



Designation: A227/A227M – 24

Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs¹

This standard is issued under the fixed designation A227/A227M; 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 two classes of round cold-drawn steel spring wire having properties and quality for the manufacture of mechanical springs, rings, and wire forms that are not subject to high stress or requiring high fatigue properties.

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 may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A510/A510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel

A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment

A751 Test Methods and Practices for Chemical Analysis of Steel Products

A764 Specification for Metallic Coated Carbon Steel Wire, Coated at Size and Drawn to Size for Mechanical Springs

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *American National Standard:*

B32.100 Preferred Metric Sizes for Round, Square, Rectangle, and Hexagon Metal Products³

2.3 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁴

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 For definition of terms used in this specification, refer to Terminology A941.

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 requirement may include, but are not limited to, the following:

4.1.1 Quantity (mass),

4.1.2 Name of material (cold-drawn steel mechanical spring wire) and class (Table 1),

4.1.3 Wire diameter (Section 9),

4.1.4 Packaging (Section 15), and

4.1.5 ASTM designation and date of issue.

4.2 The purchaser shall have the option to specify additional requirements, including but not limited to:

4.2.1 Requirements for certifications, heat analysis or test reports (see Section 14),

4.2.2 Special packing, marking, and loading requirements (see Section 15), and

4.2.3 Other special requirements, if any.

NOTE 1—A typical ordering description is as follows: 15 000 kg Cold-Drawn Mechanical Spring Wire, Class I, Size 5.00 mm in 700-kg coils to ASTM A227M dated_____, or for non-SI units, 30 000 lb Cold-Drawn Mechanical Spring Wire, Class I, Size 0.207 in. diameter in 1500-lb coils to ASTM A227 dated_____.

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, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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.

Current edition approved March 1, 2024. Published April 2024. Originally approved in 1939. Last previous edition approved in 2017 as A227/A227M – 17. DOI: 10.1520/A0227_A0227M-24.

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 Summary of Changes section appears at the end of this standard

TABLE 1 Tensile Requirements^A

SI Units				
Diameter, ^B mm	Class I		Class II	
	Tensile Strength, MPa		Tensile Strength MPa	
	min	max	min	max
0.50	1960	2240	2240	2520
0.55	1940	2220	2220	2500
0.60	1920	2200	2200	2480
0.65	1900	2180	2180	2460
0.70	1870	2140	2140	2410
0.80	1830	2100	2100	2370
0.90	1800	2070	2070	2340
1.00	1770	2040	2040	2310
1.10	1740	2000	2000	2260
1.20	1720	1980	1980	2240
1.40	1670	1930	1930	2180
1.60	1640	1880	1880	2120
1.80	1600	1840	1840	2080
2.00	1580	1810	1810	2040
2.20	1550	1780	1780	2010
2.50	1510	1730	1730	1960
2.80	1480	1700	1700	1920
3.00	1460	1680	1680	1900
3.50	1420	1630	1630	1840
4.00	1380	1590	1590	1800
4.50	1350	1550	1550	1750
5.00	1320	1510	1510	1700
5.50	1300	1490	1490	1670
6.00	1280	1470	1470	1650
6.50	1250	1440	1440	1630
7.00	1220	1410	1410	1600
7.50	1200	1390	1390	1580
8.00	1190	1370	1370	1550
9.00	1160	1340	1340	1520
10.00	1130	1310	1310	1490
11.00	1110	1280	1280	1450
12.00	1090	1260	1260	1430
14.00	1050	1210	1210	1380
16.00	1010	1170	1170	1330

Inch-pound Units				
Diameter, in.	Class I		Class II	
	Tensile Strength, ksi		Tensile Strength, ksi	
	min	max	min	max
0.020	283	323	324	364
0.023	279	319	320	360
0.026	275	315	316	356
0.029	271	311	312	352
0.032	266	306	307	347
0.035	261	301	302	342
0.041	255	293	294	332
0.048	248	286	287	325
0.054	243	279	280	316
0.062	237	272	273	308
0.072	232	266	267	301
0.080	227	261	262	296
0.092	220	253	254	287
0.106	216	248	249	281
0.120	210	241	242	273
0.135	206	237	238	269
0.148	203	234	235	266
0.162	200	230	231	261
0.177	195	225	226	256
0.192	192	221	222	251
0.207	190	218	219	247
0.225	186	214	215	243
0.250	182	210	211	239
0.312	174	200	201	227
0.375	167	193	194	220
0.438	161	186	187	212
0.500	156	180	181	205
0.562	152	176	177	201
0.625	147	170	171	194

^A Tensile strength values for intermediate diameters shall be interpolated.^B Preferred sizes. For a complete list, refer to ANSI/ASME B32.100, Preferred Metric Sizes for Round, Square, Rectangle, and Hexagon Metal Products.

5. Manufacture

5.1 The steel may be made by any commercially accepted steel-making process. The rod to be used in the manufacture of wire furnished to this specification shall be in accordance with Specification A510/A510M.

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

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

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 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 cast or heat. When requested, this shall be reported to the purchaser and shall conform to the requirements of Table 2.

6.3 *Product Analysis*—An analysis may be made by the purchaser from finished wire representing each cast or heat of steel. The chemical composition thus determined, as to elements required or restricted, shall conform to the product analysis requirements specified in Table 3 of Specification A510/A510M.

6.4 For referee purposes, Test Methods, Practices, and Terminology A751 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 ten coils, or fraction thereof, in a lot. Each heat in a given lot shall be tested.

7.1.3 *Location of Tests*—It shall be permissible for test specimens to be taken from either or both ends of the coil.

7.1.4 *Test Method*—The tension test shall be made in accordance with Test Methods and Definitions A370.

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. Wrap test on wires over 8.0 mm or 0.312 in. in diameter is not applicable. Since the conventional methods will

TABLE 2 Chemical Requirements

Element	Composition, %
Carbon	0.45–0.85 ^A
Manganese	0.30–1.30 ^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 %.