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Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes[1]

This standard is issued under the fixed designation B189; 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 lead-coated and lead-alloy-coated, round, soft or annealed copper wire for electrical purposes.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard. The SI values for density and resistivity are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* The hazard statement applies only to Section 6 of this specification.

2. Referenced Documents

2.1 The following documents of the issue in effect at the time of reference form a part of these methods to the extent referenced herein:

2.2 *ASTM Standards:*[2]

B49 Specification for Copper Rod Drawing Stock for Electrical Purposes

B193 Test Method for Resistivity of Electrical Conductor Materials

B258 Specification for Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors

2.3 *NIST:*

NBS Handbook 100 Copper Wire Tables[3]

3. Ordering Information

3.1 Orders for material under this specification shall include the following information:

3.1.1 Quantity of each size and type of coating;

3.1.2 Wire size: diameter in inches (see 5.3 and Table 1);

3.1.3 Type of coating (see Section 1);

3.1.4 Type of copper, if special (see 4.2);

3.1.5 Package size (see 8.1);

3.1.6 Special package marking, if required; and

3.1.7 Place of inspection (see 6.1).

4. Material

4.1 *Coating Material*—The coating material shall be commercially pure lead or a lead alloy. The lead alloy shall conform to the following requirements as to chemical composition as determined by analysis of samples from the coating bath:

Lead, min, %	25
Tin, max, %	75[A]
Antimony, max, %	6

[A] It is permissible to use alloying constituents other than those specified above to replace a portion of the tin.

4.2 *Copper-Base Metal*—The base metal shall be copper of such quality and purity that the finished product shall have properties and characteristics prescribed in this specification.

4.2.1 Copper of special qualities, forms, or types, as may be agreed upon between the manufacturer and the purchaser, and which will conform to the requirements prescribed in this specification may also be used.

NOTE 1—Specification B49 defines copper suitable for use.

5. General Requirements (See Section 9)

5.1 *Tensile Strength and Elongation (Explanatory Note 1)*—The coated wire shall conform to the requirements for elongation prescribed in Table 1. No requirements for tensile strength are specified. For wire whose nominal diameter is more than 0.001 in. (1 mil) greater than a size listed in Table 1, but less than that of the next larger size, the requirements of the next larger size shall apply.

[1] This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.04 on Conductors of Copper and Copper Alloys.

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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 National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, http://www.nist.gov.

TABLE 1 Tensile Requirements

Diameter, in.	Area at 20°C		Elongation in 10 in., min, %
	cmils	in.^{2}	
0.4600	211 600	0.1662	30
0.4096	167 800	0.1318	30
0.3648	133 100	0.1045	30
0.3249	105 600	0.08291	30
0.2893	83 690	0.06573	25
0.2576	66 360	0.05212	25
0.2294	52 620	0.04133	25
0.2043	41 740	0.03278	25
0.1819	33 090	0.02599	25
0.1620	26 240	0.02061	25
0.1443	20 820	0.01635	25
0.1285	16 510	0.01297	25
0.1144	13 090	0.01028	25
0.1019	10 380	0.008155	20
0.0907	8 230	0.00646	20
0.0808	6 530	0.00513	20
0.0720	5 180	0.00407	20
0.0641	4 110	0.00323	20
0.0571	3 260	0.00256	20
0.0508	2 580	0.00203	20
0.0453	2 050	0.00161	20
0.0403	1 620	0.00128	20
0.0359	1 290	0.00101	20
0.0320	1 020	0.000804	20
0.0285	812	0.000638	20
0.0253	640	0.000503	20
0.0226	511	0.000401	20
0.0201	404	0.000317	15
0.0179	320	0.000252	15
0.0159	253	0.000199	15
0.0142	202	0.000158	15
0.0126	159	0.000125	15
0.0113	128	0.000100	15
0.0100	100	0.0000785	10
0.0089	79.2	0.0000622	10
0.0080	64.0	0.0000503	10
0.0071	50.4	0.0000396	10
0.0063	39.7	0.0000312	10
0.0056	31.4	0.0000246	10
0.0050	25.0	0.0000196	10
0.0045	20.2	0.0000159	10
0.0040	16.0	0.0000126	10
0.0035	12.2	0.00000962	10
0.0031	9.61	0.00000755	10

5.2 *Resistivity (Explanatory Note 2)*—The electrical resistivity of the coated wire at a temperature of 20°C shall not exceed the values prescribed in Table 2.

