



Designation: ~~A276-06~~ Designation: **A 276 – 08**

## 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.*

### 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/A582M-.

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.~~

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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 in the Unified Numbering System (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/A484M-),

3.1.6 Surface preparation of shapes (Section 8 of Specification A 484/A 484M/A484M-),

3.1.7 Applicable dimensions including size, thickness, width, and length,  $\pm 1$ .

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

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

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at 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, <http://www.sae.org>.

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

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

UNS Designation <sup>B</sup>	Type	Composition, %									
		Carbon	Manganese	Phos-phorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Other Elements
<b>Austenitic Grades</b>											
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
											Cb 8 × C min 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, 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, Ta 0.10 Co 0.20
<b>Austenitic-Ferritic Grades</b>											
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
S32202	...	0.030	2.00	0.040	0.010	1.00	21.5–24.0	1.00–2.80	0.45	0.18–0.26	...
S32205	...	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 W 0.50–1.00
<b>Ferritic Grades</b>											
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 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 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 Cu 0.15
<b>Martensitic Grades</b>											
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	<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	...	...
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.

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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

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.