



Designation: A 555/A 555M – 05

Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods¹

This standard is issued under the fixed designation A 555/A 555M; 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 (ε) indicates an editorial change since the last revision or reappraisal.

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

1. Scope*

1.1 This specification covers general requirements that shall apply to stainless wire and wire rods. Wire rods are a semifinished product intended primarily for the manufacture of wire. Wire is intended primarily for cold forming, including coiling, stranding, weaving, heading and machining as covered under the latest revision of each of the following ASTM specifications: A 313/A 313M, A 368, A 478, A 492, A 493, A 580/A 580M and A 581/A 581M.

1.2 In case of conflicting requirements, the individual material specification and this general requirement specification shall prevail in the order named.

1.3 General requirements for flat products other than wire are covered in Specification A 480/A 480M.

1.4 General requirements for bar and billet products are covered in Specification A 484/A 484M.

1.5 The values stated in 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 independent of the other. Combining values from the two systems may result in nonconformance with the specification.

1.6 Unless the order specifies the applicable metric specification designation, the material shall be furnished in the inch-pound units.

2. Referenced Documents

2.1 ASTM Standards:²

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.

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

A 313/A 313M Specification for Stainless Steel Spring Wire

A 368 Specification for Stainless Steel Wire Strand

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 478 Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A 484/A 484M Specification for General Requirements for Stainless and Heat-Resisting Bars, Billets, and Forgings

A 492 Specification for Stainless Steel Rope Wire

A 493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

A 580/A 580M Specification for Stainless Steel Wire

A 581/A 581M Specification for Free-Machining Stainless and Heat-Resisting Steel Wire and Wire Rods

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment

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

E 112 Test Methods for Determining Average Grain Size

2.2 *Federal Standard*:³

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.3 *Military Standards*:³

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-163 Preservation of Steel Products for Domestic Shipment

2.4 *Other Standard*:⁴

Primary Metals Bar Code Standard

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

⁴ Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48034.

*A Summary of Changes section appears at the end of this standard.

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *bar*—wire that has been straightened and cut (see Specification A 484/A 484M). However, a straightened and cut small diameter product is often called straightened and cut wire.

3.1.2 *wire*—as covered by this specification and the specifications itemized in 1.1, is any round or shaped cold-reduced product, in coils only, produced by cold-finishing coiled wire rod.

3.1.3 *wire rods*—semifinished product intended primarily for the manufacture of wire. They are hot rolled generally to an approximate round cross section in continuous length coils.

4. Materials and Manufacture

4.1 The material may be furnished in one of the conditions detailed in the applicable material specification, that is, annealed, bright annealed, cold worked, or as otherwise specified on the purchase order.

4.2 A variety of finishes, coatings, and lubricants are available. The particular type used is dependent upon the specific end use. Unless otherwise specified, the finish, coating, and lubricant will be furnished as required by the individual material specification or purchase order.

5. Chemical Composition

5.1 *Heat or Cast Analysis*—The chemical analysis of each heat shall be determined in accordance with the applicable material specification and Test Methods, Practices, and Terminology A 751.

5.1.1 The analysis of each heat shall be made from a test sample taken during the pouring of the melt, or from the in-process product later in the manufacturing flow.

5.1.2 The heat analysis shall conform to the chemical requirements for each of the specified elements for the grade ordered, as listed in the applicable product specification.

5.1.3 All commercial metals contain small amounts of elements other than those which are specified. It is neither practical nor necessary to specify limits for unspecified elements, whether intentionally added unspecified elements, residual elements, or trace elements, that can be present. The producer is permitted to analyze for unspecified elements and is permitted to report such analyses. The presence of an unspecified element and the reporting of an analysis for that element shall not be a basis for rejection unless the presence of that element causes the loss of a property typically expected for that metal for the type and quality ordered.

5.1.4 The purchaser is permitted to require in the purchase order a maximum limit for an individual element not specified in the product specification. Such a requirement for an element not listed in the product specification, when acknowledged in the order acceptance, shall be treated as a specified element, with determination of chemical analysis and reporting of that analysis.

5.1.5 The purchaser is permitted to make the requirements for any element more stringent, that is, require higher minimums for elements having minimum requirements or ranges with minimum requirements, or requiring lower maximums for

elements having specified maximums, or ranges with maximums. The purchaser is not permitted to make chemical requirements less stringent.

5.1.6 Analysis limits shall be established for specific elements rather than groups of elements, including but not limited to “all others,” “rare earths,” and “balance,” unless all elements in such a group are similar in technical effect and are associated in typical methods of chemical analysis.

5.2 *Product Analysis*—When required, a product analysis shall be determined in accordance with Test Methods, Practices, and Terminology A 751. The chemical composition thus determined shall conform to the tolerances shown in Table 1.

5.3 The steel shall not contain an unspecified element for the ordered grade to the extent that the steel conforms to the requirements of another grade in the referencing product specification, and any of the product specifications within the scope of this general specification, for which that element has a specified minimum.

6. Permissible Variations in Dimensions

6.1 Unless otherwise specified in the purchase order, the product shall conform to the permissible variations in dimensions as specified in Tables 2-5 of this specification.

7. Workmanship, Finish, and Appearance

7.1 The material shall be of uniform quality consistent with good manufacturing and inspection practices. Imperfections that may be present shall be of such a nature or degree, for the type and quality ordered, that they will not adversely affect the forming, machining, or fabrication of finished parts.