TABLE 2 Electrical Resistivity Requirements

Nominal Diameter, in.	Resistivity at 20°C, Ω·lb/mile^2
0.460 to 0.290, incl	896.15
Under 0.290 to 0.103, incl	900.77
Under 0.103 to 0.0201, incl	910.15
Under 0.0201 to 0.0111, incl	929.52
Under 0.0111 to 0.0030, incl	939.51

5.3 *Dimensions and Permissible Variations (Explanatory Note 1)*—The wire sizes shall be expressed as the diameter of the wire in decimal fractions of an inch to the nearest 0.0001 in. (0.1 mil). The coated wire shall not vary from the specified diameter by more than the amounts prescribed in Table 3.

5.4 *Continuity of Coating*—The lead or lead-alloy coating shall be continuous. The continuity of coating on the wire shall be determined on representative samples taken before stranding or insulating. The continuity of coating shall be determined by the ammonium persulfate test in accordance with 6.4 or by the sodium polysulfide-hydrochloric acid test in accordance with 6.5. In case the results obtained in the sodium polysulfide-hydrochloric acid test are not conclusive, the ammonium persulfate test shall be employed and the results obtained by this latter test shall be final.

5.5 *Joints*—Necessary joints in the completed wire and in the wire and rods prior to final drawing shall be made in accordance with the best commercial practice.

5.6 *Finish*—The coating shall consist of a smooth continuous layer, firmly adherent to the surface of the copper. The wire shall be free of all imperfections not consistent with the best commercial practice.

6. Test Methods

6.1 *Tensile Strength and Elongation (Explanatory Note 3)*—No test for tensile strength shall be required.

6.1.1 The elongation of wire whose nominal diameter is larger than 0.0808 in. (2.052 mm) in diameter shall be determined as the permanent increase in length, expressed in percent of the original length, due to the breaking of the wire in tension, measured between gage marks placed originally 10 in. (254 mm) apart upon the test specimen. The elongation of the wire whose nominal diameter is 0.0808 in. (2.052 mm) and under may be determined as just described or by measurements made between the jaws of the testing machine. When the latter method is used, the zero length shall be the distance between the jaws at the start of the tension test and be as near 10 in. (254 mm) as practical, and the final length shall be the distance between the jaws at the time of rupture. The fracture shall be between gage marks in the case of specimens so marked or between the jaws of the testing machine and not closer than 1 in. (25.4 mm) to either gage mark or either jaw.

6.2 *Resistivity (Explanatory Note 2)*—The electrical resistivity of the material shall be determined in accordance with Test Method B193. The purchaser may accept certification that the wire was drawn from rod stock meeting the international standard for annealed copper in lieu of resistivity tests on the finished wire.

TABLE 3 Permissible Variations in Diameter

Nominal Diameter of Wire, in.	Permissible Variations in Diameter	
	plus	minus
Under 0.0100	0.0003 in. (0.3 mil)	0.0001 in. (0.1 mil)
0.0100 and over	3 %[A]	1 %[A]

[A] Expressed to the nearest 0.0001 in. (0.1 mil).

6.3 *Dimensional Measurements*—Dimensional measurements shall be made with a micrometer caliper equipped with a vernier graduated in 0.0001 in. (0.1 mil). Measurements shall be made on at least three places on each unit selected for this test. If accessible, one measurement shall be taken on each end and one near the middle. The average of the three measurements shall determine compliance with the requirements.

6.4 *Continuity of Coating (Ammonium Persulfate Test):*

6.4.1 *Specimens:*

6.4.1.1 *Length of Specimens*—The length of test specimens shall be determined by substituting the appropriate value of *K*, as given in Table 4, in the following equation:

$$L = K/D$$

where:

L = length of test specimen, in. (or mm), and
D = diameter of the coated wire, in. (or mm).

In cases where the length of a specimen, determined by the above equation, is such that it cannot be immersed as a single length in the specified manner, it may be divided into shorter sections which will permit complete immersion.

