



Designation: **A473—18 A473 – 18a**

# Standard Specification for Stainless Steel Forgings<sup>1</sup>

This standard is issued under the fixed designation A473; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

## 1. Scope\*

1.1 This specification covers austenitic, austenitic-ferritic, ferritic, and martensitic stainless steel forgings for general use, and for low- or high-temperature service.

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.

1.3 Supplementary requirements from Specification **A788/A788M** may be specified when additional testing, inspection, or processing is required.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

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

**A370** Test Methods and Definitions for Mechanical Testing of Steel Products

**A751** Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

**A788/A788M** Specification for Steel Forgings, General Requirements

**A1058** Test Methods for Mechanical Testing of Steel Products—Metric

**E8/E8M** Test Methods for Tension Testing of Metallic Materials

**E527** Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

## 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 Dimensions, including prints or sketches,

3.1.3 Name of material (stainless steel forgings),

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

3.1.5 Condition (**Table 2**), and

3.1.6 ASTM designation and date of issue.

3.1.7 Test for magnetic permeability if specified by customer purchase order when ordering Types 207 and 205.

3.1.8 Special requirements.

3.2 If possible the intended end use of the item should be given on the purchase order especially when the item is ordered for a specific end use or uses.

NOTE 1—A typical ordering description is as follows: 5 stainless steel forgings, Type 410, Designation A, ASTM Specification A473 dated \_\_\_\_\_. End use: pump blocks for oil well equipment.

<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 **A01.06** on Steel Forgings and Billets.

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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.

\*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 Number	Carbon, %	Manganese, %	Phosphorus, %	Sulfur, %	Silicon, %	Chromium, %	Nickel, %	Molybdenum, %	Nitrogen, %	Other Elements, %
<b>Austenitic Grades</b>											
S20100	201	0.15	5.5–7.5	0.060	0.030	1.00	16.0–18.0	3.5–5.5	...	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	1.00–1.75	...	0.32–0.40	
S21900	XM-10	0.08	8.0–10.0	0.060	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	0.060	0.030	1.00	19.0–21.5	5.5–7.5	...	0.15–0.40	
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	...	...	
S30300	303	0.15	2.00	0.20	0.15 min	1.00	17.0–19.0	8.0–10.0	0.60 <sup>C</sup>	...	
S30323	303 Se	0.15	2.00	0.20	0.06	1.00	17.0–19.0	8.0–10.0	...	...	Se 0.15 min
S30400	304	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–11.0	...	0.10	
S30403	304L	0.030	2.00	0.045	0.030	1.00	18.0–20.0	8.0–12.0	...	0.10	
S30500	305	0.12	2.00	0.045	0.030	1.00	17.0–19.0	10.5–13.0	...	...	
S30800	308	0.08	2.00	0.045	0.030	1.00	19.0–21.0	10.0–12.0	...	...	
S30815	...	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	...	...	
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	...	...	
S31254	...	0.020	1.00	0.030	0.010	0.80	19.5–20.5	17.5–18.5	6.0–6.5	0.18–0.25	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	0.10	
S31603	316L	0.030	2.00	0.045	0.030	1.00	16.0–18.0	10.0–14.0	2.00–3.00	0.10	
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	
S32100	321	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	...	Ti 5×C min
S34700	347	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–13.0	...	...	Cb+Ta 10×C, min <sup>D</sup>
S34800	348	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–13.0	...	...	Cb+Ta 10×C, min <sup>D</sup> Ta 0.10 Co 0.20
<b>Austenitic-Ferritic Grades</b>											
S32550 <sup>E</sup>	...	0.04	1.50	0.040	0.030	1.00	24.0–27.0	4.5–6.5	2.9–3.9	0.10–0.25	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
S32950	...	0.03	2.00	0.035	0.010	0.60	26.0–29.0	3.5–5.2	1.00–2.50	0.15–0.35	
<b>Ferritic Grades</b>											
S40500	405	0.08	1.00	0.040	0.030	1.00	11.5–14.5	0.60	...	...	A1 0.10–0.30
S42900	429	0.12	1.00	0.040	0.030	1.00	14.0–16.0	0.75	...	...	
S43000	430	0.12	1.00	0.040	0.030	1.00	16.0–18.0	0.75	...	...	
S43020	430F	0.12	1.25	0.06	0.15 min	1.00	16.0–18.0	0.75	0.60 <sup>C</sup>	...	
S43023	430F Se	0.12	1.25	0.06	0.06	1.00	16.0–18.0	0.75	...	...	Se 0.15 min
S44600	446	0.20	1.50	0.040	0.030	1.00	23.0–27.0	0.75	...	0.25	
<b>Martensitic Grades</b>											
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	0.75	...	...	
S41008	410S	0.08	1.00	0.040	0.030	1.00	11.5–13.5	0.75	...	...	
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>F</sup>	0.05	0.5–1.0	0.030	0.030	0.60	11.5–14.0	3.5–5.5	0.40–0.80	...	
S41600	416	0.15	1.25	0.06	0.15 min	1.00	12.0–14.0	...	0.60 <sup>C</sup>	...	
S41623	416 Se	0.15	1.25	0.06	0.06	1.00	12.0–14.0	...	...	...	Se 0.15 min
S42000	420	Over 0.15	1.00	0.040	0.030	1.00	12.0–14.0	...	...	...	
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> New designation established in accordance with Practice E527 and SAE J 1086.

