Designation: A580/A580M – 18

Standard Specification for Stainless Steel Wire[1]

This standard is issued under the fixed designation A580/A580M; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification covers stainless steel wire, except the free-machining types. It includes round, square, octagon, hexagon, and shape wire in coils only for the more commonly used types of stainless steels for general corrosion resistance and high-temperature service. For bars in straightened and cut lengths, see Specifications A276 or A479/A479M.

NOTE 1—For free-machining stainless wire, designed especially for optimum machinability, see Specification A581/A581M.

1.2 Unless the order specifies the applicable "M" specification designation, the material shall be furnished to the inch-pound units.

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

1.4 *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:*[2]

A276 Specification for Stainless Steel Bars and Shapes

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A479/A479M Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

A555/A555M Specification for General Requirements for Stainless Steel Wire and Wire Rods

A581/A581M Specification for Free-Machining Stainless Steel Wire and Wire Rods

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

2.2 *Society of Automotive Engineers Standard:*[3]

J 1086 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),

3.1.2 Name of material (stainless steel),

3.1.3 Type or UNS designation (Table 1),

3.1.4 Condition (4.1),

3.1.5 Finish (4.2),

3.1.6 Cross section (round, square, and so forth),

3.1.7 Applicable dimensions including size, thickness, and width,

3.1.8 ASTM designation A580/A580M and date of issue,

3.1.9 Coil diameter (inside or outside diameter, or both) and coil weight, and

3.1.10 Special requirements.

NOTE 2—A typical ordering description is as follows: 5000 lb [2000 kg] Type 304, wire, annealed and cold drawn, ½ in. [13 mm] round, ASTM Specification A580/A 580M dated _____. End use: machined hydraulic coupling parts.

4. Manufacture

4.1 *Condition* (Table 2)*:*

4.1.1 *Condition A*—Annealed as a final heat treatment. Material in Condition A may be given a final cold drawing for size control or finish, or both, slightly raising tensile strength.

4.1.2 *Condition B*—Cold worked to higher strength.

4.1.3 *Condition T*—Heat treated to an intermediate temper generally by austenitizing, quenching, and tempering at a relatively low temperature.

[1] 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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[2] 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.

[3] 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[A]

UNS Designation[B]	Type	Composition, %									
		Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Other Elements
Austenitic Grades											
N08926	. . .	0.020	2.00	0.030	0.010	0.50	19.0–21.0	24.0–26.0	6.0–7.0	0.15–0.25	Cu 0.50–1.50
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 max
N08700	. . .	0.040	2.00	0.040	0.030	1.00	19.0–23.0	24.0–26.0	4.3–5.0	. . .	Cu 0.50 max Nb 8xC–0.40
S20161	. . .	0.15	4.0–6.0	0.040	0.040	3.0–4.0	15.0–18.0	4.0–6.0	. . .	0.08–0.20	. . .
S20910	XM-19	0.06	4.0–6.0	0.040	0.030	1.00	20.5–23.5	11.5–13.5	1.50–3.00	0.20–0.40	Nb 0.10–0.30 V 0.10–0.30
S21400	XM-31	0.12	14.0–16.0	0.045	0.030	0.30–1.00	17.0–18.5	1.00	. . .	0.35	. . .
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	0.060	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	. . .
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	0.040	0.030	1.00	16.5–19.0	0.5–2.50		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	. . .	. . .	. . .
S30400	304	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–10.5	. . .	0.10	. . .
S30403	304L[C]	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	. . .	. . .	. . .
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	. . .	0.10	Nb[D] 10xC min, Nb 1.10 max
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	. . .	. . .	. . .
S31400	314	0.25	2.00	0.045	0.030	1.50–3.00	23.0–26.0	19.0–22.0			
S31277	. . .	0.020	3.00	0.030	0.010	0.50	20.5–23.0	26.0–28.0	6.5–8.0	0.30–0.40	Cu 0.50–1.50
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[C]	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	. . .
S31730	. . .	0.030	2.00	0.040	0.010	1.00	17.0–19.0	15.0–16.5	3.0–4.0	0.045	Cu 4.0–5.0
S32100	321	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	. . .	. . .	Ti 5xC min
S34700	347	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–13.0	. . .	. . .	Nb 10xC min Nb 1.10 max
S34751	347LN	0.005–0.020	2.00	0.045	0.030	1.00	17.0–19.0	9.0–13.0	. . .	0.06–0.10	Nb 0.20–0.50, Nb 15xC, min
S34800	348	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–13.0	. . .	. . .	Nb 10xC min, Nb 1.0 max, Ta 0.10 Co 0.20
Austenitic-Ferritic (Duplex) Grades											
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	. . .
S82441	. . .	0.030	2.50–4.00	0.035	0.005	0.70	23.0–25.0	3.0–4.5	1.00–2.00	0.20–0.30	Cu 0.10–0.80
Ferritic Grades											
S40500	405	0.08	1.00	0.040	0.030	1.00	11.5–14.5	. . .	. . .		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	Nb 10x(C+N) –0.80
S43000	430	0.12	1.00	0.040	0.030	1.00	16.0–18.0	...			
S44400	. . .	0.025	1.00	0.040	0.030	1.00	17.5–19.5	1.00	1.75–2.50	0.035	(Ti+Nb) 0.20+4(C+N) –0.80
S44600	446	0.20	1.50	0.040	0.030	1.00	23.0–27.0	. . .		0.25	. . .
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
S44535	. . .	0.030	0.30–0.80	0.050	0.020	0.50	20.0–24.0	. . .	. . .	. . .	Cu 0.50, Al 0.50 La 0.04–0.20 Ti 0.03–0.20
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	. . .	. . .	. . .	. . .
S41400	414	0.15	1.00	0.040	0.030	1.00	11.5–13.5	1.25–2.50	. . .	. . .	. . .
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	. . .	. . .