6.4.1.2 *Treatment of Specimens*—The specimens shall be thoroughly cleaned by immersion in a suitable organic solvent such as benzene, ether, or trichloroethylene for at least 3 min, then removed and wiped dry with a clean soft cloth. (**Caution:** Explanatory Note 4.) The ends of each specimen shall be completely coated with wax to protect the exposed copper. The wax-coated length shall not be included in determining the length of the specimen.

6.4.2 *Special Solutions:*

6.4.2.1 *Test Solution (Ammonium Persulfate)*—Dissolve 10 g of ammonium persulfate (cp crystals containing not less than 95 % of ammonium persulfate) in 500 mL of distilled water. Add 75 mL of cp NH_4OH (sp gr 0.90) and dilute to 1 L with distilled water. The ammonium persulfate solution shall be freshly prepared each day. Tests are to be conducted and shall not be subjected to temperatures above 100°F (38°C).

6.4.2.2 *Reference Color Standard (Copper Sulfate-Ammonium Hydroxide)*—Dissolve 0.100 g of anhydrous copper sulfate in distilled water, add 75 mL of cp NH_4OH (sp gr 0.90), and dilute to 1 L.

6.4.3 *Procedure*—Immerse a specimen of the required length (see section 6.4.1.1) in the quantity of test solution prescribed in Table 4, using as the container a test tube of appropriate dimensions. Immerse the specimen in the test solution at a temperature between 83 and 87°F (28 and 31°C) for a period of 15 min. Then remove the specimen and compare the test solution with an equal depth of the reference color standard contained in a similar test tube. Make the color comparison by viewing the solutions lengthwise of the test tubes. The color of the test solution after immersion of the test specimen shall not be darker than that of the reference color-standard solution.

6.5 *Continuity of Coating (Sodium Polysulfide-Hydrochloric Acid Test):*

6.5.1 *Specimens:*

6.5.1.1 *Length of Specimens*—The test specimens shall each have a length of about 6 in. (152 mm). They shall be tagged or marked to correspond with the coil, spool, or reel from which they were cut.

6.5.1.2 *Treatment of Specimens*—The test specimens shall be thoroughly cleaned by immersion in a suitable organic solvent, such as benzene, ether, or trichloroethylene for at least 3 min, then removed and wiped dry with a clean, soft cloth. (**Caution:** Explanatory Note 4.) The specimens thus cleaned shall be kept wrapped in a clean, dry cloth until tested. (**Warning:** That part of the specimen to be immersed in the test solution shall not be handled. Care shall be taken to avoid abrasion by the cut ends.)

6.5.2 *Special Solutions* (Explanatory Note 5):

6.5.2.1 *Sodium Polysulfide Solution (sp gr 1.142)*—A concentrated solution shall be made by dissolving sodium sulfide cp crystals in distilled water until the solution is saturated at about 21°C and adding sufficient flowers of sulfur (in excess of 250 g/L of solution) to provide complete saturation, as shown by the presence in the solution of an excess of sulfur after the solution has been allowed to stand for at least 24 h. The test solution shall be made by diluting a portion of the concentrated solution with distilled water to a specific gravity of 1.142 at 16°C. The sodium polysulfide test solution should have sufficient strength to blacken thoroughly a piece of clean, untinned copper wire in 5 s. A portion of the test solution used for testing specimens shall not be considered to be exhausted until it fails to blacken a piece of clean copper as described above.

6.5.2.2 *Hydrochloric Acid Solution (sp gr 1.088)*—Commercial HCl (sp gr 1.12) shall be diluted with distilled water to a specific gravity of 1.088 measured at 16°C. A portion of HCl solution having a volume of 180 mL shall be considered to be exhausted when the number of test specimens prescribed in Table 5 have been immersed in it for two cycles.

