Designation: A 510 – 07

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 A 510 has been developed—Specification A 510M; therefore, no metric equivalents are presented in this specification.

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

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 (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 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.

[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 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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TABLE 1 Steel Wire Gauge[A]

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	½	0.500
¼	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.

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),

4.1.5 Packaging,

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 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.

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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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TABLE 4 Nonresulfurized Carbon Steel, High Manganese, 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, 15L18.

UNS Designation[A]	Grade No.	Chemical Composition Limits, %				SAE No.
		Carbon	Manganese	Phosphorus, max	Sulfur, max	
G 15130	1513	0.10 to 0.16	1.10 to 1.40	0.040	0.050	1513
G 15180	1518	0.15 to 0.21	1.10 to 1.40	0.040	0.050	1518
G 15220	1522	0.18 to 0.24	1.10 to 1.40	0.040	0.050	1522
G 15240	1524[B]	0.19 to 0.25	1.35 to 1.65	0.040	0.050	1524
G 15250	1525	0.23 to 0.29	0.80 to 1.10	0.040	0.050	1525
G 15260	1526	0.22 to 0.29	1.10 to 1.40	0.040	0.050	1526
G 15270	1527[B]	0.22 to 0.29	1.20 to 1.50	0.040	0.050	1527
G 15360	1536[B]	0.30 to 0.37	1.20 to 1.50	0.040	0.050	1536
G 15410	1541[B]	0.36 to 0.44	1.35 to 1.65	0.040	0.050	1541
G 15470	1547	0.43 to 0.51	1.35 to 1.65	0.040	0.050	1547
G 15480	1548[B]	0.44 to 0.52	1.10 to 1.40	0.040	0.050	1548
G 15510	1551[B]	0.45 to 0.56	0.85 to 1.15	0.040	0.050	1551
G 15520	1552[B]	0.47 to 0.55	1.20 to 1.50	0.040	0.050	1552
G 15610	1561[B]	0.55 to 0.65	0.75 to 1.05	0.040	0.050	1561
G 15660	1566[B]	0.60 to 0.71	0.85 to 1.15	0.040	0.050	1566
G 15720	1572[B]	0.65 to 0.76	1.00 to 1.30	0.040	0.050	1572

[A] Designation established in accordance with Practice E 527 and SAE J 1086.
[B] These grades were formerly designated as 10XX steels.

TABLE 5 Resulfurized Carbon Steels, Cast or Heat Chemical Ranges and Limits

NOTE 1—*Silicon*—When silicon is required, the following ranges and limits are commonly used: Up to 1110, incl, 0.10 max, %; 1116 and over, 0.10 max, %, 0.10 to 0.20 %, or 0.15 to 0.35 %.

NOTE 2—Because of the degree to which sulfur segregates, product analysis for sulfur in resulfurized carbon steel is not technologically appropriate unless misapplication is clearly indicated.

UNS Designation[A]	Grade No.	Chemical Composition Limits, %				SAE No.
		Carbon	Manganese	Phosphorus, max	Sulfur	
G 11080	1108	0.08 to 0.13	0.50 to 0.80	0.040	0.08 to 0.13	1108
G 11090	1109	0.08 to 0.13	0.60 to 0.90	0.040	0.08 to 0.13	1109
G 11100	1110	0.08 to 0.13	0.30 to 0.60	0.040	0.08 to 0.13	1110
G 11160	1116	0.14 to 0.20	1.10 to 1.40	0.040	0.16 to 0.23	1116
G 11170	1117	0.14 to 0.20	1.00 to 1.30	0.040	0.08 to 0.13	1117
G 11180	1118	0.14 to 0.20	1.30 to 1.60	0.040	0.08 to 0.13	1118
G 11190	1119	0.14 to 0.20	1.00 to 1.30	0.040	0.24 to 0.33	1119
G 11320	1132	0.27 to 0.34	1.35 to 1.65	0.040	0.08 to 0.13	1132
G 11370	1137	0.32 to 0.39	1.35 to 1.65	0.040	0.08 to 0.13	1137
G 11390	1139	0.35 to 0.43	1.35 to 1.65	0.040	0.13 to 0.20	1139
G 11400	1140	0.37 to 0.44	0.70 to 1.10	0.040	0.08 to 0.13	1140
G 11410	1141	0.37 to 0.45	1.35 to 1.65	0.040	0.08 to 0.13	1141
G 11440	1144	0.40 to 0.48	1.35 to 1.65	0.040	0.24 to 0.33	1144
G 11450	1145	0.42 to 0.49	0.70 to 1.00	0.040	0.04 to 0.07	1145
G 11460	1146	0.42 to 0.49	0.70 to 1.00	0.040	0.08 to 0.13	1146
G 11510	1151	0.48 to 0.55	0.70 to 1.00	0.040	0.08 to 0.13	1151

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

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.

