Designation: B105 – 05

Standard Specification for Hard-Drawn Copper Alloy Wires for Electric Conductors[1]

This standard is issued under the fixed designation B105; 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 hard-drawn round copper alloy wires for electric conductors.

1.2 The copper alloy wires shall be made in any one of ten distinct alloys designated 8.5 to 85 in accordance with their increasing conductivities or designated by assigned UNS numbers (see Explanatory Note 1) as follows:

	Copper Alloy UNS No.		Copper Alloy UNS No.
Alloy 8.5	C65100	Alloy 40	
Alloy 13	C51000	Alloy 55	C16500
Alloy 15		Alloy 74	C19600
Alloy 20		Alloy 80	C16200
Alloy 30	C50700	Alloy 85	C16200

1.3 The SI values of density and resistivity are to be regarded as standard. For all other properties the inch-pound values are to regarded as standard, and the SI values may be approximate.

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]

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

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.3 *Other Document:*

NBS Handbook 100—Copper Wire Tables[3]

3. Ordering Information

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

3.1.1 Quantity of each size and grade,

3.1.2 Wire size: diameter in inches or millimetres (see 9.1 and Table 1),

3.1.3 Alloy (see 1.2 and Table 1),

3.1.4 Special composition limits, if required (see 5.2),

3.1.5 Package size (see 14.1),

3.1.6 Special package marking, if required, and

3.1.7 Place of inspection (see 13.1).

4. Material and Manufacture

4.1 The material used shall be copper alloys of such nature and composition as to secure by proper treatment the properties prescribed in this specification for the finished wire.

5. Chemical Composition

5.1 The chemical composition of copper alloy wires shall conform to the requirements of Table 2. The values prescribed in Table 2 cover limits of composition of the different alloys which may be supplied (see Note 2).

5.2 The maximum percentage of the various alloying elements to be found in any one of the alloys is prescribed in Table 2. If the purchaser elects to check the composition of any material supplied to conform to the performance requirements of any one of the alloys, the composition limits should be made the subject of a definite agreement between the manufacturer and the purchaser in the placing of individual orders.

6. Chemical Analysis

6.1 An analysis may be made on each lot of 5000 lb (2300 kg) or fraction thereof. Millings or clippings shall be made from at least ten separate coils. Equal quantities shall be taken from each coil and shall be thoroughly mixed together.

[1] This specification is under the jurisdiction of the 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), U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.

TABLE 1 Tensile Requirements[A]

NOTE 1—Conversion factors are presented for ready adaptation to computer readout and electronic data transmission. The factors are written as a number greater than one and less than ten with six or less decimal places. This number is followed by the letter E (for exponent), a plus or minus symbol, and two digits which indicate the power of 10 by which the number must be multiplied to obtain the correct value. For example: 2.54 E + 01 = 2.54 × 10^1= 25.4.