6.5.3 *Procedure*—Immerse a length of at least 4.5 in. (114 mm) from each of the cleaned specimens in accordance with the following cycles, in test solutions maintained at a temperature between 16 and 21°C:

TABLE 4 Data for Ammonium Persulfate Test

Wire Diameter, in.	*K*	Quantity of Test Solutions, mL
0.460 to 0.321, incl	1.2	150
Under 0.321 to 0.161, incl	0.8	100
Under 0.161 to 0.0810, incl	0.4	50
Under 0.0810 to 0.0400, incl	0.2	25
Under 0.0400 to 0.0030, incl	0.1	12.5

TABLE 5 Limiting Number of Test Specimens for Hydrochloric Acid Test

Diameter, in.	Maximum Number of Specimens to be Tested for Two Cycles in 180 mL of Acid Solution
0.460 to 0.141, incl	2
Under 0.141 to 0.0851, incl	4
Under 0.0851 to 0.0501, incl	6
Under 0.0501 to 0.0381, incl	10
Under 0.0381 to 0.0301, incl	12
Under 0.0301 to 0.0030, incl	14

6.5.3.1 Immerse the specimen for 30 s in the sodium polysulfide solution, wash, and then shake lightly to remove excess water.

6.5.3.2 Immerse the specimen for 1 min in the HCl solution, wash, and then shake lightly to remove excess water.

6.5.3.3 Immerse the specimen for 30 s in the sodium polysulfide solution, wash, and then shake lightly to remove excess water.

6.5.3.4 Immerse the specimen for 1 min in the HCl solution, wash, and then shake lightly to remove excess water. After the operations described, examine the specimens to ascertain whether blackened areas resulting from the action of the sodium polysulfide are present. (Blackening of the coated surface that occurs when the specimen is immersed in the sodium polysulfide solution should disappear during immersion in the HCl solution, leaving blackened areas only where copper is exposed.) In examining specimens, disregard blackening present within 0.5 in. of the cut ends.

6.5.3.5 *Washing Specimens*—After each immersion, thoroughly wash the specimens in clean water and then shake lightly to remove excess water.

6.6 *Finish*—Surface-finish inspection shall be made with the unaided eye (normal spectacles excepted).

7. Inspection

7.1 *General (Explanatory Notes 3 and 6)*—Unless otherwise specified in the contract or purchase order, the manufacturer shall be responsible for the performance of all inspection and test requirements specified.

7.1.1 All inspections and tests shall be made at the place of manufacture unless otherwise agreed to by the manufacturer and the purchaser at the time of the purchase.

7.1.2 The manufacturer shall afford the inspector representing the purchaser all reasonable manufacturer's facilities to satisfy him that the material is being furnished in accordance with this specification.

7.1.3 Unless otherwise agreed by the purchaser and the manufacturer, conformance of the wire to the various requirements listed in Section 5 shall be determined on samples taken from each lot of wire presented for acceptance.

7.1.4 The manufacturer shall, if requested prior to inspection, certify that all wire in the lot was made under such conditions that the product as a whole conforms to the requirements of this specification as determined by regularly made and recorded tests.

7.2 *Definitions for Inspection Purposes:*

7.2.1 *lot (Explanatory Note 7)*—any amount of wire of one type and size presented for acceptance at one time, such amount, however, not to exceed 25 000 lb (11 350 kg).

7.2.2 *sample*—a quantity of production units (coils, reels, and so forth.) selected at random from the lot for the purpose of determining conformance of the lot to the requirements of this specification.

7.2.3 *specimen*—a length of wire removed for test purposes from any individual production unit of the sample.

7.3 *Sample Size (Explanatory Note 6)*—The number of production units in a sample shall be as follows:

7.3.1 For elongation and resistivity determinations, the sample shall consist of four production units. For continuity of coating tests, the sample shall consist of eight production units. From each unit, one test specimen of sufficient length shall be removed for the performance of the required tests.

7.3.2 For dimensional measurements, the sample shall consist of a quantity of production units shown in Table 6 under the heading "First Sample."

7.3.3 For surface-finish inspection and for packaging inspection (when specified by the purchaser at the time of placing the order) the sample shall consist of a quantity of production units shown in Table 7.

8. Packaging and Package Marking

8.1 Package sizes shall be agreed upon by the manufacturer and the purchaser when placing individual orders.

8.2 The wire shall be protected against damage in ordinary handling and shipping.

9. Conformance Criteria (Explanatory Notes 3 and 6)

9.1 Any lot of wire, the samples of which comply with the conformance criteria of this section, shall be considered as complying to the requirements of Section 5. Individual production units that fail to meet one or more of the requirements shall be rejected. Failure of a sample group from a lot to meet one or more of the following criteria shall constitute cause for rejection of the lot. The conformance criteria for each of the prescribed properties given in Section 5 are as follows:

9.1.1 *Elongation*—The lot shall be considered conforming if the average elongation of the four specimens is not less than the appropriate elongation value in Table 1 plus 2.8 %; however, any individual production unit, the specimen from which has an elongation less than the appropriate elongation value in Table 1, shall be rejected.

