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~~Designation:A510–07~~ Designation: A 510 – 08

Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel[1]

This standard is issued under the fixed designation A 510; 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 Department of Defense.

1. Scope*

1.1 This specification covers general requirements for carbon steel wire rods and uncoated coarse round wire in coils or straightened and cut lengths.

1.2 In case of conflict, the requirements in the purchase order, on the drawing, in the individual specification, and in this general specification shall prevail in the sequence named.

NOTE ~~1—A complete metric companion to Specification A510 has been developed—Specification A510M; therefore, no metric equivalents are presented in this specification.~~ 1—A complete metric companion to this specification has been developed—Specification A 510M; therefore, no metric equivalents are presented in this specification.

1.3 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

A 510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel (Metric)

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

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

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 527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 *SAE Standard:*[4]

J 1086 Numbering Metals and Alloy

2.3 *AIAG Standard:*[5]

AIAGB-5 02.00 Primary Metals Identification Tag Application Standard

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *carbon steel*—steel in which no minimum content is specified or required for aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, or zirconium, or any other element added to obtain a desired alloying effect; when the specified minimum for copper does not exceed 0.40 %; or when the maximum content specified for any of the following elements does not exceed these percentages: manganese 1.65, silicon 0.60, or copper 0.60.

3.1.1.1 *Discussion*—In all carbon steels small quantities of certain residual elements unavoidably retained from raw materials are sometimes found that are not specified or required, such as copper, nickel, molybdenum, chromium, etc. These elements are

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[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.~~

[3] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.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.**

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considered as incidental and are not formally determined or reported. Elements may be specified to improve machinability of carbon steels such as sulfur and lead.

3.1.2 *coarse round wire—from 0.035 to 0.999 in. in diameter, inclusive*, wire that is produced from hot-rolled wire rods or hot-rolled coiled bars by one or more cold reductions primarily for the purpose of obtaining a desired size with dimensional accuracy, surface finish, and mechanical properties. By varying the amount of cold reduction and other wire mill practices, including thermal treatment, a wide diversity of mechanical properties and finishes are made available.

3.1.2.1 *Discussion*—Coarse round wire is designated by Steel Wire Gauge numbers, common fractions, or decimal parts of an inch. The Steel Wire Gauge system is shown in Table 1. Since the many gauge systems in use may cause confusion, the purchaser is encouraged to specify wire diameters in inches or decimal parts, or both.

3.1.3 *straightened and cut wire*—wire that is produced from coils of wire by means of special machinery which straightens the wire and cuts it to a specified length.

3.1.3.1 *Discussion*—The straightening operation may alter the mechanical properties of the wire, especially the tensile strength. The straightening operation may also induce changes in the diameter of the wire. The extent of the changes in the properties of the wire after cold straightening depends upon the kind of wire and also on the normal variations in the adjustments of the straightening equipment. It is therefore not possible to forecast the properties of straightened and cut wire and each kind of wire needs individual consideration. In most cases, the end use of straightened and cut wire is not seriously influenced by these changes.

3.1.4 *wire rods*—rods that are hot rolled from billets to an approximate round cross section into coils of one continuous length. Rods are not comparable to hot-rolled bars in accuracy of cross section or surface finish and as a semifinished product are intended primarily for the manufacture of wire.

3.1.4.1 *Discussion*—Rod sizes from 7⁄32 to 47⁄64 in. in diameter, inclusive, are designated by fractions or decimal parts of an inch as shown in Table 2.

4. Ordering Information

4.1 Orders for hot-rolled wire rods under this specification should include the following information:

4.1.1 Quantity (pounds),

4.1.2 Name of material (wire rods),

4.1.3 Diameter (Table 2),

4.1.4 Chemical composition grade no. (Tables 3-6),

4.1.4.1 If ordered to chemical composition, see Section 6.1.1.

4.1.4.2 If ordered to tensile strength, with or without chemistry ranges, see 6.1.2.

4.1.5 Packaging,

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TABLE 1 Steel Wire Gauge[A]

ASTM A510-08
https://standards.iteh.ai/catalog/standards/sist/0bb042aa-fdc1-4eac-8e56-6cabb6c78c7/astm-a510-08

Gauge No.	Decimal Equivalent, in.	Gauge No.	Decimal Equivalent, in.
7/0	0.490	9	0.148*
6/0	0.462*	9½	0.142
5/0	0.430*	10	0.135
4/0	0.394*	10½	0.128
3/0	0.362*	11	0.120*
2/0	0.331	11½	0.113
1/0	0.306	12	0.106*
1	0.283	12½	0.099
1½	0.272	13	0.092*
2	0.262*	13½	0.086
2½	0.253	14	0.080
3	0.244*	14½	0.076
3½	0.234	15	0.072
4	0.225*	15½	0.067
4½	0.216	16	0.062*
5	0.207	16½	0.058
5½	0.200	17	0.054
6	0.192	17½	0.051
6½	0.184	18	0.048*
7	0.177	18½	0.044
7½	0.170	19	0.041
8	0.162	19½	0.038
8½	0.155	20	0.035*

[A] The steel wire gauge outlined in this table has been taken from the original Washburn and Moen Gauge chart. In 20 gauge and coarser, sizes originally quoted to 4 decimal equivalent places have been rounded to 3 decimal places in accordance with rounding procedures of Practice E 29. All rounded U.S. customary values are indicated by an asterisk.

