Designation: B246 – 15

Standard Specification for Tinned Hard-Drawn and Medium-Hard-Drawn Copper Wire for Electrical Purposes[1]

This standard is issued under the fixed designation B246; 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 U.S. Department of Defense.

1. Scope

1.1 This specification covers tinned hard-drawn and medium-hard-drawn round 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.

1.2.1 *Exception*—For density, resistivity and temperature, the values stated in SI units are to be regarded as 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. For hazard statement, see Sections 10 and 13.*

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[2]

B5 Specification for High Conductivity Tough-Pitch Copper Refinery Shapes

B49 Specification for Copper Rod Drawing Stock for Electrical Purposes

B170 Specification for Oxygen-Free Electrolytic Copper—Refinery Shapes

B193 Test Method for Resistivity of Electrical Conductor Materials

2.3 *National Bureau of Standards:*[3]

NBS Handbook 100—Copper Wire Tables

3. Ordering Information

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

3.1.1 Quantity of each size,

3.1.2 Wire size, diameter in inches (see 5.1 and Table 1),

3.1.3 Type of copper, if special (see 4.2),

3.1.4 Temper (see 7.1 and Table 1),

3.1.5 Package size (see 18.1),

3.1.6 Special package marking, if required, and

3.1.7 Place of inspection (Section 16).

4. Materials

4.1 The tinned wire shall be made by coating hard-drawn and medium-hard-drawn copper wire with commercially pure tin (see Note 1). For purposes of this specification, the tin shall be considered commercially pure if the total of other elements, exclusive of copper, does not exceed 1 %. Notwithstanding the previous sentence, chemical analysis of the tin coating or of the tin used for coating shall not be required under this specification. Adequacy of the tin coating is ensured by the continuity of coating and adherence of coating requirements (Sections 9 and 13, respectively).

4.2 The copper shall be copper of such quality and purity that the finished product shall have the properties and characteristics prescribed in this specification.

NOTE 1—Specification B49 defines copper suitable for use.

4.3 Copper bars 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.

5. Dimensions, Mass, and Permissible Variations

5.1 The wire sizes shall be expressed as the diameter of the coated wire in decimal fractions of an inch to the nearest 0.0001 in. (0.001 mm) (Explanatory Note 5).

[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 Technical Information Service (NTIS), 5301 Shawnee Rd., Alexandria, VA 22312, http://www.ntis.gov.

TABLE 1 Tensile Requirements

Diameter		Area at 20°C			Tinned Hard-Drawn Wire			Tinned Medium-Hard-Drawn Wire				
					Tensile Strength, min.		Elongation in 10 in. (250mm), % min	Tensile Strength, min.				
								psi		Mpa		Elongation in 10 in. (250mm), % min
in.	mm	cmil	in.^{2}	mm^2	psi	Mpa		min.	max.	min.	max.	
0.2043	5.189	41738	0.03278	21.15	54100	370.6	1.7	42400	55300	290.4	378.8	1.9
0.1819	4.620	33088	0.02599	16.77	55100	377.4	1.6	43300	55700	296.6	381.5	1.7
0.1620	4.115	26244	0.02061	13.30	55900	382.9	1.4	44100	56000	302.1	383.6	1.5
0.1443	3.665	20822	0.01635	10.55	56700	388.4	1.3	44900	56300	307.6	385.6	1.4
0.1285	3.264	16512	0.01297	8.367	57300	392.5	1.3	45500	56700	311.7	388.4	1.3
0.1144	2.906	13087	0.01028	6.632	57900	396.6	1.2	46000	57000	315.1	390.4	1.3
0.1019	2.588	10384	0.008155	5.262	58400	400.0	1.2	46500	57300	318.5	392.5	1.2
0.0907	2.304	8226	0.006461	4.1684	58900	403.5	1.1	46900	57700	321.3	395.2	1.2
0.0808	2.052	6529	0.005128	3.308	59100	404.8	1.1	47200	58000	323.3	397.3	1.1
0.0720	1.829	5184	0.004072	2.627	59300	406.2	1.1	47300	58300	324.0	399.3	1.1
0.0641	1.628	4109	0.003227	2.082	59600	408.2	1.0	47600	58700	326.1	402.1	1.0
0.0571	1.450	3260	0.002561	1.652	59800	409.6	1.0	47800	59000	327.4	404.1	1.0
0.0508	1.290	2581	0.002027	1.308	59900	410.3	1.0	47900	59300	328.1	406.2	1.0

5.2 The coated wire shall not vary from the specified diameter by more than +3 % or –1 %.

5.3 Ten percent, but not less than five coils or spools (or all, if the lot is less than five) from any lot of wire shall be taken near each end and one near the middle. If any of these selected coils or spools fails to conform to the requirements prescribed in 5.2, all coils or spools shall be gaged in the manner specified.

6. Workmanship, Finish, and Appearance

6.1 The tin coating shall consist of a smooth continuous layer, firmly adhering to the surface of the copper.

6.2 The wire shall be free from all imperfections not consistent with the best commercial practice.

7. Tensile Properties

7.1 The tinned wire shall conform to the requirements as to tensile properties prescribed in Table 1 (Explanatory Note 1).

7.2 For wire the nominal diameter of which is more than 0.001 in. (0.025 mm) greater than a size listed in Table 1, but which is less than that of the next larger size, the requirements of the next larger size shall apply.

7.3 Tension tests shall be made on representative samples. Determine the elongation of the wire as the permanent increase in length due to the breaking of the wire in tension, measured between gage marks placed originally 10 in. (250 mm) apart upon the test specimen (Explanatory Note 2).

7.4 If any part of the fracture takes place outside the gage marks or in the jaws of the testing machine, or if an examination of the specimen indicates a flaw, the value obtained may not be representative of the material. In such cases the test may be discarded and a new test made.

7.5 *Retests*—If upon testing a specimen from any coil or spool of wire, the results do not conform to the requirements prescribed in Table 1, two additional specimens shall be tested, and the average of the three tests shall determine the acceptance or rejection of the coil or spool.

8. Resistivity

8.1 Electrical resistivity shall be determined on representative specimens by resistance measurements made in accordance with Test Method B193. At a temperature of 20°C the resistivity of coated wire shall not exceed the values prescribed in Table 2 (Explanatory Note 3).

9. Continuity of Coating

9.1 The continuity of coating on the wire shall be determined on representative samples taken before stranding or insulating (Explanatory Note 4).

TABLE 2 Electrical Resistivity Requirements

Nominal Diameter		Resistivity at 20°C			
		lb/mile^2		g/m^2	
in.	mm	Hard	Medium-Hard	Hard	Medium-Hard
0.2043 to 0.103, incl	5.2 to 2.6, incl	943.92	938.85	0.1653	0.1644
Under 0.103 to 0.0508, incl	Under 2.6 to 1.3, incl	910.15	946.06	0.1594	0.1657