Designation: A581/A581M – 95b (Reapproved 2014)

Standard Specification for Free-Machining Stainless Steel Wire and Wire Rods[1]

This standard is issued under the fixed designation A581/A581M; 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 cold-finished wire and hot-finished wire rods in coils. Wire rods are a semi-finished product primarily for the manufacture of wire. Wire includes rounds, squares, hexagons, and special shapes in the more commonly used types of stainless free-machining steels designed especially for optimum machinability and for general corrosion and high-temperature service.

NOTE 1—For wire other than those of the free-machining types, see Specification A580/A580M.

1.2 The values stated in either inch-pound units or SI (metric) units are to be regarded separately as standards; within the text and tables, the SI units are shown in [brackets]. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

A580/A580M Specification for Stainless Steel Wire

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

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

2.2 *SAE Standard:*[3]

J 1086 Practice for Numbering Metals and Alloys (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),

3.1.2 Name of material (stainless steel),

3.1.3 Condition (see Section 5),

3.1.4 Finish (see Section 7),

3.1.5 Applicable dimensions including size, thickness, width, and length or coil diameter (inside or outside diameter), and coil weights,

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

3.1.7 Type or UNS designation (Table 1),

3.1.8 ASTM designation (Specification A581/A581M) and date of issue, and

3.1.9 Exceptions to the specification or special requirements.

NOTE 2—A typical ordering description is as follows: 5000 lb [2000 kg] stainless steel wire, annealed, ¼ in. [6.5 mm] round, coils, Type 303, ASTM Specification A581/A581M dated . End use: machined valve parts.

4. Chemical Composition

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

4.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A751.

5. Condition

5.1 Cold-finished wire may be furnished in one of the conditions listed in Table 2.

5.2 Wire rods may be furnished in the as-hot-rolled or as-hot-rolled and annealed condition.

[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.

TABLE 1 Chemical Requirements

UNS Designation[A]	Type	Composition, %							
		Carbon, max	Manganese[B]	Phosphorus, max	Sulfur[B]	Silicon, max	Chromium	Nickel	Other Elements
					AUSTENITIC				
S20300	XM-1	0.08	5.0–6.5	0.04	0.18–0.35	1.00	16.0–18.0	5.0–6.5	Cu 1.75–2.25
S30300	303	0.15	2.00	0.20	0.15 min	1.00	17.0–19.0	8.0–10.0	...
				0.20					
S30310	XM-5	0.15	2.5–4.5	0.20	0.25 min	1.00	17.0–19.0	7.0–10.0	...
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
S30345	XM-2	0.15	2.00	0.05	0.11–0.16	1.00	17.0–19.0	8.0–10.0	Mo 0.40–0.60 Al 0.60–1.00
					MARTENSITIC				
S41600	416	0.15	1.25	0.06	0.15 min	1.00	12.0–14.0	...	...
S41610	XM-6	0.15	1.50–2.50	0.06	0.15 min	1.00	12.0–14.0	...	...
S41623	416 Se	0.15	1.25	0.06	0.06	1.00	12.0–14.0	...	Se 0.15 min
					FERRITIC				
S18200	XM-34	0.08	2.50	0.04	0.15 min	1.00	17.5–19.5	...	Mo 1.50–2.50
S18235	...	0.025	0.50	0.030	0.15–0.35	1.00	17.5–18.5	1.00	Mo 2.00–2.50 Ti 0.30–1.00 N 0.025 max C+N 0.035 max
S41603	...	0.08	1.25	0.06	0.15 min	1.00	12.0-14.0	...	...
S43020	430 F	0.12	1.25	0.06	0.15 min	1.00	16.0–18.0	...	...
S43023	430 F Se	0.12	1.25	0.06	0.06	1.00	16.0–18.0	...	Se 0.15 min

[A] New designation established in accordance with Practice E527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).
[B] Maximum unless otherwise noted.

TABLE 2 Condition

UNS Designation	Type	Condition A (Annealed)	Condition B (Cold Worked)	Condition T (Intermediate Temper)	Condition H (Hard Temper)
			AUSTENITIC		
S20300	XM-1	A	B	...	...
S30300	303	A	B	...	...
S30310	XM-5	A	B	...	...
S30323	303 Se	A	B	...	...
S30345	XM-2	A	B	...	...
			MARTENSITIC		
S41600	416	A	...	T	H
S14160	XM-6	A	...	T	H
S41623	416 Se	A	...	T	H
			FERRITIC		
S18200	XM-34	A	...	...	...
S18235	...	A	B	...	...
S41603	...	A	...	...	...
S43020	430 F	A	...	...	...
S43023	430 F Se	A	...	...	...

TABLE 3 Mechanical Test Requirements

Type	Condition (see Section 5)	Tensile Strength	
		ksi	[MPa]
All (Except S 18235)	A	85 to 125	[585 to 860]
S18235	A	60 to 90	[415 to 620]
	B	80 to 120	[550 to 830]
303, 303Se, XM-1, XM-2, XM-3, and XM-5	B[A]	115 to 145	[795 to 1000]
416, 416Se, and XM-6	T	115 to 145	[790 to 1000]
416, 416Se, and XM-6	H	140 to 175	[965 to1210]

[A] Condition B applies only to wire annealed and cold worked to produce high strength in chromium-nickel types not hardenable by heat treatment.

6. Mechanical Requirements

6.1 Wire products shall conform to the mechanical test requirements specified in Table 3.

6.2 Wire rods shall conform to the annealed mechanical test requirements specified in Table 3.

7. Finish

7.1 Wire rods are furnished with a hot rolled or a hot rolled and cleaned finish.

7.2 Wire in the cold-finished condition, is generally furnished with a cold-drawn finish.

8. General Requirements for Delivery

8.1 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.

9. Keywords

9.1 free-machining; free-machining wire; stainless steel

APPENDIX

(Nonmandatory Information)

X1. CROSS REFERENCE

X1.1 This table is intended to assist the user when Specification A581/A581M is referenced in a government procurement. It shows the types of steels in Specification A581/A581Mreplacing the steels formerly specified in MIL-W-52263C(MR).

TABLE X1.1 Cross Reference

UNS Designation[A]	MIL-W-52263C(MR)	Specification A581, Type
S20300	203 EZ	XM-1
S30300	303	303
S30310	303 plus X	XM-5
S30323	303 Se	303 Se
S30345	303 Ma	XM-2
S41600	416	416
S41610	416 plus X	XM-16
S41623	416 Se	416 Se
S43020	430 F	430 F
S43023	430 Se	430 F Se

[A] New designation established in accordance with Practice E527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).