TABLE 2 Sizes of Wire Rods[A]

Inch Fraction	Decimal Equivalent, in.	Inch Fraction	Decimal Equivalent, in.
7/32	0.219	31/64	0.484
15/64	0.234	1/2	0.500
1/4	0.250	33/64	0.516
17/64	0.266	17/32	0.531
9/32	0.281	35/64	0.547
19/64	0.297	9/16	0.562
5/16	0.312	37/64	0.578
21/64	0.328	19/32	0.594
11/32	0.344	39/64	0.609
23/64	0.359	5/8	0.625
3/8	0.375	41/64	0.641
25/64	0.391	21/32	0.656
13/32	0.406	43/64	0.672
27/64	0.422	11/16	0.688
7/16	0.438	45/64	0.703
29/64	0.453	23/32	0.719
15/32	0.469	47/64	0.734

[A] Rounded off to 3 decimal places in decimal equivalents in accordance with procedures outlined in Practice E 29.

4.1.6 ASTM designation and date of issue, and
4.1.7 Special requirements, if any.

NOTE 2—A typical ordering description is as follows: 100 000 lb Wire Rods, 7/32 in., Grade 1010 in approximately 1000 lb Coils to ASTM A 510 dated _____.

4.2 Orders for coarse round wire under this specification should include the following information:
4.2.1 Quantity (pounds or pieces),
4.2.2 Name of material (uncoated carbon steel wire),
4.2.3 Diameter (see 3.1.2),
4.2.4 Length (straightened and cut only),
4.2.5 Chemical composition (Tables 3-6),
4.2.6 Packaging,
4.2.7 ASTM designation and date of issue, and
4.2.8 Special requirements, if any.

NOTE 3—A typical ordering description is as follows: 40 000 lb Uncoated Carbon Steel Wire, 0.148 in. (9 ga.) diameter, Grade 1008 in 500 lb Coils on Tubular Carriers to ASTM A 510-XX, or
2500 Pieces, Carbon Steel Wire, 0.375 in. diameter, Straightened and Cut 29½ in., Grade 1015, in 25 Piece Bundles on Pallets to ASTM A 510-XX.

5. Manufacture

5.1 The steel shall be made by the electric-furnace, basic-oxygen or other similar commercially accepted steel making process. The steel may be either ingot cast or strand cast.

6. Chemical Composition

6.1 The chemical composition for steel under this specification shall conform to the requirements set forth in the purchase order. ~~Chemical~~

6.1.1 If material is ordered to chemical composition, the compositions are specified by ranges or limits for carbon and other elements. The grades commonly specified for carbon steel wire rods and coarse round wire are shown in Tables 3-6.

6.1.2 For wire rods intended for direct-drawn wire, it is common practice to specify a range of tensile strength. If chemistry ranges are also specified, due consideration should be taken to ensure that the producer can achieve the required strengths within the allowable carbon range. The limits for Mn, P, and S are normally specified according to Table 3.

6.2 *Cast or Heat Analysis* (*Formerly Ladle Analysis*)—An analysis of each cast or heat shall be made by the producer to determine the percentage of the elements specified. The analysis shall be made from a test sample, preferably taken during the pouring of the cast or heat. The chemical composition thus determined shall be reported, if required, to the purchaser, or his representative. Reporting of significant figures and rounding shall be in accordance with Test Methods, Practices, and Terminology A 751.

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TABLE 3 Nonresulfurized Carbon Steel Cast or Heat Chemical Ranges and Limits

NOTE 1—*Silicon*—When silicon is required the following ranges and limits are commonly used for nonresulfurized carbon steels: 0.10 max, %, 0.07 to 0.15 %, 0.10 to 0.20 %, 0.15 to 0.35 %, 0.20 to 0.40 %, or 0.30 to 0.60 %.

NOTE 2—*Copper*—When required, copper is specified as an added element.

NOTE 3—*Lead*—When lead is required as an added element, a range from 0.15 to 0.35 % is specified. Such a steel is identified by inserting the letter "L'' between the second and third numerals of the grade number, for example, 10L18.

NOTE 4—*Boron Addition to Improve Hardenability*—Standard killed carbon steels, which are fine grain, may be produced with a boron addition to improve hardenability and typically contain an intentional addition of .01 % minimum titanium. Such steels are produced to a range of 0.0005 to 0.003 % boron. These steels are identified by inserting the letter "B'' between the second and third numerals of the grade number, for example, 10B46. The UNS designation is also modified by changing the last digit to "1" to indicate boron, for example, G 1046.1.

NOTE 5—*Boron Additions to Control Strain-Ageing Behavior* —Intentional additions of Boron to low carbon steels for the purpose of controlling strain-ageing behavior during wire drawing is permissible only with the agreement of the purchaser. In such cases, the Boron content shall be reported in either a material test report or certification.