[A] Maximum or range, unless otherwise indicated. Where ellipses appear in this table, there is no requirement and the element need not be analyzed for or reported.
[B] Designation established in accordance with Practice E527 and SAE J 1086.
[C] 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.
[D] The terms Columbium (Cb) and Niobium (Nb) both refer to the same element.

TABLE 2 Mechanical Test Requirements

UNS Designation	Type	Condition (see 4.1)	Final Operation	Tensile Strength,[A] min		Yield Strength,[B] min		Elongation in Length 4 × Guage Diameter of Test Specimens,[C] min, %	Reduction of Area, min, %
				ksi	[MPa]	ksi	[MPa]		
			Austenitic Grades						
N08926	. . .	B	cold finished (0.010–0.029 in. Dia)	245	[1690]	205	[1415]	. . .	. . .
N08926	. . .	B	cold finished (0.030–0.081 in. Dia)	240	[1655]	200	[1380]	. . .	. . .
N08926	. . .	B	cold finished (0.082–0.108 in. Dia)	220	[1515]	180	[1240]	. . .	. . .
N08926	. . .	B	cold finished (0.109–0.160 in. Dia)	210	[1445]	170	[1170]	. . .	. . .
N08367	. . .	A	cold finished annealed	95	[655]	45	[310]	30	. . .
N08700	. . .	A	cold finished annealed	80	[550]	35	[240]	30	50
S20161	. . .	A	cold finished annealed	125	[860]	50	[345]	40	40
S20910	XM-19	A	cold finished annealed	100	[690]	55	[380]	35	55
S21400	XM-31	A	cold finished	130	[900]	85	[585]	24	60
			annealed	100	[690]	50	[345]	40	65
		B	cold finished	220	[1520]	190	[1310]	5	50
S21800	. . .	A	cold finished annealed	95	[655]	50	[345]	35	55
S21900 and S21904	XM-10 and XM-11	A	cold finished annealed	90	[620]	50	[345]	45	60
S31277	. . .	B	cold finished (0.010–0.029 in. Dia)	250	[1725]	210	[1445]	. . .	. . .
S31277	. . .	B	cold finished (0.030–0.081 in. Dia)	245	[1690]	205	[1415]	. . .	. . .
S31277	. . .	B	cold finished (0.082–0.108 in. Dia)	240	[1655]	200	[1380]	. . .	. . .
S31277	. . .	B	cold finished (0.109–0.160 in. Dia)	235	[1620]	195	[1345]	. . .	. . .
S24000 and S24100	XM-29 and XM-28	A	cold finished annealed	100	[690]	55	[380]	30	50
S28200	. . .	A	cold finished annealed	110	[760]	60	[415]	35	55
		B	cold finished	175	[1210]	150	[1035]	15	50
S30200, S30215, S30400, S30500, S30800, S30900, S30908, S30940, S31000, S31008, S31400, S31600, S31700, S32100, S34700, S34800	302, 302B, 304, 305, 308, 309, 309S, 309Cb, 310, 310S, 314, 316, 317, 321, 347, 348	A	cold finished	90	[620]	45	[310]	30[D]	40[D]
			annealed	75	[520]	30	[210]	35[D]	50[D]
S34751	347LN	A	annealed	75	[515]	30	[205]	35[D]	50[D]
S31730	. . .	A	annealed	70	[480]	25	[175]	35[D]	50[D]
S30403 and S31603	304L and 316L	A	cold finished	90	[620]	45	[310]	30[D]	40[D]
			annealed	70	[485]	25	[170]	35[D]	50[D]
			Austenitic-Ferritic (Duplex) Grades						
S32202		A	annealed	94	[650]	65	[450]	30	50
S82441	t < 0.4 in. [10 mm]	A	annealed	107	[740]	78	[540]	25	
S82441	t ≥ 0.4 in. [10 mm]	A	annealed	99	[680]	70	[480]	25	
			Ferritic Grades						
S40976	. . .	A	annealed	60	[415]	20	[140]	20	45
S40500,[E] S43000, S44400, S44600	405, 430, . . ., 446	A	cold finished	70	[485]	40	[275]	16	45
			annealed	70	[485]	40	[275]	20	45
S44700 and S44800	. . ., . . .	A	cold finished	75	[520]	60	[415]	15	30
			annealed	70	[485]	55	[380]	20	40
S44535	. . .	A	cold finished annealed	58	[400]	36	[250]	20[F]	. . .

