Designation: B48 – 00 (Reapproved 2021)ε1

Standard Specification for Soft Rectangular and Square Bare Copper Wire for Electrical Conductors[1]

This standard is issued under the fixed designation B48; 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.

ε[1] NOTE—Table 1 was corrected editorially in October 2021.

1. Scope

1.1 This specification covers soft or annealed bare copper wire, rectangular or square in shape with rounded corners (Explanatory Note 1).

1.2 For the purpose of this specification, the wire is classified as follows:

1.2.1 *Type A*—For all applications except those involving edgewise bending.

1.2.2 *Type B*—For applications involving edgewise bending. Type B wire of thickness less than 0.020 in. (0.51 mm) or with a ratio of width to thickness greater than 30 to 1 is not contemplated in this specification.

1.3 Unless otherwise specified by the purchaser, Type A material shall be furnished.

1.4 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; except for Sections 12 and 13.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B49 Specification for Copper Rod for Electrical Purposes

B193 Test Method for Resistivity of Electrical Conductor Materials

B279 Test Method for Stiffness of Bare Soft Square and Rectangular Copper and Aluminum Wire for Magnet Wire Fabrication

E8/E8M Test Methods for Tension Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *Other Documents:*

NBS Handbook 100 Copper Wire Tables[3]

3. Ordering Information

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

3.1.1 Quantity of each size;

3.1.2 Type of wire (see 1.1, 1.2, and 1.3);

3.1.3 Wire size: thickness and width, in inches or millimetres (see 6.1);

3.1.4 Type of copper, if special (see Section 4);

3.1.5 Package size (see 16.1);

3.1.6 Special package marking, if required; and

3.1.7 Place of inspection (see Section 15).

4. Material

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

4.2 Specification B49 defines the materials suitable for use.

5. Manufacture

5.1 The wire shall be annealed after the last drawing or rolling to size and shape, and shall be so processed as to produce a uniformly soft product with a clean surface.

5.2 The finished wire shall not contain joints except such as have passed through drawing dies. Necessary joints in the wire and rods prior to final drawing shall be made in accordance with good commercial practice.

[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 Variation in Thickness

Specified Thickness				Width								
				Over 1.000† in. (25.4 mm)			1.000 in. (25.4 mm) to 0.492 in. (12.5 mm)			Under 0.492 in. (12.5 mm)		
in.		mm		Permissible Variation in Thickness, max, plus and minus								
				in	%	mm	in.	%	mm	in.	%	mm
0.501 and over		12.73 and over		...	1	...	...	1	...	...	...	...
under	to, incl	under	to, incl									
0.501	0.280	12.73	7.11	...	1	...	...	1	...	0.003	...	0.076
0.280	0.201	7.11	5.11	0.003	...	0.08	...	1	...	...	1	...
0.201	0.098	5.11	2.49	0.0025	...	0.064	...	1	...	...	1	...
0.098	0.051	2.49	1.30	0.002	...	0.051	0.001	...	0.03	0.001	...	0.03
0.051	...	1.30	...	0.0015	...	0.038	0.001	...	0.03	0.001	...	0.03

† Editorially corrected.

6. Dimensions and Permissible Variations

6.1 The dimensions shall be expressed in decimal fractions of an inch or in millimetres. Unless otherwise specified, it will be assumed that the dimensions are in inches. (Explanatory Note 6, Explanatory Note 7, and Explanatory Note 8.)

6.2 The thickness shall not vary from that specified by more than the amounts prescribed in Table 1.

6.3 The width shall not vary from that specified by more than the amounts prescribed in Table 2.

6.4 The wire shall have rounded corners or rounded edges as specified in Table 3 and as shown in Fig. 1. Where rounded corners are required, the corners of the wire shall be rounded within the limits of radii, 25 % under and 25 % over (as determined by a radius gage) those radii values specified in Table 3.

6.5 From each shipping unit, approximately 12 ft (3.66 m) shall be unwound and the wire gaged at six places between points 12 in. (30.5 cm) and 12 ft (3.66 m) from the end. The shipping unit shall be rejected if the average of the measurements obtained is not within the limits specified in 6.2 and 6.3.

7. Physical Requirements

7.1 *Elongation:*

7.1.1 Type A wire shall conform to the requirements for elongation given in Table 4.

7.1.2 For Type B wire elongation tests shall not be required.

7.1.3 Elongation tests shall be made in accordance with Test Methods E8/E8M on representative samples. The elongation shall be determined 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). The fracture shall be in between gage marks and not closer than 1 in. (25 mm) to either gage mark.

7.2 *Bending:*

7.2.1 Both edges of Type B wire shall withstand bending edgewise through 180° around the mandrel indicated without cracking. The mandrel shall be one of the sizes shown in Table 5 and shall be the size that is equal to or next larger than the figure obtained by multiplying the width of the wire by the factor in Table 6, corresponding to the ratio of the width to the thickness of the wire. In cases where the mandrel diameter desired is less than 0.156 in. (3.96 mm) or the thickness is less than 0.020 in. (0.51 mm) or the ratio of the width to thickness of the wire is greater than 30 to 1, the scope of Type B wire is exceeded and the edgewise bending properties shall be as agreed upon between the purchaser and the manufacturer (Explanatory Note 3 and Explanatory Note 4).

7.2.2 For Type A wire the bend test shall not be required.

7.3 *Low Stress Elongation (LSE):*

7.3.1 Types A and B wire shall have a minimum LSE value of 1 % determined in accordance with Test Method B279. (Explanatory Note 5).

7.4 *Retests:*

7.4.1 If upon testing a sample from any coil or reel of wire, the results do not conform to the respective requirements of 7.1, 7.2, and 7.3, two additional samples shall be tested, each of which shall conform to the prescribed requirements.

8. Standard Reference Temperature

8.1 For the purpose of this specification, all wire dimensions and properties shall be considered as occurring at the internationally standardized reference temperature of 20 °C.

9. Standard Rules for Rounding Off

9.1 All calculations for the standard nominal dimensions and properties of rectangular and square wires shall be rounded off in the final value only, in accordance with the rounding-off method of Practice E29.

TABLE 2 Variation in Width

Specified Width		Permissible Variation in Width, max, plus and minus
in.	mm	
0.492 and over	12.5 and over	1 % but not to exceed 0.016 in. (0.406 mm)
Under 0.492 to 0.315, incl	under 12.5 to 8.00, incl	0.003 in. (0.076 mm)
Under 0.315 to 0.098, incl	under 8.00 to 2.49, incl	1 %
Under 0.098	under 2.49	0.001 in. (0.025 mm)