ...                          |

**TABLE 1 Continued**

| UNS Designation <sup>B</sup> | Type               | Composition, %     |           |            |        |           |           |           |            |                    |                                     |
|------------------------------|--------------------|--------------------|-----------|------------|--------|-----------|-----------|-----------|------------|--------------------|-------------------------------------|
|                              |                    | Carbon             | Manganese | Phosphorus | Sulfur | Silicon   | Chromium  | Nickel    | Molybdenum | Nitrogen           | Other Elements                      |
| 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          | ...                                 |
| 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          | ...                                 |
| 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                        |
| 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                        |
| 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 ×<br>(C+N)-0.80        |
| S44600                       | 446                | 0.20               | 1.50      | 0.040      | 0.030  | 1.00      | 23.0–27.0 | 0.15      | ...        | 0.25               | ...                                 |
| 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             |
| S44700                       | ...                | 0.010              | 0.30      | 0.025      | 0.020  | 0.20      | 28.0–30.0 | 0.15      | 3.5–4.2    | 0.020              | C+N 0.025<br>Cu 0.15                |
| 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              | C+N 0.025<br>Cu 0.15                |
| Martensitic Grades           |                    |                    |           |            |        |           |           |           |            |                    |                                     |
| S40300                       | 403                | 0.15               | 1.00      | 0.040      | 0.030  | 0.50      | 11.5–13.0 | ...       | ...        | ...                | ...                                 |
| S41000                       | 410                | 0.15               | 1.00      | 0.040      | 0.030  | 1.00      | 11.5–13.5 | ...       | ...        | ...                | ...                                 |
| S41040                       | XM-30              | 0.18               | 1.00      | 0.040      | 0.030  | 1.00      | 11.0–13.0 | ...       | ...        | ...                | 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                       | <sup>H</sup>       | 0.05               | 0.50–1.00 | 0.030      | 0.030  | 0.60      | 11.5–14.0 | 3.5–5.5   | 0.50–1.00  | ...                | ...                                 |