Designation: A 679/A 679M – 06

Standard Specification for Steel Wire, High Tensile Strength, Cold Drawn[1]

This standard is issued under the fixed designation A 679/A 679M; 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.

1. Scope*

1.1 This specification covers round, uncoated, high tensile strength, cold-drawn steel spring wire, having properties and quality suitable for the manufacture of mechanical springs and wire forms subject to high static stresses or infrequent dynamic load, or both.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

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

A 510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

A 510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel [Metric]

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

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

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *ANSI Standard:*[3]

B32.4 Preferred Metric Sizes for Round, Square, Rectangle, and Hexagon Metal Products

2.3 *Federal Standard:*[4]

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

2.4 *AIAG Standard:*[5]

AIAGB-5 02.00 Primary Metals Identification Tag Application Standard

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology A 941.

4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material under this specification. Such requirements may include, but are not limited to, the following:

4.1.1 Quantity (mass),

4.1.2 Name of material (steel wire, high tensile strength, hard drawn),

4.1.3 Dimensions (Table 1 and Section 9),

4.1.4 Packaging (Section 15),

4.1.5 Heat analysis report, if requested (6.2),

4.1.6 Certification or test report, or both, if specified (Section 14), and

4.1.7 ASTM designation and year of issue.

NOTE 1—A typical ordering description is as follows: 20 Mg high tensile strength, hard-drawn steel mechanical spring wire, 5.00-mm diameter, 500-kg coils to ASTM A 679/A 679M dated ____, or for inch-pound units, 40,000-lb high tensile strength, hard-drawn steel mechanical spring wire, 0.192-in. diameter, in 1000-lb coils to ASTM A 679/A 679M dated ____.

5. Materials and Manufacture

5.1 The steel may be made by any commercially accepted steel making process. The steel may be either ingot cast or continuous strand cast. The rod to be used in the manufacture of wire furnished to this specification shall be in accordance with Specifications A 510 or A 510M.

5.2 The finished wire shall be free from detrimental pipe and undue segregation.

5.3 The wire shall be cold drawn to produce the desired mechanical properties.

5.4 The wire finish shall be suitable for forming or coiling. It is not intended that this material be furnished with a metallic coating.

[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 A01.03 on Steel Rod and Wire.

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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 American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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

[5] 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.**

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TABLE 1 Tensile Requirements

SI Units			Inch-Pound Units		
Diameter, mm[A,B]	Tensile Strength, MPa		Diameter, in.	Tensile Strength, ksi	
	min	max		min	max
0.50	2400	2650	0.020	350	387
0.55	2380	2620	0.023	343	380
0.60	2350	2600	0.026	337	373
0.65	2320	2580	0.029	331	366
0.70	2300	2550	0.032	327	361
0.80	2250	2500	0.035	322	356
0.90	2200	2450	0.041	314	347
1.00	2150	2400	0.048	306	339
1.10	2120	2380	0.054	300	331
1.20	2100	2350	0.062	293	324
1.40	2050	2300	0.072	287	317
1.60	2000	2250	0.080	282	312
1.80	1980	2220	0.092	275	304
2.00	1950	2200	0.106	268	296
2.20	1900	2150	0.120	263	290
2.50	1850	2100	0.135	258	285
2.80	1820	2050	0.148	253	279
3.00	1800	2000	0.162	249	275
3.50	1750	1950	0.177	245	270
4.00	1700	1900	0.1927	241	267
4.50	1680	1880	0.207	238	264
5.00	1650	1850			

[A] Tensile strength values for intermediate diameters shall be interpolated.
[B] Preferred sizes. For a complete list, refer to ANSI B32.4

6. Chemical Composition

6.1 The steel shall conform to the requirements for chemical composition prescribed in Table 2.

6.2 *Heat Analysis*— Each heat of steel shall be analyzed by the manufacturer to determine the percentage of elements prescribed in Table 2. This analysis shall be made from a test specimen preferably taken during the pouring of the heat. When requested, in the purchase order, the heat analysis shall be reported to the purchaser.

6.3 *Product Analysis*— An analysis may be made by the purchaser from finished wire representing each heat of steel. The chemical composition thus determined, as to elements required or restricted, shall conform to the product analysis requirements specified in Table 7 of Specifications A 510 or A 510M.

6.4 For referee purposes, Test Methods, Practices, and Terminology A 751 shall be used.

7. Mechanical Properties

7.1 *Tension Test*:

7.1.1 *Requirements*— The material as represented by tension test specimens shall conform to the requirements prescribed in Table 1.

7.1.2 *Number of Tests*— One test specimen shall be taken for each 10 coils or fraction thereof, in a lot. Each heat in a given lot shall be tested.

