Designation: A 493 – 95 (Reapproved 2004)

Standard Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging[1]

This standard is issued under the fixed designation A 493; 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 Department of Defense.

1. Scope

1.1 This specification covers cold-finished and hot-finished stainless steel wire and wire rods for cold heading or cold forging for applications, such as fasteners, where corrosion resistance is a factor.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI equivalents are in parentheses and may be approximate.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A 555/A 555M Specification for General Requirements for Stainless Steel Wire and Wire Rods

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

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 Size (diameter),

3.1.3 Type or UNS number (see Table 1),

3.1.4 Name (wire or wire rods),

3.1.5 ASTM designation and issue date,

3.1.6 Condition (see 5.2),

3.1.7 Coating (see 5.3),

3.1.8 Coil size (inside and outside diameter),

3.1.9 Special requirements, and

3.1.10 Supplementary requirements.

4. General Requirements for Delivery

4.1 In addition to the requirements of this specification, all requirements of the current editions of Specification A 555/A 555M shall apply. Failure to comply with the general requirements of Specification A 555/A 555M constitutes nonconformance with this specification.

NOTE 1—A typical ordering description is as follows: 5000 lb (2268 kg) 0.225 in. (5.72 mm) round Type 305 cold heading wire, lightly drafted, copper coated, 32 in. (813 mm) max OD—22 in. (559 mm) min ID, coils, ASTM Specification A 493 – XX. End use: hex head machine bolts.

5. Manufacture

5.1 *Heat Treatment*:

5.1.1 Austenitic grades shall be annealed at 1800°F (980°C) minimum, so that grain boundary carbides enter into solution, and rapidly quenched to prevent grain boundary precipitation of carbides that would cause susceptibility to intergranular corrosion. See Supplementary Requirements.

5.1.2 Ferritic and martensitic grades shall be annealed to meet the requirements for mechanical properties.

5.2 *Condition*:

5.2.1 Wire shall be furnished in one of the following conditions:

5.2.1.1 Lightly drafted (normal condition and need not be specified if this is condition desired),

5.2.1.2 Annealed, or

5.2.1.3 Drafted to a specified tensile strength range (as agreed upon between purchaser and producer).

5.2.2 Rods shall be furnished in the annealed condition, scale removed.

5.3 *Coatings and Lubricants*:

5.3.1 Coatings are necessary for most cold-heading or forming operations. An electroplated copper coating is often used. The following coatings may be specified: copper, lime, or special (as agreed upon between purchaser and producer).

[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.

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TABLE 1 Chemical Requirements

Grade		Composition, %										
UNS Designation	AISI Type	Carbon, max[A]	Manganese, max	Phosphorus, max	Sulfur, max	Silicon, max	Chromium	Nickel	Copper	Molybdenum	Nitrogen, max[A]	Other Elements
					Austenitic Grades							
S 30200	302	0.15	2.00	0.045	0.030	1.00	17.0–19.0	8.0–10.0	1.00 max		0.10	
S 30400	304	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–10.5	1.00 max		0.10	
S 30403	304L	0.030	2.00	0.045	0.030	1.00	18.0–20.0	8.0–12.0	1.00 max		0.10	
S 30430		0.03	2.00	0.045	0.030	1.00	17.0–19.0	8.0–10.0	3.0–4.0			
S 30500	305	0.04	2.00	0.045	0.030	1.00	17.0–19.0	10.5–13.0	1.00 max			
S 31600	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	
S 31603	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	
S 38400	384	0.04	2.00	0.045	0.030	1.00	15.0–17.0	17.0–19.0				
					Ferritic Grades							
S 40940		0.06	1.00	0.045	0.040	1.00	10.5–11.7	0.50 max				Cb 10XC–0.75
S 42900	429	0.12	1.00	0.040	0.030	1.00	14.0–16.0					
S 43000	430	0.04	1.00	0.040	0.030	1.00	16.0–18.0					
S 44401	. . .	0.025	1.00	0.040	0.030	. . .	17.5–19.5	1.00 max		1.75–2.50	0.035	Ti+Cb 0.20+4× (C+N)−0.80
S 44625[B]	. . .	0.010[B]	0.40	0.020	0.020	0.40	25.0–27.5	0.50 max	0.2 max	0.75–1.50	0.015[B]	Ni+Cu 0.5 max
S 44700[B]	. . .	0.010[B]	0.30	0.025	0.020	0.20	28.0–30.0	0.15 max	0.15 max	3.5–4.2	0.020[B]	C+N 0.025 max
S 44800[B]	. . .	0.010[B]	0.30	0.025	0.020	0.20	28.0–30.0	2.00–2.50	0.15 max	3.5–4.2	0.020[B]	C+N 0.025 max
					Martensitic Grades							
S 41000	410	0.15	1.00	0.040	0.030	1.00	11.5–13.5					
S 42010	. . .	0.15–0.30	1.00	0.040	0.030	1.00	13.5–15.0	0.35–0.85		0.40–0.85		
S 43100	431	0.20	1.00	0.040	0.030	1.00	15.0–17.0	1.25–2.50				
S 44004	440C	0.95–1.20	1.00	0.040	0.030	1.00	16.0–18.0			0.75 max		