6.3 *Product Analysis* (*Formerly Check Analysis*)—A product analysis may be made by the purchaser. The analysis is not used for a duplicate analysis to confirm a previous result. The purpose of the product analysis is to verify that the chemical composition is within specified limits for each element, including applicable permissible variations in product analysis. The results of analyses taken from different pieces of a heat may differ within permissible limits from each other and from the heat or cast analysis. Table 7 shows the permissible variations

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TABLE 6 Rephosphorized and Resulfurized Carbon Steel Cast or Heat Chemical Ranges and Limits

NOTE 1— It is not common practice to produce the 12XX series of steel to specified limits for silicon. Silicon impairs machinability.
NOTE 2—Because of the degree to which phosphorus and sulfur segregate, product analysis for phosphorus and sulfur in the 12XX series steel is not technologically appropriate unless misapplication is clearly indicated.

UNS Designation[A]	Grade No.	Chemical Composition Limits, %					SAE No.
		Carbon, max	Manganese	Phosphorus	Sulfur	Lead	
G 12110	1211	0.13	0.60 to 0.90	0.07 to 0.12	0.10 to 0.15	. . .	1211
G 12120	1212	0.13	0.70 to 1.00	0.07 to 0.12	0.16 to 0.23	. . .	1212
G 12130	1213	0.13	0.70 to 1.00	0.07 to 0.12	0.24 to 0.33	. . .	1213
G 12150	1215	0.09	0.75 to 1.05	0.04 to 0.09	0.26 to 0.35	. . .	1215
. . .	12L13	0.13	0.70 to 1.00	0.07 to 0.12	0.24 to 0.33	0.15 to 0.35	12L13
. . .	12L14	0.15	0.85 to 1.15	0.04 to 0.09	0.26 to 0.35	0.15 to 0.35	12L14
. . .	12L15	0.09	0.75 to 1.05	0.04 to 0.09	0.26 to 0.35	0.15 to 0.35	12L15

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

TABLE 7 Permissible Variations for Product Analysis of Carbon Steel

Element	Limit, or Max of Specified Range, %	Over Max Limit, %	Under Min Limit, %
Carbon	0.25 and under	0.02	0.02
	over 0.25 to 0.55, incl	0.03	0.03
	over 0.55	0.04	0.04
Manganese	0.90 and under	0.03	0.03
	over 0.90 to 1.65, incl	0.06	0.06
Phosphorus	to 0.040, incl	0.008	. . .
Sulfur	to 0.060, incl	0.008	. . .
Silicon	0.35 and under	0.02	0.02
	over 0.35 to 0.60, incl	0.05	0.05
Copper[A]	under minimum only	. . .	0.02
Lead[B]	0.15 to 0.35, incl	0.03	0.03

[A] Product analysis permissible variations for copper apply only when the amount of copper is specified or required. Copper bearing steels typically specify 0.20 % min copper.
[B] Product analysis permissible variations for lead apply only when the amount of lead is specified or required. A range from 0.15 to 0.35 % lead is normally specified for leaded steels.

for product analysis of carbon steel. The results of the product analysis obtained, except lead, shall not vary both above and below the permissible limits.

6.3.1 Rimmed or capped steels are characterized by a lack of uniformity in their chemical composition, especially for the elements carbon, phosphorus, and sulfur, and for this reason product analysis is not technologically appropriate for these elements unless misapplication is clearly indicated.

6.3.2 Because of the degree to which phosphorus and sulfur segregate, product analysis for these elements is not technologically appropriate for rephosphorized or resulfurized steels, or both, unless misapplication is clearly indicated.

6.3.3 The location at which chips for product analysis are obtained from the sample is important because of segregation. For rods and wire, chips are taken by milling or machining the full cross section of the sample.

6.3.3.1 Steel subjected to certain thermal treatment operations by the purchaser may not give chemical analysis results that properly represent its original composition. Therefore, purchasers should analyze chips taken from the steel in the condition in which it is received from the producer.

6.3.3.2 When samples are returned to the producer for product analysis, the samples should consist of pieces of the full cross section.

6.3.4 For referee purposes, Test Methods E 30 shall be used.

7. Metallurgical Structure

7.1 Grain size, when specified, shall be determined in accordance with the requirements of Test Methods E 112.

7.2 Wire rods of the steel grades listed in Table 3, when supplied in the "as-rolled" condition, shall not contain injurious microconstituents such as untempered martensite.

8. *Mechanical Requirements* Mechanical Requirements

8.1 The properties enumerated in individual specifications shall be determined in accordance with Test Methods and Definitions A 370.

8.2 Because of the great variety in the kinds of wire and the extensive diversity of end uses, a number of formal mechanical test procedures have been developed. These tests are used as control tests by producers during the intermediate stages of wire processing, as well as for final testing of the finished product, and apply particularly to specification wire and wires for specified end uses. A number of these tests are further described in Supplement IV, Round Wire Products, of Test Methods and Definitions A 370.