TABLE 6 Sampling for Dimensional Measurements

Number of Units in Lot	First Sample		Second Sample		
	Number of Units in Sample, n_1	Allowable Number of Defects in First Sample, c_1	Number of units in Sample, n_2	$n_1 + n_2$	Allowable Number of Defects in Both Samples, c_2
1 to 14, incl	all	0	...	...	...
15 to 50, incl	14	0	...	...	...
51 to 100, incl	19	0	23	42	1
101 to 200, incl	24	0	46	70	2
201 to 400, incl	29	0	76	105	3
401 to 800, incl	33	0	112	145	4
Over 800	34	0	116	150	4

TABLE 7 Sampling for Surface Finish and Packaging Inspection

Number of Units in Lot	Number of Units in Sample, *n*	Allowable Number of Defective Units, *c*
1 to 30, incl	all	0
31 to 50, incl	30	0
51 to 100, incl	37	0
101 to 200, incl	40	0
201 to 300, incl	70	2
301 to 500, incl	100	2
501 to 800, incl	130	3
Over 800	155	4

9.1.1.1 The lot shall be considered to have failed to meet the elongation conformance criterion if the average of the four specimens is less than the elongation in Table 1 plus 2.8 % and the elongation of any of the individual specimens is less than the value in Table 1.

9.1.1.2 If the average of the four specimens is less than the elongation in Table 1 plus 2.8 % and the elongation of each of the individual specimens is equal to or more than the value in Table 1, six additional specimens from six production units other than the four originally sampled shall be tested. The lot shall be considered conforming if the elongation of each of the ten specimens is not less than the appropriate elongation value in Table 1, and the average of the ten specimens is not less than that value plus 2.8 %. The lot shall be considered to have failed to meet the elongation requirement if any of the ten specimens is less than the appropriate elongation value in Table 1 or if the average of the ten specimens is less than that value plus 2.8 %.

9.1.2 *Resistivity*—The electrical resistivity of each of the four specimens shall conform to the requirements of 4.2. Failure to meet these requirements shall constitute failure to meet the resistivity conformance criterion.

9.1.3 *Dimensions*—The dimensions of the first sample (Table 6) shall conform to the requirements of 5.3. If there are no failures, the lot conforms to this requirement. If there are failures but the number of these does not exceed the allowable defect number, c_2 (Table 6), for the respective number of units in the sample, a second sample equal to n_2 shall be taken and the total defects of the n_1 plus n_2 units shall not exceed the allowable defect number, c_2. Failure to meet this requirement shall constitute failure to meet the dimensional conformance criterion.

9.1.4 *Continuity of Coating*—The continuity of the coating of each of the eight specimens shall conform to the requirements of 5.4. Failure of more than two specimens shall constitute failure to meet the continuity criterion. If not more than two specimens fail to meet the continuity criterion, eight additional specimens from the lot shall be tested, all of which shall conform to the continuity criterion. However, any individual production unit, the specimen from which failed to meet the continuity criterion, shall be rejected.

9.1.5 *Surface Finish*—The surface finish of the samples taken in accordance with Table 7 shall conform to the requirements of 5.6. The number of units in the sample showing surface defects not consistent with commercial practice shall not exceed the allowable defect number, *c*, in Table 5. Failure to meet this requirement shall constitute failure to meet the surface-finish conformance criterion.

9.1.6 *Packaging*—Conformance to the packaging requirements specified by the purchaser shall be determined in accordance with Table 7. The number of units in the sample showing nonconformance to the requirement shall not exceed the allowable defect number, *c*, in Table 7. Failure to meet this requirement shall constitute failure to meet the packaging conformance criterion.

10. Density (Explanatory Note 8)

10.1 For the purpose of calculating mass per unit length, cross sections, and so forth, the density of the copper shall be taken as 8.89 g/cm^3 (0.32117 lb/in.^{3}) at 20°C.