[A] Maximum, unless otherwise indicated.
[B] Product analysis tolerance over the maximum limit for carbon and nitrogen to be 0.002 %.

5.3.2 Lubricants are applied over the coating during the final drafting operation performed by the producer. Soap is generally used. The following lubricants may be specified: soap, grease, or special (as agreed upon between purchaser and producer).

6. Chemical Requirements

6.1 The steel shall conform to the requirements for chemical composition specified in Table 1.

6.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A 751.

7. Mechanical Requirements

7.1 The material shall conform to the requirements as to mechanical properties specified in Table 2. Material can be manufactured to tensile strength ranges other than those shown in Table 2. The producer should be consulted when material is required to tensile strength ranges other than those specified.

8. Resistance to Intergranular Corrosion

8.1 All austenitic grades in the annealed condition or annealed and lightly drafted condition shall be capable of passing Practice E of Practices A 262. When Supplementary Requirement S1 is invoked, all austenitic grades shall be tested and pass Practice E of Practices A 262.

9. Packaging and Package Marking

9.1 *Packaging*—Coils shall be bundled or boxed in such a manner as to assure safe delivery to their destination when properly transported by any common carrier.

9.2 *Markings*—Each lift, bundle, or box shall be properly tagged with durable tags (metal, plastic, or equivalent), showing size, grade, cold-heading wire, condition coating, heat number, and ASTM A 493.

10. Keywords

10.1 austenitic stainless steel; ferritic stainless steel; martensitic stainless steel; stainless steel cold forging wire; stainless steel cold heading wire

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TABLE 2 Mechanical Property Requirements for Lightly Drafted and Annealed Wire

NOTE 1— This table applies to sizes 0.100 in. (2.5 mm) and larger. For smaller sizes, similar mechanical properties apply to ferritic and martensitic grades; however the producer should be consulted regarding somewhat higher tensile properties applicable to austenitic grades.

Grade		As-Annealed		Lightly Drafted	
UNS No.	Type No.	ksi max.	MPa max.	ksi max.	MPa max.
		Austenitic Grades			
S 30200	302	95	655	105	725
S 30400	304	90	620	105	725
S 30403	304L	90	620	102	705
S 30430	. . .	88	605	96	660
S 30500	305	85	585	95	655
S 31600	316	90	620	95	655
S 31603	316L	85	585	93	640
S 38400	384	80	550	85	585
		Ferritic Grades			
S 40940	409Cb	70	485	80	550
S 42900	429	85	485	90	620
S 43000	430	75	520	86	595
S 44401	. . .	80	550	90	620
S 44625	. . .	100	690	105	725
S 44700	. . .	100	690	105	725
S 44800	. . .	100	690	105	725
		Martensitic Grades			
S 41000	410	82	565	85[A]	585[A]
S 42010	. . .	100	690	105	725
S 43100	431	110	760	115	795
S 44004	440C	110	760	120	830

[A] For sizes below 0.160 in. (4 mm) 90 ksi (620 MPa) max.

SUPPLEMENTARY REQUIREMENTS

The following may be required when the purchase order so specifies:

S1. Austenitic Grades

S1.1 Austenitic grades shall be tested and pass the test for intergranular susceptibility in accordance with Practice E of Practices A 262.

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