Designation: A 407 – 07

Standard Specification for Steel Wire, Cold-Drawn, for Coiled-Type Springs[1]

This standard is issued under the fixed designation A 407; 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, cold-drawn, steel spring wire having properties and quality intended for the manufacture of the following types of upholstery springs:

1.1.1 *Type A*—Coiled (Marshall pack),

1.1.2 *Type B*—Coiled and knotted,

1.1.3 *Type C*—Coiled and knotted (offset style),

1.1.4 *Type D*—Coiled and hooked (single and cross helicals),

1.1.5 *Type E*—Coiled and hooked (short tension—regular tensile strength),

1.1.6 *Type F*—Coiled and hooked (short tension—high tensile strength),

1.1.7 *Type G*—Regular lacing,

1.1.8 *Type H*—Automatic lacing,

1.1.9 *Type I*—Zig-zag (U-formed),

1.1.10 *Type J*—Square-formed, and

1.1.11 *Type K*—Sinuous for furniture spring units.

1.2 These types of upholstery springs are used in the manufacture of automotive seat springs, furniture springs, bed spring units, mattresses, furniture cushions, and automobile seats. This wire is not intended for the manufacture of mechanical springs.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

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

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

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

2.2 *AIAG Standard:*

AIAGB-5 02.00 Primary Metals Identification Tag Application Standard[3]

3. Ordering Information

3.1 Orders for material under this specification should include the following information for each ordered item:

3.1.1 Quantity (weight),

3.1.2 Name of material (name of specific type required) (Section 1 and Table 1),

3.1.3 Diameter (Table 2),

3.1.4 Packaging, marking, and loading (Section 12),

3.1.5 ASTM designation and date of issue, and

3.1.6 Heat (cast) analysis (if desired).

NOTE 1—A typical ordering description is as follows: 50 000 lb [15 000 kg], cold-drawn upholstery spring wire Type B for coiling and knotting, size 0.080 in. [2.0 mm], 1500-lb [700 kg] coils on tubular carriers to ASTM A 407 dated.

4. Manufacture

4.1 The steel shall be made by any of the following processes: open-hearth, basic-oxygen, or electric-furnace.

4.2 A sufficient discard shall be made to ensure freedom from injurious piping and undue segregation.

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

5. Chemical Composition

5.1 Upholstery spring wire for coiled-type springs is customarily produced within the chemical ranges shown below. Chemical composition and processing may vary depending on the gage of wire and specific use.

Carbon, %	0.45 to 0.70[A]
Manganese, %,	0.60 to 1.20[A]
Phosphorus, max, %	0.040
Sulfur, max, %	0.050

[A] In any lot in which all the wire is of the same size and type, and submitted for inspection at the same time, the carbon content shall not vary more than 0.20 %, and the manganese content shall not vary more than 0.30 %.

5.2 An analysis of each heat (cast) shall be made by the producer to determine the percentage of elements specified

[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 Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48033-7100, www.aiag.org.

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TABLE 1 Tensile Strength Requirements[A]

