



Designation: A581/A581M – 22

Standard Specification for Free-Machining Stainless Steel Wire and Wire Rods¹

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 free-machining stainless steels of 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 free-machining stainless steels designed especially for optimum machinability and for general corrosion and high-temperature service.

1.2 The following alloys are covered:

1.2.1 Austenitic alloys: UNS numbers S20300, S30300, S30310, S30323, and S30345;

1.2.2 Martensitic alloys: UNS numbers S41600, S41610, and S41623; and

1.2.3 Ferritic alloys: UNS numbers S18200, S18235, S41603, S43020, and S43023.

NOTE 1—For wire other than for free-machining applications, see Specification [A580/A580M](#).

NOTE 2—For Free-Machining Stainless Steel Bars, see Specification [A582/A582M](#).

1.3 The values stated in either inch-pound units or SI (metric) units are to be regarded separately as standard; 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.

1.4 Unless the order specifies the applicable “M” specification designation, the material shall be furnished to the inch-pound units.

1.5 *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.*

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. Referenced Documents

2.1 *ASTM Standards*:^{2,3}

[A555/A555M Specification for General Requirements for Stainless Steel Wire and Wire Rods](#)

[A580/A580M Specification for Stainless Steel Wire](#)

[A582/A582M Specification for Free-Machining Stainless Steel Bars](#)

[A751 Test Methods and Practices for Chemical Analysis of Steel Products](#)

[A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys](#)

[E527 Practice for Numbering Metals and Alloys in the Unified Numbering System \(UNS\)](#)

2.2 *SAE Standard*:⁴

[J 1086 Practice for Numbering Metals and Alloys \(UNS\)](#)

3. Terminology

3.1 Refer to Terminology [A941](#) for terms related to steel, stainless steel, and related alloys.

4. Ordering Information

4.1 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:

4.1.1 Quantity (weight),

4.1.2 Alloy UNS Designation (see [Table 1](#)),

4.1.3 Condition (see [Section 7](#) and [Table 2](#)),

4.1.4 Finish (see [Section 9](#)),

4.1.5 Applicable dimensions and tolerances, if different than Specification [A555/A555M](#), including size, thickness, width, and length or coil diameter (inside or outside diameter), and coil weights,

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

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 Refer to [Table X1.1](#) for guidance regarding type designations.

⁴ 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

UNS Designation ^A	Type ^C	Composition, %							
		Carbon, max	Manganese ^B	Phosphorus, max	Sulfur ^B	Silicon, max	Chromium	Nickel	Other Elements
AUSTENITIC ALLOYS									
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	...
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 ALLOYS									
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 ALLOYS									
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 UNS designation established in accordance with Practice E527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).

^B Maximum unless otherwise noted.

^C Refer to Table X1.1 for guidance regarding type designations.

TABLE 2 Condition

UNS Designation	Type ^A	Condition A (Annealed)	Condition B (Cold Worked)	Condition T (Intermediate Temper)	Condition H (Hard Temper)
AUSTENITIC ALLOYS					
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 ALLOYS					
S41600	416	A	...	T	H
S41610	XM-6	A	...	T	H
S41623	416 Se	A	...	T	H
FERRITIC ALLOYS					
S18200	XM-34	A	...	...	...
S18235	...	A	B	...	...
S41603	...	A	...	...	...
S43020	430 F	A	...	...	...
S43023	430 F Se	A	...	...	...

^A Refer to Table X1.1 for guidance regarding type designations.

4.1.7 ASTM designation (Specification A581/A581M) and date of publication, and

4.1.8 Additional requirements agreed to between the supplier and purchaser.

NOTE 3—An example of ordering description is as follows: 5000 lb [2000 kg] stainless steel wire ¼ in. [6.5 mm], Alloy UNS No. designation, Condition B (cold worked), round, coils, ASTM Specification A581/A581M-XX. End use: machined valve parts.

5. General Requirements

5.1 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 non-conformance with this specification.

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition requirements specified in Table 1.

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

7. Condition

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

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

8. Mechanical Property Requirements

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

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

9. Finish

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

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

10. Keywords

10.1 free-machining; free-machining wire; stainless steel

TABLE 3 Mechanical Test Requirements

UNS Designation	Type ^B	Condition (see Section 7)	Tensile Strength	
			ksi	[MPa]
All except S18235	...	A	85 to 125	[585 to 860]
S18235	...	A	60 to 90	[415 to 620]
		B ^A	80 to 120	[550 to 830]
S20300	XM-1	B ^A	115 to 145	[795 to 1000]
S30300	303			
S30310	XM-5			
S30323	303Se			
S30345	XM-2			
S41600	416	T	115 to 145	[790 to 1000]
S41610	XM-6			
S41623	416Se			
S41600	416	H	140 to 175	[965 to 1210]
S41610	XM-6			
S41623	416Se			

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

^B Refer to **Table X1.1** for guidance regarding type designations.

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/A581M replacing 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 UNS designation established in accordance with Practice E527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).