Designation: A 713 – 04

Standard Specification for Steel Wire, High-Carbon Spring, for Heat-Treated Components[1]

This standard is issued under the fixed designation A 713; 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 carbon spring steel wire in coils intended for the manufacture of mechanical springs and wire forms that are heat treated (austenitized, quenched, and tempered) after fabrication.

1.2 The values stated in inch-pound units are to be regarded as the standard.

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

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

E 30 Test Methods for Chemical Analysis of Steel, Cast Iron, Open-Hearth Iron, and Wrought Iron[3]

E 112 Test Methods for Determining Average Grain Size

E 350 Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 *Society of Automotive Engineers Standard:*[4]

J 1086 Numbering Metals and Alloys

2.3 *AIAG Standard:*[5]

AIAGB-5 02.00 Primary Metals Identification Tag Application Standard

3. Terminology

3.1 *Definitions:*

3.1.1 *heat-treated components*—mechanical springs or wire forms that are austenitized, quenched, and tempered after fabrication.

3.2 Refer to Terminology A 941 for a more detailed description of heat-treating terms.

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 include, but are not limited to, the following:

4.1.1 Quantity (weight),

4.1.2 Name of material (Sections 1 and 7),

4.1.3 Diameter (Table 1),

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

4.1.5 ASTM designation and date of issue,

4.1.6 Special requirements (Sections 8 and 9), and

4.1.7 End use.

NOTE 1—A typical ordering description is as follows: Steel Wire, High Carbon Spring, for Heat-Treated Components, Grade 1070, to ASTM A 713 dated _____, for Door Closer Springs, 30 000 lb, Size 0.250 in. in 500-lb Catch Weight Coils.

5. General Requirements for Delivery

5.1 Material furnished under this specification shall conform to the applicable requirements of the latest edition of Specification A 510 unless otherwise specified herein.

6. Materials and Manufacture

6.1 The steel shall be made by the open-hearth, basic-oxygen, or electric-furnace process.

6.2 The wire, prior to fabrication, shall be thermally treated or thermally treated and drawn.

[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] Withdrawn.

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990.

[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 Permissible Variations in Wire Diameter

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

Diameter, in. (mm)	Permissible Variations, Plus and Minus, in. (mm)	Permissible Out-of-Round, in. (mm)
0.035 to 0.075 (0.89 to 1.90), incl	0.001 (0.03)	0.001 (0.03)
Over 0.075 to 0.375 (1.90 to 9.52), incl	0.002 (0.05)	0.002 (0.05)
Over 0.375 to 0.625 (9.52 to 15.88), incl	0.003 (0.08)	0.003 (0.08)

6.3 The condition or wire (metallurgical and mechanical properties) to be used is at the discretion of the purchaser and is generally dependent on the severity of the component part to be formed.

7. Chemical Composition

7.1 The steel shall conform to the requirements for chemical composition prescribed in Table 2 for the grade ordered.

7.2 A chemical composition other than those shown in Table 2 may be supplied when agreed upon by the manufacturer and purchaser.

7.3 An analysis of each cast or heat shall be made by the manufacturer to determine the percentage of elements specified in Table 2. The chemical composition thus determined shall be reported to the purchaser or his representative upon request.

7.4 A product analysis may be made by the purchaser. The chemical composition thus determined, as to elements required or restricted, shall conform to permissible variations for product analysis as specified in Table 10 in Specification A 510. For referee purposes, Test Methods E 30 or Test Methods E 350 shall be used.

TABLE 2 Chemical Composition

NOTE— The following ranges of silicon are commonly specified for high-carbon steels: 0.10 to 0.20 %; 0.15 to 0.30 %; 0.20 to 0.40 %; or 0.30 to 0.60 %.

UNS Designation[A]	Grade	Composition, %			
		Carbon	Manganese	Phosphorus, max	Sulfur, max
G 10550	1055	0.50–0.60	0.60–0.90	0.040	0.050
G 10590	1059	0.55–0.65	0.50–0.80	0.040	0.050
G 10600	1060	0.55–0.65	0.60–0.90	0.040	0.050
G 10640	1064	0.60–0.70	0.50–0.80	0.040	0.050
G 10650	1065	0.60–0.70	0.60–0.90	0.040	0.050
G 10690	1069	0.65–0.75	0.40–0.70	0.040	0.050
G 10700	1070	0.65–0.75	0.60–0.90	0.040	0.050
G 10740	1074	0.70–0.80	0.50–0.80	0.040	0.050
G 10750	1075	0.70–0.80	0.40–0.70	0.040	0.050
G 10780	1078	0.72–0.85	0.30–0.60	0.040	0.050
G 10800	1080	0.75–0.88	0.60–0.90	0.040	0.050
G 10840	1084	0.80–0.93	0.60–0.90	0.040	0.050
G 10860	1086	0.80–0.93	0.30–0.50	0.040	0.050
G 10900	1090	0.85–0.98	0.60–0.90	0.040	0.050
G 10950	1095	0.90–1.03	0.30–0.50	0.040	0.050
G 15610	1561	0.55–0.65	0.75–1.05	0.040	0.050
G 15660	1566	0.60–0.71	0.85–1.15	0.040	0.050
G 15720	1572	0.65–0.76	1.00–1.30	0.040	0.050

