Designation: A713 – 04 (Reapproved 2010)

Standard Specification for
Steel Wire, High-Carbon Spring, for Heat-Treated
Components¹

This standard is issued under the fixed designation A713; 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
A370 Test Methods and Definitions for Mechanical Testing
of Steel Products
A510 Specification for General Requirements for Wire Rods
and Coarse Round Wire, Carbon Steel
A700 Practices for Packaging, Marking, and Loading Meth-
ods for Steel Products for Shipment
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
E30 Test Methods for Chemical Analysis of Steel, Cast Iron,
Open-Hearth Iron, and Wrought Iron (Withdrawn 1995)³
E112 Test Methods for Determining Average Grain Size
E350 Test Methods for Chemical Analysis of Carbon Steel,
Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and
Wrought Iron
E527 Practice for Numbering Metals and Alloys in the
Unified Numbering System (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 Appla-
lication 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 A941 for a more detailed descrip-
tion 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
A713 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 con-
form to the applicable requirements of the latest edition of
Specification A510 unless otherwise specified herein.

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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approved in 1975. Last previous edition approved in 2004 as A713 – 04. DOI:
10.1520/A0713-04R10.

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 The last approved version of this historical standard is referenced on
www.astm.org.

⁴ Available from American Society of Mechanical Engineers (ASME), ASME
www.asme.org.

⁵ Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd.,
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.

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.

### Table 2 Chemical Composition

<table>
<thead>
<tr>
<th>UNS Designation</th>
<th>Grade</th>
<th>Carbon, max</th>
<th>Phosphorus, max</th>
<th>Sulfur, max</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 10550</td>
<td>1055</td>
<td>0.50–0.60</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10590</td>
<td>1059</td>
<td>0.55–0.65</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10600</td>
<td>1060</td>
<td>0.55–0.65</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10640</td>
<td>1064</td>
<td>0.60–0.70</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10650</td>
<td>1065</td>
<td>0.60–0.70</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10690</td>
<td>1069</td>
<td>0.65–0.75</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10700</td>
<td>1070</td>
<td>0.65–0.75</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10740</td>
<td>1074</td>
<td>0.70–0.80</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10750</td>
<td>1075</td>
<td>0.70–0.80</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10780</td>
<td>1078</td>
<td>0.72–0.85</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10800</td>
<td>1080</td>
<td>0.75–0.88</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10840</td>
<td>1084</td>
<td>0.80–0.93</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10860</td>
<td>1086</td>
<td>0.80–0.93</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10900</td>
<td>1090</td>
<td>0.85–0.98</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 10950</td>
<td>1095</td>
<td>0.90–1.03</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 15610</td>
<td>1561</td>
<td>0.55–0.65</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 15660</td>
<td>1566</td>
<td>0.60–0.71</td>
<td>0.040</td>
<td>0.050</td>
</tr>
<tr>
<td>G 15720</td>
<td>1572</td>
<td>0.65–0.76</td>
<td>0.040</td>
<td>0.050</td>
</tr>
</tbody>
</table>

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 A510. For referee purposes, Test Methods E30 or Test Methods E350 shall be used.

8. Metallurgical Structure

8.1 Austenitic grain size, when specified, shall be determined in accordance with the requirements of Test Methods E112 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 A370.

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.

### Table 3 Wrap Test Requirements

<table>
<thead>
<tr>
<th>Wire Diameter, in. (mm)</th>
<th>Grades to 1090</th>
<th>Grades 1090 and Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 0.162 (4)</td>
<td>1x</td>
<td>2x</td>
</tr>
<tr>
<td>Over 0.162 to 0.312 (4 to 8), incl</td>
<td>2x</td>
<td>3x</td>
</tr>
</tbody>
</table>

*Designation established in accordance with Practice E527 and SAE J 1086.
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 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 A700.

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