TABLE 2 *Continued*

UNS Designation	Type	Condition (see 4.1)	Final Operation	Tensile Strength,[A] min		Yield Strength,[B] min		Elongation in Length 4 × Guage Diameter of Test Specimens,[C] min, %	Reduction of Area, min, %
				ksi	[MPa]	ksi	[MPa]		
Martensitic Grades									
S40300 and S41000	403 and 410	A	cold finished	70	[485]	40	[275]	16	45
			annealed	70	[485]	40	[275]	20	45
		T	cold finished	100	[690]	80	[550]	12	40
		H	cold finished	120	[830]	90	[620]	12	40
S41400	414	A	cold finished	150 max	[1035] max	. . .	. . .	. . .	. . .
S42000	420	A	cold finished	125 max	[860] max	. . .	. . .	. . .	. . .
S43100, S44002, S44003, S44004	431, 440A, 440B, 440C	A	cold finished	140 max	[965] max	. . .	. . .	. . .	. . .

[A] Minimum unless otherwise noted. Where ellipses appear in this table there is no requirement.
[B] 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, based on a total extension under load of 0.5 %, may be used.
[C] For wire products, it is generally necessary to use sub-size test specimens in accordance with Test Methods and Definitions A370.
[D] For material 5⁄32 in. [3.96 mm] and under in size, the elongation and reduction in area shall be 25 % and 40 %, respectively.
[E] Material shall be capable of being heat treated to a maximum hardness of HRC 25 when oil quenched from 1750°F [955°C].
[F] Elongation requirement for S44535 applies only to diameters greater or equal to 0.003 in. [0.08 mm].

4.1.4 *Condition H*—Heat treated to a hard temper generally by austenitizing, quenching, and tempering at a relatively low temperature.

4.2 *Finish:*

4.2.1 *Cold Drawn*—A finish resulting from a final cold drawing pass, generally with cold drawing lubricant left on. Special bright finishes, lubricant removal, and so forth, for special end uses must be negotiated with the producer.

4.2.2 *Annealed and Pickled*—A dull matte appearance necessarily associated with the dead-soft condition when no final cold drawing is permitted.

5. Chemical Composition

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

6. Mechanical 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.

TABLE 3 Response to Heat Treatment

Type[A]	Heat Treatment[B] Temperature °F [°C]	Quenchant	Hardness HRC, min
403	1750 [955]	Air	35
410	1750 [955]	Air	35
414	1750 [955]	Oil	42
420	1825 [1000]	Air	50
431	1875 [1025]	Oil	40
440A	1875 [1025]	Air	55
440B	1875 [1025]	Oil	56
440C	1875 [1025]	Air	58

[A] Samples for testing shall be in the form of a section not exceeding 3⁄8 in. (9.50 mm) in thickness.
[B] Temperature tolerance is ±25°F [±15°C].

7. General Requirements for Delivery

7.1 In addition to the requirements of this specification, all requirements of the current edition of Specification A555/A555M shall apply. Failure to comply with the general requirements of Specification A555/A555M constitutes nonconformance with this specification.

8. Keywords

8.1 stainless steel; wire

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A580/A580M – 16) that may impact the use of this standard. (Approved March 1, 2018.)

(1) Changed "Cb" to "Nb" for N08700, S20910, S40976, and S44400 in Table 1.
(2) Added missing ellipses for S44600 in Table 1.
(3) Corrected correspondence between UNS and Type in Table 2 for S30400 through S34800.
(4) Corrected UNS for S44400 in Table 2.

Committee A01 has identified the location of selected changes to this standard since the last issue (A580/A580M – 15) that may impact the use of this standard. (Approved Sept. 1, 2016.)

(1) Changed "Cb" to Nb.
(2) Corrected Nb range for UNS S34700 and UNS S34751.