Diameter		Area			Elongation, min, % in 10 in. (250 mm)	Tensile Strength, min																	
						Alloy 8.5		Alloy 13		Alloy 15 and 20		Alloy 30		Alloy 40		Alloy 55		Alloy 74		Alloy 80		Alloy 85	
in.	mm	cmil	in.^{2}	mm^2		ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa
0.2893	7.348	83694	0.06573	42.41	2.2	97.5	672.2	102.5	706.7	109.5	755.0	74.0	510.2	73.4	508.1	76.0	524.0	74.0	510.2	72.0	496.4	68.5	472.3
0.2576	6.543	66358	0.05212	33.62	2.0	103.8	715.7	108.8	750.2	114.5	789.5	80.0	551.6	74.9	516.4	77.8	536.4	75.5	520.6	73.5	506.8	69.9	481.9
0.2294	5.827	52624	0.04133	26.67	1.8	107.5	741.2	112.5	775.7	118.5	817.0	85.0	586.1	76.3	526.1	79.3	546.8	77.5	534.3	75.0	517.1	71.2	490.9
0.2043	5.189	41738	0.03278	21.15	1.6	110.2	759.8	115.2	794.3	121.3	836.3	89.0	613.6	77.7	535.7	80.9	557.8	79.0	544.7	76.4	526.8	72.5	499.9
0.1819	4.620	33088	0.02599	16.77	1.5	112.2	773.6	117.2	808.1	123.3	850.1	92.5	637.8	79.0	544.7	82.4	568.1	80.0	551.6	77.5	534.3	73.6	507.5
0.1620	4.115	26244	0.02061	13.30	1.4	114.0	786.0	119.0	820.5	125.0	861.9	94.8	653.6	80.4	554.3	84.0	579.2	81.0	558.5	78.6	541.9	74.7	515.0
0.1443	3.665	20822	0.01635	10.55	1.3	115.3	795.0	120.3	829.4	126.5	872.2	96.5	665.3	81.8	564.0	85.5	589.5	82.4	568.1	79.8	550.2	75.8	522.6
0.1285	3.264	16512	0.01297	8.367	1.3	116.6	803.9	121.6	838.4	127.9	881.8	97.9	675.0	83.2	573.6	87.0	599.8	83.5	575.7	81.0	558.5	77.0	530.9
0.1144	2.906	13087	0.01028	6.632	1.2	117.8	812.2	122.8	846.7	129.2	890.8	99.0	682.6	84.6	583.3	88.5	610.2	84.6	583.3	82.2	566.8	78.1	538.5
0.1019	2.588	10384	0.008155	5.262	1.2	118.9	819.8	123.9	854.3	130.3	898.4	100.1	690.2	86.0	593.0	90.0	620.5	85.5	589.5	83.4	575.0	79.2	546.1
0.0907	2.304	8226.5	0.006461	4.1684	1.2	119.8	826.0	124.8	860.5	131.2	904.6	101.2	697.8	87.1	600.5	91.3	629.5	86.6	597.1	84.6	583.3	80.3	553.7
0.0808	2.052	6528.6	0.005128	3.308	1.1	120.6	831.5	125.6	866.0	132.0	910.1	102.2	704.6	88.2	608.1	92.6	638.5	87.7	604.7	85.7	590.9	81.4	561.2
0.0720	1.829	5184.0	0.004072	2.627	1.1	121.2	835.6	126.2	870.1	132.6	914.3	103.0	710.2	89.6	617.8	93.8	646.7	88.8	612.3	86.8	598.5	82.5	568.8
0.0641	1.628	4108.8	0.003227	2.082	1.1	121.7	839.1	126.7	873.6	133.2	918.4	103.7	715.0	90.4	623.3	95.0	655.0	89.8	619.2	87.8	605.4	83.4	575.0
0.0571	1.450	3260.4	0.002561	1.652	1.0	122.2	842.5	127.2	877.0	133.6	921.1	104.4	719.8	91.4	630.2	96.0	661.9	90.6	624.7	88.7	611.6	84.2	580.5
0.0508	1.290	2580.6	0.002027	1.308	1.0	122.5	844.6	127.5	879.1	134.0	923.9	105.2	725.3	92.1	635.0	97.0	668.8	92.0	634.3	89.5	617.1	85.0	586.1
0.0453	1.151	2052.1	0.001612	1.040	1.0	122.8	846.7	127.8	881.2	134.2	925.3	105.9	730.2	93.1	641.9	98.0	675.7	92.8	639.8	90.3	622.6	85.7	590.9
0.0403	1.024	1624.1	0.001276	0.8229	0.9	123.0	848.1	128.0	882.5	134.5	927.4	106.6	735.0	94.0	648.1	98.6	679.8	93.5	644.7	91.0	627.4	86.4	595.7
0.0359	0.912	1288.8	0.001012	0.6530	0.9	123.2	849.4	128.2	883.9	134.8	929.4	107.3	739.8	94.5	651.6	99.0	682.6	94.0	648.1	91.6	631.6	87.0	599.8
0.0320	0.813	1024.0	0.0008043	0.5189	0.9	123.5	851.5	128.5	886.0	135.0	930.8	108.0	744.8	95.0	655.0	99.5	686.0	94.5	651.6	92.2	635.7	87.6	604.0

[A] Conversion factors: 1 in. = 2.54 E + 01 mm, 1 kcmil = 5.067 E – 01 mm^2. 1 in.^{2} = 6.452 E + 02 mm^2, 1 ksi = 6.895 E + 00 MPa.