8. Lot Size

8.1 A lot for product analysis shall consist of all wire made from the same heat.

8.2 For other tests required by the product specification, a lot shall consist of all product of the same size, same heat, and produced under the same processing conditions. All austenitic, ferritic, and free-machining stainless steels, as well as martensitic grades when annealed to Condition A and precipitation or age hardening grades when solution treated, may be heat treated in more than one charge in the same furnace or in several furnaces, utilizing controlled processing and equipment (see appendix). However, when heat treating martensitic stainless steels to Condition T or H and when age hardening the precipitation hardening stainless steels, a lot shall consist of the same size, same heat, and the same heat treat charge in a batch-type furnace or under the same conditions in a continuous furnace.

9. Number of Tests and Retests

9.1 Unless otherwise specified in the product specification, one sample per heat shall be selected for chemical analysis and one mechanical test sample shall be selected from each lot of wire. All tests shall conform to the chemical and mechanical requirements of the material specification.

9.2 One intergranular corrosion test, when required, and one grain size test, when required, shall be made from each lot. It is often convenient to obtain test material from the specimen selected for mechanical testing.

TABLE 1 Product Analysis Tolerances

NOTE— This table specifies tolerances over the maximum limits or under the minimum limits of the chemical requirements of the applicable material specification (see 1.1); it does not apply to heat analysis.

Element	Upper Limit or Maximum of Specified Range, %	Tolerances over the Maximum (Upper Limit) or Under the Minimum (Lower Limit)	Element	Upper Limit or Maximum of Specified Range, %	Tolerances over the Maximum (Upper Limit) or Under the Minimum (Lower Limit)
Carbon	to 0.010, incl	0.002	Cobalt	over 0.05 to 0.50, incl	0.01
	over 0.010 to 0.030, incl	0.005		over 0.50 to 2.00, incl	0.02
	over 0.030 to 0.20, incl	0.01		over 2.00 to 5.00, incl	0.05
	over 0.20 to 0.60, incl	0.02		over 5.00 to 10.00, incl	0.10
	over 0.60 to 1.20, incl	0.03		over 10.00 to 15.00, incl	0.15
Manganese	to 1.00, incl	0.03	Columbium + tantalum	over 15.00 to 22.00, incl	0.20
	over 1.00 to 3.00, incl	0.04		over 22.00 to 30.00, incl	0.25
	over 3.00 to 6.00, incl	0.05		to 1.50, incl	0.05
	over 6.00 to 10.00, incl	0.06		over 1.50 to 5.00, incl	0.10
	over 10.00 to 15.00, incl	0.10		over 5.00	0.15
Phosphorus	to 0.040, incl	0.005	Tantalum	to 0.10, incl	0.02
	over 0.040 to 0.20, incl	0.010		Copper	to 0.50, incl
Sulfur	to 0.040, incl	0.005	over 0.50 to 1.00, incl		0.05
	over 0.040 to 0.20, incl	0.010	over 1.00 to 3.00, incl		0.10
	over 0.20 to 0.50, incl	0.020	over 3.00 to 5.00, incl		0.15
Silicon	to 1.00, incl	0.05	over 5.00 to 10.00, incl		0.20
	over 1.00 to 3.00, incl	0.10	Aluminum	to 0.15, incl	-0.005,
Chromium	over 4.00 to 10.00, incl	0.10		over 0.15 to 0.50, incl	+0.01
	over 10.00 to 15.00, incl	0.15		over 0.50 to 2.00, incl	0.10
	over 15.00 to 20.00, incl	0.20		over 2.00 to 5.00, incl	0.20
	over 20.00 to 30.00, incl	0.25		over 5.00 to 10.00, incl	0.35
Nickel	to 1.00, incl	0.03	Nitrogen	to 0.02, incl	0.005
	over 1.00 to 5.00, incl	0.07		over 0.02 to 0.19, incl	0.01
	over 5.00 to 10.00, incl	0.10		over 0.19 to 0.25, incl	0.02
	over 10.00 to 20.00, incl	0.15		over 0.25 to 0.35, incl	0.03
	over 20.00 to 30.00, incl	0.20		over 0.35 to 0.45, incl	0.04
	over 30.00 to 40.00, incl	0.25	Tungsten	to 1.00, incl	0.03
	over 40.00	0.30		over 1.00 to 2.00, incl	0.05
Molybdenum	over 0.20 to 0.60, incl	0.03	over 2.00 to 5.00, incl	0.07	
	over 0.60 to 2.00, incl	0.05	over 5.00 to 10.00, incl	0.10	
	over 2.00 to 7.00, incl	0.10	over 10.00 to 20.00, incl	0.15	
	over 7.00 to 15.00, incl	0.15	Vanadium	to 0.50, incl	0.03
	over 15.00 to 30.00, incl	0.20		over 0.50 to 1.50, incl	0.05
Titanium	to 1.00, incl	0.05	Selenium	all	0.03
	over 1.00 to 3.00, incl	0.07			
	over 3.00	0.10			

9.3 If any test specimen shows imperfections that may affect the test results, it may be discarded and another specimen substituted.

9.4 If the results of any test lot are not in conformance with the requirements of this specification and the applicable product specification, a retest sample of two specimens may be tested to replace each failed specimen of the original sample. If one of the retest specimens fails, the lot shall be rejected.