Diameter, in. [mm]	Wire Gage	Tensile Strength, ksi [MPa] min	Tensile Strength, ksi [MPa] max
Type A, Marshall Pack			
0.048 [1.2]	18	255 [1800]	295 [2060]
0.054 [1.4]	17	250 [1760]	290 [2010]
0.062 [1.6]	16	250 [1710]	290 [1950]
0.072 [1.8]	15	240 [1680]	280 [1920]
0.080 [2.0]	14	230 [1650]	270 [1890]
0.092 [2.4]	13	225 [1610]	265 [1830]
0.106 [2.8]	12	220 [1560]	260 [1780]
Type B, Coiled and Knotted			
0.062 [1.6]	16	235 [1550]	270 [1790]
0.072 [1.8]	15	230 [1530]	265 [1770]
0.080 [2.0]	14	225 [1500]	260 [1740]
0.092 [2.4]	13	215 [1460]	250 [1680]
0.106 [2.6]	12	205 [1420]	235 [1640]
0.120 [3.0]	11	195 [1380]	225 [1600]
0.135 [3.5]	10	190 [1350]	220 [1560]
0.148 [3.8]	9	185 [1300]	215 [1530]
0.162 [4.2]	8	180 [1300]	210 [1500]
Type C, Coiled and Knotted (Offset Type)			
0.072 [1.8]	15	215 [1450]	245 [1690]
0.080 [2.0]	14	210 [1430]	240 [1670]
0.092 [2.4]	13	200 [1390]	230 [1610]
0.106 [2.6]	12	195 [1360]	225 [1580]
Type D, Coiled and Hooked (Cross Helicals)			
0.048 [1.2]	18	215 [1490]	255 [1750]
0.054 [1.4]	17	210 [1440]	250 [1700]
0.062 [1.6]	16	210 [1410]	250 [1650]
Type E, Coiled and Hooked (Short Tension, Regular Tensile Strength)			
0.080 [2.0]	14	200 [1410]	240 [1650]
0.092 [2.4]	13	200 [1360]	240 [1580]
0.106 [2.6]	12	195 [1330]	235 [1550]
Type F, Coiled and Hooked (Short Tension, High Tensile Strength)			
0.080 [2.0]	14	225 [1550]	260 [1790]
0.092 [2.4]	13	220 [1520]	255 [1740]
0.106 [2.6]	12	215 [1490]	250 [1710]
Type G, Regular Lacing Wire			
0.041 [1.0]	19	235 [1640]	275 [1910]
0.048 [1.2]	18	230 [1600]	270 [1860]
0.054 [1.4]	17	225 [1560]	265 [1810]
0.062 [1.6]	16	225 [1520]	265 [1760]
Type H, Automatic Lacing Wire			
0.041 [1.0]	19	250 [1740]	290 [2020]
0.048 [1.2]	18	245 [1700]	285 [1960]
0.054 [1.4]	17	240 [1660]	280 [1910]
0.062 [1.6]	16	235 [1620]	275 [1860]
Type I, Zig-Zag Type Automobile Seat and Back Spring Units			
		Class I	Class II
0.092 [2.4]	13	220 [1520] 250 [1720]	230 [1590] 260 [1800]
0.106 [2.6]	12	215 [1480] 245 [1690]	225 [1550] 255 [1760]
0.120 [3.0]	11	210 [1450] 240 [1660]	215 [1480] 245 [1690]
0.135 [3.5]	10	205 [1410] 235 [1620]	210 [1450] 240 [1660]
0.148 [3.8]	9	200 [1380] 230 [1590]	205 [1410] 235 [1620]
0.162 [4.2]	8	190 [1310] 220 [1520]	200 [1380] 230 [1590]
Type J, Square-Formed Type Automobile Seat and Back Spring Units			
		Class I	Class II
0.092 [2.4]	13	215 [1480] 245 [1690]	225 [1550] 255 [1760]
0.106 [2.6]	12	210 [1450] 240 [1660]	220 [1520] 250 [1720]
0.120 [3.0]	11	205 [1410] 235 [1620]	215 [1480] 245 [1690]
0.135 [3.5]	10	200 [1380] 230 [1590]	210 [1450] 240 [1660]
0.148 [3.8]	9	190 [1310] 220 [1520]	200 [1380] 230 [1590]
0.162 [4.2]	8	180 [1240] 210 [1450]	190 [1310] 220 [1520]

TABLE 1 *Continued*

Diameter, in. [mm]	Wire Gage	Tensile Strength, ksi [MPa] min	Tensile Strength, ksi [MPa] max
Type K, Sinuous Type Furniture Spring Units			
0.092 [2.4]	13	235 [1660]	270 [1860]
0.106 [2.6]	12	235 [1620]	265 [1830]
0.120 [3.0]	11	230 [1590]	260 [1800]
0.135 [3.5]	10	225 [1550]	255 [1760]
0.148 [3.8]	9	220 [1520]	250 [1720]
0.162 [4.2]	8	215 [1480]	245 [1690]
0.177 [4.5]	7	210 [1450]	240 [1660]
0.192 [5.0]	6	207 [1430]	237 [1630]

[A] Tensile strength values for diameters not shown in this table shall conform to that shown for the next larger diameter (for example, for diameter 0.128 in. [3.25 mm] the value shall be the same as for 0.135 in. [3.42 mm]).