NOTE 6—For steels that do not have intentional boron additions for hardenability or for control of strain aging behavior, the boron content will not normally exceed 0.0008 %.

UNS Designation[A]	Grade No.	Chemical Composition Limits, %				SAE No.
		Carbon	Manganese	Phosphorus, max	Sulfur, max	
G 10050	1005	0.06 max	0.35 max	0.040	0.050	1005
G 10060	1006	0.08 max	0.25 to 0.45	0.040	0.050	1006
G 10080	1008	0.10 max	0.30 to 0.50	0.040	0.050	1008
G 10100	1010	0.08 to 0.13	0.30 to 0.60	0.040	0.050	1010
G 10110	1011	0.08 to 0.13	0.60 to 0.90	0.040	0.050	1011
G 10120	1012	0.10 to 0.15	0.30 to 0.60	0.040	0.050	1012
G 10130	1013	0.11 to 0.16	0.50 to 0.80	0.040	0.050	1013
G 10150	1015	0.13 to 0.18	0.30 to 0.60	0.040	0.050	1015
G 10160	1016	0.13 to 0.18	0.60 to 0.90	0.040	0.050	1016
G 10170	1017	0.15 to 0.20	0.30 to 0.60	0.040	0.050	1017
G 10180	1018	0.15 to 0.20	0.60 to 0.90	0.040	0.050	1018
G 10190	1019	0.15 to 0.20	0.70 to 1.00	0.040	0.050	1019
G 10200	1020	0.18 to 0.23	0.30 to 0.60	0.040	0.050	1020
G 10210	1021	0.18 to 0.23	0.60 to 0.90	0.040	0.050	1021
G 10220	1022	0.18 to 0.23	0.70 to 1.00	0.040	0.050	1022
G 10230	1023	0.20 to 0.25	0.30 to 0.60	0.040	0.050	1023
G 10250	1025	0.22 to 0.28	0.30 to 0.60	0.040	0.050	1025
G 10260	1026	0.22 to 0.28	0.60 to 0.90	0.040	0.050	1026
G 10290	1029	0.25 to 0.31	0.60 to 0.90	0.040	0.050	1029
G 10300	1030	0.28 to 0.34	0.60 to 0.90	0.040	0.050	1030
G 10340	1034	0.32 to 0.38	0.50 to 0.80	0.040	0.050	. . .
G 10350	1035	0.32 to 0.38	0.60 to 0.90	0.040	0.050	1035
G 10370	1037	0.32 to 0.38	0.70 to 1.00	0.040	0.050	1037
G 10380	1038	0.35 to 0.42	0.60 to 0.90	0.040	0.050	1038
G 10390	1039	0.37 to 0.44	0.70 to 1.00	0.040	0.050	1039
G 10400	1040	0.37 to 0.44	0.60 to 0.90	0.040	0.050	1040
G 10420	1042	0.40 to 0.47	0.60 to 0.90	0.040	0.050	1042
G 10430	1043	0.40 to 0.47	0.70 to 1.00	0.040	0.050	1043
G 10440	1044	0.43 to 0.50	0.30 to 0.60	0.040	0.050	1044
G 10450	1045	0.43 to 0.50	0.60 to 0.90	0.040	0.050	1045
G 10460	1046	0.43 to 0.50	0.70 to 1.00	0.040	0.050	1046
G 10490	1049	0.46 to 0.53	0.60 to 0.90	0.040	0.050	1049
G 10500	1050	0.48 to 0.55	0.60 to 0.90	0.040	0.050	1050
G 10530	1053	0.48 to 0.55	0.70 to 1.00	0.040	0.050	1053
G 10550	1055	0.50 to 0.60	0.60 to 0.90	0.040	0.050	1055
G 10590	1059	0.55 to 0.65	0.50 to 0.80	0.040	0.050	1059
G 10600	1060	0.55 to 0.65	0.60 to 0.90	0.040	0.050	1060
G 10640	1064	0.60 to 0.70	0.50 to 0.80	0.040	0.050	1064
G 10650	1065	0.60 to 0.70	0.60 to 0.90	0.040	0.050	1065
G 10690	1069	0.65 to 0.75	0.40 to 0.70	0.040	0.050	1069
G 10700	1070	0.65 to 0.75	0.60 to 0.90	0.040	0.050	1070
G 10740	1074	0.70 to 0.80	0.50 to 0.80	0.040	0.050	1074
G 10750	1075	0.70 to 0.80	0.40 to 0.70	0.040	0.050	1075
G 10780	1078	0.72 to 0.85	0.30 to 0.60	0.040	0.050	1078
G 10800	1080	0.75 to 0.88	0.60 to 0.90	0.040	0.050	1080
G 10840	1084	0.80 to 0.93	0.60 to 0.90	0.040	0.050	1084
G 10850	1085	0.80 to 0.93	0.70 to 1.00	0.040	0.050	1085
G 10860	1086	0.80 to 0.93	0.30 to 0.50	0.040	0.050	1086
G 10900	1090	0.85 to 0.98	0.60 to 0.90	0.040	0.050	1090
G 10950	1095	0.90 to 1.03	0.30 to 0.50	0.040	0.050	1095

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

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