Designation: A228/A228M – 16

Standard Specification for Steel Wire, Music Spring Quality[1]

This standard is issued under the fixed designation A228/A228M; 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 types of round, cold-drawn steel music spring quality wire, uniform in mechanical properties, intended especially for the manufacture of springs subject to high stresses or requiring good 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.

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

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

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A938 Test Method for Torsion Testing of Wire

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

E1077 Test Methods for Estimating the Depth of Decarburization of Steel Specimens

2.2 *Federal Standard:*

Fed. Std. No. 123, Marking for Shipment (Civil Agencies)[3]

2.3 *American National Standard:*[4]

B32.100 Preferred Metric Sizes for Flat, Round, Square, Rectangular, and Hexagonal Metal Products

2.4 *AIAG Standard:*[5]

AIAG B-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 A941.

4. Ordering Information

4.1 Orders for steel wire under this specification shall contain the following information:

4.1.1 Quantity (weight in lbs, or mass in kg),

4.1.2 Name (music steel spring wire) and type (Type 1 or Type 2) of material,

4.1.3 Diameter (Table 1 and Section 9),

4.1.4 Finish (see 10.2),

4.1.5 Packaging (Section 15), and

4.1.6 ASTM designation and year 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, 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 inch-pound units ordering description is as follows: 10 000 lb Music Steel Spring Wire, Type 1, 0.055 in. diameter, phosphate

[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 Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111–5098, http://www.dodssp.daps.mil.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[5] Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48033, http://www.aiag.org.

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

TABLE 1 Tensile Requirements

Inch-Pound Units

Diameter, in.[A]	Tensile Strength, ksi		Diameter, in.[A]	Tensile Strength, ksi	
	min	max		min	max
0.004	439	485	0.059	296	327
0.005	426	471	0.063	293	324
0.006	415	459	0.067	290	321
0.007	407	449	0.072	287	317
0.008	399	441	0.076	284	314
0.009	393	434	0.080	282	312
0.010	387	428	0.085	279	308
0.011	382	422	0.090	276	305
0.012	377	417	0.095	274	303
0.013	373	412	0.100	271	300
0.014	369	408	0.102	270	299
0.015	365	404	0.107	268	296
0.016	362	400	0.110	267	295
0.018	356	393	0.112	266	294
0.020	350	387	0.121	263	290
0.022	345	382	0.125	261	288
0.024	341	377	0.130	259	286
0.026	337	373	0.135	258	285
0.028	333	368	0.140	256	283
0.030	330	365	0.145	254	281
0.032	327	361	0.150	253	279
0.034	324	358	0.156	251	277
0.036	321	355	0.162	249	275
0.038	318	352	0.177	245	270
0.040	315	349	0.192	241	267
0.042	313	346	0.207	238	264
0.045	309	342	0.225	235	260
0.048	306	339	0.250	230	255
0.051	303	335	0.262	228	253
0.055	300	331	0.283	223	248

SI Units

Diameter, mm[A]	Tensile Strength, MPa		Diameter, mm[A]	Tensile Strength, MPa	
	min	max		min	max
0.10	3000	3300	1.1	2120	2380
0.11	2950	3250	1.2	2100	2350
0.12	2900	3200	1.4	2050	2300
0.14	2850	3150	1.6	2000	2250
0.16	2800	3100	1.8	1980	2220
0.18	2750	3050	2.0	1950	2200
0.20	2700	3000	2.2	1900	2150
0.22	2680	2980	2.5	1850	2100
0.25	2650	2950	2.8	1820	2050
0.28	2620	2920	3.0	1800	2000
0.30	2600	2900	3.2	1780	1980
0.35	2550	2820	3.5	1750	1950
0.40	2500	2750	3.8	1720	1920
0.45	2450	2700	4.0	1700	1900
0.50	2400	2650	4.5	1680	1880
0.55	2380	2620	5.0	1650	1850
0.60	2350	2600	5.5	1620	1820
0.65	2320	2580	6.0	1600	1800
0.70	2300	2550	6.5	1580	1780
0.80	2250	2500	7.0	1550	1750
0.90	2200	2450	7.2	1540	1740
1.00	2150	2400			

[A] Tensile strength values for intermediate diameters may be interpolated.

coated in 1000 lb coils to ASTM A288M_A228M dated _____, or for metric units, 5000 kg Music Steel Spring Wire, Type 1, 1.40 mm diameter, phosphate coated in 500 kg coils to ASTM A288 dated _____.

5. Materials and 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 from detrimental pipe and undue segregation.

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

5.3.1 Type 1 wire shall be directly drawn from either as-rolled rods or from air patented rods or wire to the final wire diameter.

5.3.2 Type 2 wire shall be drawn from either patented rod or patented wire to the final wire diameter. Air patenting is not allowed.

5.3.3 Type 2 wire may be substituted for Type 1 wire. Conversely, Type 1 wire may not be substituted for Type 2 wire.

NOTE 2—The method of patenting, and in particular the method utilized for controlled cooling, can be designed to optimize the microstructure and mechanical properties of either patented wire rod or patented wire, as well as of wires drawn from either of these. Because patenting is performed in a linear manner rather than in a coiled or serpentine manner, the uniformity of microstructure and mechanical properties along the patented wire or patented wire rod length is improved compared to that existing in either of these prior to patenting.

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 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.

TABLE 2 Chemical Requirements

Element	Composition, %
Carbon	0.70–1.00
Manganese	0.20–0.70
Phosphorus, max	0.025
Sulfur, max	0.030
Silicon	0.10–0.30