11. Keywords

11.1 copper electrical conductor; copper wire; electrical conductor; electrical conductor—copper; lead-alloy-coated copper wire; lead-coated copper wire; soft copper wire

EXPLANATORY NOTES

NOTE 1—The values of the wire diameters in Table 1 are given to the nearest 0.0001 in. and correspond to the standard sizes given in Specification B258. The use of gage numbers to specify wire sizes is not recognized in this specification because of the possibility of confusion. An excellent discussion of wire gages and related subjects is contained in *NBS Handbook 100* of the National Bureau of Standards.

NOTE 2—"Resistivity" is used in place of "percentage conductivity." The value of 0.15328 Ω·g/m^2 at 20°C is the international standard for the resistivity of annealed copper, equal to 100 % conductivity. This term means that a wire 1 m in length and weighing 1 g would have a resistance of 0.15328 Ω. This is equivalent to a resistivity value of 875.20 Ω·lb/mile, which signifies the resistance of a wire 1 mile in length, weighing 1 lb. The volumetric conversion factors applicable to copper do not apply to lead-coated and lead-alloy-coated wire of small diameter because the coating has a much greater density than has copper and in the small sizes of wire occupies an appreciable volume of the whole. A complete discussion of resistivity of uncoated copper wire is contained in *NBS Handbook 100*.[3] Relationships which may be useful in connection with the values of resistivity prescribed in this specification are as shown in Table 8, each column containing equivalent expressions at 20°C.

NOTE 3—In general, tested values of tensile strength are increased and tested values of the elongation are reduced with increase of speed of the moving head of the testing machine in the tension testing of copper wire. In the case of tests on soft or annealed wire, however, the effects of speed of testing are not pronounced. Tests of soft wire made at speeds of moving head which under no-load conditions are not greater than 12 in./min do not alter the final results of tensile strength and elongation determinations to any practical extent.

NOTE 4—**Warning:** Consideration should be given to toxicity and flammability when selecting solvent cleaners.

NOTE 5—It is important that the polysulfide solution be of proper composition and strength at the time of test. A solution which is not saturated with sulfur, or which has been made from decomposed sodium sulfide crystals, may give a false indication of failure. Therefore, the requirement that the solution be tested by observing its blackening effect on a bright copper wire is significant. Significant also is the requirement that the solution be saturated with sulfur by allowing the solution to stand at least 24 h after preparation. Attention is called also to the necessity for the use of sodium sulfide which has not deteriorated through exposure to air; and if exposure has occurred, the crystals should be tested for purity. The "Standard Reagents Tests" of the American Chemical Society are useful in this connection.

TABLE 8 Resistivity Values

Conductivity at 20°C, %	100.00	97.66	97.16	96.16	94.16	93.15
Ω·lb/mile^2	875.20	896.15	900.77	910.15	929.52	939.51
Ω·g/m^2	0.15328	0.15694	0.15775	0.15940	0.16279	0.16454
Ω·cmil/ft	10.371	10.619	10.674	10.785	11.015	11.133
Ω·mm^2/m	0.017241	0.017654	0.017745	0.017930	0.018312	0.018508
Ω·in.	0.67879	0.69504	0.69863	0.70590	0.72092	0.72867
Ω·cm	1.7241	1.7654	1.7745	1.7930	1.8312	1.8508

NOTE 6—Cumulative results secured on the product of a single manufacturer, indicating continued conformance to the criteria, are necessary to ensure an overall product meeting the requirements of this specification. The sample sizes and conformance criteria given for the various characteristics are applicable only to lots produced under these conditions.

NOTE 7—A lot should comprise material taken from a product regularly meeting the requirements of this specification. Inspection of individual lots of less than 5000 lb (2268 kg) of wire cannot be justified economically. For small lots of 5000 lb (2268 kg) or less the purchaser may agree to the manufacturer's regular inspection of the product as a whole as evidence of acceptability of such small lots.

NOTE 8—The value of density of copper is in accordance with the International Annealed Copper Standard. The corresponding value at 0°C is 8.90 g/cm^3 (0.32150 lb/in.^{3}). In calculations involving density it must be borne in mind that the apparent density of coated wire is not a constant but a variable function of wire diameter. The smaller the diameter, the greater the percentage of coating present and hence the greater departure from the density of copper.