<sup>C</sup> At manufacturer's option; reported only when intentionally added.

<sup>D</sup> Columbium (Cb) and Niobium (Nb) are alternate names for element 41 in the Periodic Table of the Elements.

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

<sup>F</sup> Wrought version of CA6NM.

#### 4. General Requirements

4.1 Material supplied to this specification shall conform to the requirements of Specification A788/A788M, which outlines additional ordering information, manufacturing requirements, testing and retesting methods and procedures, marking, certification, product analysis variations, and additional supplementary requirements.

**TABLE 2 Mechanical Property Requirements**

Type	Condition	Yield Strength, min, ksi (MPa) <sup>A</sup>	Tensile Strength, min, ksi (MPa)	Elongation in 2 in. (50 mm) or 4D, min %	Reduction of Area, min, %	Brinell Hardness Number, max
<b>Austenitic Grades</b>						
201, 302, 302B, 303, 303SE, 305, 308, 309, 309S, 310, 310S, 314, 317, 321, 347, 348	A	30 (205)	75 (515)	40	50	...
202	A	45 (310)	90 (620)	40	50	...
205	A	50 (345)	90 (620)	40	50	...
304 and 316, Sections 5 in. (127 mm) and Under	A	30 (205)	75 (515)	40	50	...
304 and 316, Sections Over 5 in. (127 mm)	A	30 (205)	70 (485)	40	50	...
304L and 316L	A	25 (170)	65 (450)	40	50	...
XM-10 and XM-11	A	50 (345)	90 (620)	45	60	...
S28200	A	60 (415)	110 (760)	40	55	...
S30815	A	45 (310)	87 (600)	40	50	...
S31254	A	44 (300)	95 (650)	35	50	...
<b>Austenitic-Ferritic Grades</b>						
S32550	A	80 (550)	109 (750)	25.0	...	290
S32950	A	70 (480)	100 (690)	15	...	293
S32760	A	80 (550)	109 (750)	25	...	290
<b>Ferritic Grades</b>						
430F, 430FSE, 446	A	40 (275)	70 (485)	20	45	223
405	A	30 (205)	60 (415)	20	45	207
429	A	35 (240)	65 (450)	23	45	207
430	A	35 (240)	70 (485)	20	45	217
<b>Martensitic Grades</b>						
403, 410, 416, 416SE	A	40 (275)	70 (485)	20	45	223
403, 410	1	40 (275)	70 (485)	20	45	223
	2	85 (585)	110 (760)	15	45	269
	3	100 (690)	130 (895)	12	35	331
410S	A	35 (240)	65 (450)	22	45	217
414	A	...	...	...	...	298
	T	90 (620)	115 (795)	15	45	321
	H	100 (690)	125 (860)	15	45	321
S41425	T	95 (655)	120 (825)	15	45	321
S41500	normalized and tempered	90 (620)	115 (795)	15	45	295
420	A	...	...	...	...	223
431	A	...	...	...	...	277 <sup>B</sup>
	T	90 (620)	115 (795)	15	...	321
	H	135 (930)	175 (1210)	13	...	440
440A, 440B, 440C	A	...	...	...	...	269

<sup>A</sup> Yield strength shall be determined by the 0.2 % offset method in accordance with Test Methods and Definitions **A370**. An alternative method of determining yield strength may be used based on a total extension under load of 0.5 %.

<sup>B</sup> Type 431 forgings of designation *A*, when specified, shall be capable of meeting the above mechanical property requirements of designation *T* after oil quenching from 1800 to 1900 °F (980 to 1038 °C) and tempering at not less than 1100 °F (595 °C), or designation *H* when oil quenched from 1850 to 1950 °F (1010 to 1065 °C) and tempered at not more than 700 °F (370 °C).

4.2 If the requirements of this specification are in conflict with the requirements of Specification **A788/A788M**, the requirements of this specification shall prevail.

## 5. Manufacture

5.1 Material for forgings shall consist of ingots or blooms, billets, slabs, or bars, either forged or rolled from an ingot, and cut to the required length by a suitable process.