[A]Designation established in accordance with Practice E 527 and SAE J 1086.

8. Metallurgical Structure

8.1 Austenitic grain size, when specified, shall be determined in accordance with the requirements of Test Methods E 112 or some other mutually agreeable method.

9. Mechanical Properties

9.1 Tensile strength is not normally a requirement. Minimum or maximum values for tensile strength may be agreed upon between the purchaser and manufacturer and are dependent on the chemical composition, thermal treatment, and diameter of wire specified.

9.2 *Wrap Test*:

9.2.1 *Requirements*—Wire shall wind without fracture on a cylindrical mandrel of a diameter specified in Table 3. The wrap test is not applicable to wires over 0.312 in. (8 mm). Since the conventional methods will not accommodate wire sizes over 0.312 in., an alternative test procedure may be agreed upon between the purchaser and manufacturer.

9.2.2 *Number of Tests*—At least one test specimen shall be taken for each ten coils or fraction thereof in a lot.

9.2.3 *Location of Test*—The test specimen shall be taken from either end of the coil.

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

10. Dimensions and Tolerances

10.1 The diameter of the wire shall not vary from the specified size by more than the tolerance shown in Table 1.

11. Workmanship

11.1 The surface of the wire as received shall be substantially free of rust and such other surface imperfections of a nature or degree, for the grade ordered, that will be detrimental to the fabrication of the parts.

11.2 Wire drawn as a final operation shall not be kinked or improperly cast. To test for a cast, a single convolution, or ring, of wire shall be cut from the bundle and placed on a flat surface. The wire shall lie substantially flat and not spring up. The wire shall not show a wavy condition.

11.3 Each coil of wire shall be one continuous length.

11.4 Wire may be processed with welds made prior to wire drawing. Weld areas need not meet the mechanical requirements of the specification. If unmarked welds are unacceptable to the purchaser, special arrangements should be made with the manufacturer at the time of purchase.

12. Inspection

12.1 The manufacturer shall afford the inspector representing the purchaser all reasonable facilities to satisfy him that the

TABLE 3 Wrap Test Requirements

Wire Diameter, in. (mm)	Mandrel Sizes	
	Grades to 1090	Grades 1090 and Over
Up to 0.162 (4)	1×[A]	2×
Over 0.162 to 0.312 (4 to 8), incl	2×	3×

[A]The symbol × represents the diameter of the wire tested. For 1× mandrel, wire may be wrapped around itself.

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material being furnished is in accordance with this specification. All tests (except product analysis) and inspections shall be made at the place of manufacturer prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

13. Rejection and Rehearing

13.1 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.

13.2 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 nonconforming coils.

13.3 The material must be adequately protected and correctly identified in order that the manufacturer may make a proper investigation.

14. Certification

14.1 Upon request of the purchaser in the contract or purchase order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification together with a report of the test results shall be furnished at the time of shipment.

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

15. Packaging, Marking, and Loading

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

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

15.3 Marking shall be by tag securely attached to each coil of wire and shall show the identity of the manufacturer, size of the wire, grade, ASTM specification number, and cast or heat number.

15.4 *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 02.00, Primary Metals Identification Tag Application. The bar code may be applied to a substantially affixed tag.

16. Keywords

16.1 components; heat treated; high-carbon; spring; wire

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue, A 713–93 (1998), that may impact the use of this standard. (Approved March 1, 2004.)

(*1*) Revised 2.1 and 3.2 to change reference to the correct terminology standard.
(*2*) Revised Section 4 to eliminate non-mandatory language.
(*3*) Deleted second sentence of 7.3, since it duplicates Specification A 510.
(*4*) Moved previous Section 11 to Section 5 to conform to preferred Committee A01 style and renumbered subsequent sections.

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