8.3 Since the general utility of rods and wire requires continuity of length, in the case of rods, tests are commonly made on samples taken from the ends of coils after removing enough rings to clear any non-uniformity in the controlled cooling process, if applicable. In the case of wire, tests are commonly made on samples taken from the ends of coils, thereby not impairing the usefulness of the whole coil.

9. Dimensions, Mass, and Permissible Variations

9.1 The diameter and out-of-roundness of the wire rod shall not vary from that specified by more than that prescribed in Table 8.

9.2 The diameter and out-of-roundness of the coarse round wire and straightened and cut wire shall not vary from that specified by more than that prescribed in Table 9.

9.3 The length of straightened and cut wire shall not vary from that specified by more than that prescribed in Table 10.

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TABLE 8 Permissible Variations in Diameter for Wire Rod in Coils

NOTE 1—For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice E 29.

Diameter of Rod		Permissible Variation, Plus and Minus, in.	Permissible Out-of-Round, in.
Fractions	Decimal		
7/32 to 47/64 in., incl	0.219 to 0.734 in., incl	0.016	0.025

TABLE 9 Permissible Variations in Diameter for Uncoated Coarse Round Wire

NOTE 1— For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice E 29.

In Coils		
Diameter of Wire, in.	Permissible Variations, Plus and Minus, in.	Permissible Out-Of-Round, in.
0.035 to under 0.076	0.001	0.001
0.076 to under 0.500	0.002	0.002
0.500 and over	0.003	0.003
Straightened and Cut		
Diameter of Wire, in.	Permissible Variations, Plus and Minus, in.	Permissible Out-of-Round, in.
0.035 to under 0.076	0.001	0.001
0.076 to 0.148, incl	0.002	0.002
Over 0.148 to under 0.500	0.003	0.003
0.500 and over	0.004	0.004

TABLE 10 Permissible Variations in Length for Straightened and Cut Wire

NOTE 1—For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice E 29.

Cut Length, ft	Permissible Variations, Plus and Minus, in.
Under 3	1/16
3 to 12, incl	3/32
Over 12	1/8

9.4 The burrs formed in cutting straightened and cut wire shall not exceed the diameter specified by more than that prescribed in Table 11.

10. Workmanship, Finish, and Appearance

10.1 The wire rod shall be free of detrimental surface imperfections, tangles, and sharp kinks.

TABLE 11 Permissible Variations for Burrs for Straightened and Cut Wire

NOTE 1—For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice E 29.

Diameter of Wire, in.	Permissible Variation over Measured Diameter, in.
Up to 0.125, incl	0.004
Over 0.125 to 0.250, incl	0.006
Over 0.250 to 0.500, incl	0.008
Over 0.500	0.010

10.1.1 Two or more rod coils may be welded together to produce a larger coil. The weld zone may not be as sound as the original material. The mechanical properties existing in the weld metal may differ from those in the unaffected base metal. The weld may exceed the standard dimensional permissible variations on the minus side and must be within the permissible variations on the plus side.

10.2 The wire as received shall be smooth and substantially free from rust, shall not be kinked or improperly cast. No detrimental die marks or scratches may be present. Each coil shall be one continuous length of wire. Welds made during cold drawing are permitted.

10.3 The straightened and cut wire shall be substantially straight and not be kinked or show excessive spiral marking.

11. Number of Tests and Retests

11.1 The difficulties in obtaining truly representative samples of wire rod and coarse round wire without destroying the usefulness of the coil of wire account for the generally accepted practice of allowing retests for mechanical tests and surface examination. Two additional test pieces are cut from each end of the coil from which the original sample was taken. A portion of the coil may be discarded prior to cutting the sample for retest. If any of the retests fails to comply with the requirements, the coil of wire may be rejected. Before final rejection, however, it is frequently advisable to base final decision on an actual trial of the material to determine whether or not it will do the job for which it is intended.

12. Inspection

12.1 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.

13. Rejection and Rehearing

13.1 Any rejection based on tests made in accordance with this specification shall be reported to the producer within a reasonable length of time. The material must be adequately protected and correctly identified in order that the producer may make a proper investigation.

14. Certification

14.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

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

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15. Packaging and Package Marking

15.1 A tag shall be securely attached to each coil or bundle and shall be marked with the size, ASTM specification number, heat or cast number, grade number, and name or mark of the manufacturer.

15.2 When specified in the purchase order, packaging, marking, and loading for shipments shall be in accordance with those procedures recommended by Practices A 700.

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

16. Keywords

16.1 carbon; carbon steel; coarse round wire; general; grain size; straightened and cut; weld; wire; wire rods

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 510 – 06) that may impact the use of this standard. (Approved Sept. 1, 2007.)

(*1*) Revised 5.1.

Committee A01 has identified the location of selected changes to this standard since the last issue (A 510 – 03) that may impact the use of this standard. (Approved Sept. 1, 2006.)

(*1*) Revised 5.1.
(*2*) Revised 8.3.
(*3*) Changed Mn content of Grade 1006 in Table 3 to be consistent with other standards.

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