TABLE 2 Permissible Variations in Wire Diameter

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

Diameter, in. [mm]	Variations, plus and minus, in. [mm]	Permissible Out-of-Round, in. [mm]
Sizes finer than 0.076 [2.0]	0.001 [0.02]	0.001 [0.02]
Sizes 0.076 [2.0] to 0.162 [4.2], incl	0.002 [0.05]	0.002 [0.05]
Sizes 0.092 [2.2] to 0.192 [5.2]	0.002 [0.05]	0.002 [0.05]

above. The analysis shall be made from a test sample preferably taken during the pouring of the heat (cast). The chemical composition thus determined shall be reported to the purchaser or his representative upon request.

6. Mechanical Properties

6.1 *Tension Test:*

6.1.1 *Requirements*—The material as represented by tension test specimens shall conform to the requirements prescribed in Table 1 for the various sizes and specified types.

6.1.2 *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.

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

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

6.2 *Wrap Test:*

6.2.1 *Requirements*—The wire for zig-zag-type and for square-formed-type springs for automobile seat and back spring units, except that for coiled-type springs Type A (Marshall pack), shall wrap on itself as an arbor without breakage. The wire for sinuous-type furniture spring units shall wrap on a mandrel twice the diameter of the wire without breakage. The wire shall wrap on itself as an arbor without breakage.

6.2.2 *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.

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

6.2.4 *Test Method*—The wrap test shall be made in accordance with Supplement IV of Test Methods and Definitions A 370.

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7. Dimensions and Permissible Variations

7.1 The diameter of the wire shall not vary from that specified by more than the tolerances specified in Table 2.

8. Workmanship

8.1 *Surface Condition*—The surface of the wire as received shall be smooth and have a uniform finish suitable for coiling or shaping the various types of springs. No serious die marks, scratches, or seams may be present.

8.2 The wire shall be properly cast. To test for cast, a few convolutions of wire shall be cut from the coil and allowed to fall on a flat surface. The wire shall lie substantially flat on itself and shall not spring up and show a wavy condition.

8.3 Each coil shall be one continuous length of wire, properly coiled. Welds made prior to cold drawing are permitted. Weld areas need not meet the mechanical requirements of this specification.

9. Retests

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

10. Inspection

10.1 The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy him that the material is being produced and furnished in accordance with this specification. Mill inspection by the purchaser shall not interfere unnecessarily with the manufacturer's operations. All tests and inspections shall be made at the place of manufacture, unless otherwise agreed to.

11. Rejection and Rehearing

11.1 Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported to the manufacturer within a reasonable length of time.

11.2 Failure of any of the test specimens to comply with the requirements of this specification shall constitute grounds for rejection of the lot represented by the specimen. The lot may be resubmitted for inspection by testing every coil for the characteristic in which the specimen failed and sorting out the defective coils.

11.3 The material must be adequately protected and correctly identified in order that the producer may make proper investigation.

12. Packaging, Marking, and Loading

12.1 Packaging of the coils of wire shall be by agreement between the producer and the purchaser. This agreement shall include coil dimensions and weights.

12.2 When specified, the packaging, marking, and loading shall be in accordance with Practices A 700.

12.3 Marking shall be by a tag securely attached to each coil of wire and shall show the identity of the producer, size of the wire, type, and ASTM specification designation.

12.4 *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 AIAGB-5 02.00, Primary Metals Identification Tag Application. The bar code may be applied to a substantially affixed tag.

13. Keywords

13.1 coiled-type; cold-drawn; sinuous; springs; square-formed; upholstery; wire; zig-zag

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