TABLE 2 Chemical Requirements

Element	Composition, %
Carbon	0.65–1.00[A]
Manganese	0.20–1.30[B]
Phosphorus, max	0.040
Sulfur, max	0.050
Silicon	0.15–0.35

[A] Carbon in any one lot shall not vary more than 0.13 %.
[B] Manganese in any one lot shall not vary more than 0.30 %.

7.1.3 *Test Method*— The tension test shall be made in accordance with Test Methods and Definitions A 370.

7.2 *Wrap Test*:

7.2.1 *Requirements*— The material as represented by the wrap test specimens shall conform to the requirements specified in Table 3.

7.2.2 *Number of Tests*— One test specimen shall be taken for each 10 coils, or fraction thereof, in a lot. Each heat in a given lot shall be tested.

7.2.3 *Location of Test*— Test specimens shall be taken from either end of the coil.

7.2.4 *Test Method*— The wrap test shall be made in accordance with Test Methods and Definitions A 370.

8. Metallurgical Requirements

8.1 *Microstructure*—The wire shall be cold drawn with a fine pearlite structure.

8.2 *Surface Conditions*—The wire surface shall not exhibit imperfections that exceed 3.5 % of the wire diameter or 0.25 mm (0.010 in.) in depth, whichever is smaller.

9. Dimensions and Permissible Variations

9.1 The permissible variations in the diameter of the wire shall be as specified in Table 4.

10. Workmanship, Finish, and Appearance

10.1 *Workmanship*— The wire shall not be kinked or improperly cast. To test for cast, one convolution of wire shall be cut from the coil and placed on a flat surface. The wire shall not spring up excessively nor show a wavy condition.

10.1.1 Each coil shall be one continuous length of wire, properly coiled and firmly tied. Welds made prior to cold drawing are permitted.

10.2 *Appearance*—The surface shall be smooth and free of rust with no imperfections such as pits or die marks that tend to impair the use of the wire for springs. Any other surface requirements shall be negotiated at the time of entry of the order.

11. Retests

11.1 If any test specimen exhibits obvious imperfections or shows the presence of a weld, it may be discarded and another specimen substituted.

12. Inspection

12.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of

TABLE 3 Wrap Test Requirements[A]

SI Units	
Diameter, mm	Mandrel Size
Over 0.50 to 3.00, incl	2×
Over 3.00 to 5.00, incl	4×
Inch-Pound Units	
Diameter, in.	Mandrel Size
0.020 to 0.162, incl	2×
Over 0.162 to 0.207, incl	4×

[A] The symbol "X" represents the diameter of the wire tested.

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TABLE 4 Permissible Variations in Wire Diameter[A]

SI Units		
Diameter, mm	Permissible Variations, ±mm	Permissible Out-of-Round, ±mm
To 0.70, incl	0.02	0.02
0.70 to 2.00, incl	0.03	0.03
Over 2.00	0.05	0.05
Inch-Pound Units		
Diameter, in.	Permissible Variations, ±in.	Permissible Out-of-Round, ±in.
0.020 to 0.028, incl	0.0008	0.0008
Over 0.028 to 0.075, incl	0.001	0.001
Over 0.075 to 0.207, incl	0.002	0.002

[A] For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice E 29.

all inspection and test requirements specified in this specification. Except as otherwise specified in the contract or purchase order, the manufacturer may use his own or any other suitable facilities for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

13. Rejection and Rehearing

13.1 Unless otherwise specified, any rejection based on tests made in accordance with these specifications shall be reported to the manufacturer as soon as possible so that an investigation may be initiated.

13.2 The material shall be adequately protected and correctly identified in order that the manufacturer is able to make a proper investigation.

14. Certification

14.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

14.2 The certification shall include the specification number, year of issue, and revision letter, if any.

15. Marking for Shipment

15.1 The coil mass, dimensions, and the method of packaging shall be agreed upon between the manufacturer and purchaser.

15.2 A tag shall be securely attached to each coil of wire with identifying information as agreed upon by the purchaser and manufacturer.

15.3 Unless otherwise specified in the purchaser's order, packaging, marking, and loading for shipments shall be in accordance with those procedures recommended by Practices A 700.

15.4 Marking for shipment of material for civil agencies shall be in accordance with Fed. Std. No. 123.

15.5 *Bar Coding*—In addition to the previously-stated identification requirements, bar coding is acceptable as a supplementary identification method. Bar coding should be consistent with AIAG Standard 02.00. The bar code may be applied to a substantially affixed tag.

16. Keywords

16.1 hard drawn; high tensile; wire

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue, A 679/A 679M – 00, that may impact the use of this standard. (Approved May 1, 2006.)

(*1*) In 2.4, removed the referenced document referring to MIL-STD-163. This standard is obsolete and all references were removed.

(*2*) In 15.4, removed the first sentence referring to MIL-STD-163.

(*3*) In 6.3, change the table reference from Table 10 to Table 7.

(*4*) Added summary of changes section.

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