



## Standard Specification for Copper Trolley Wire<sup>1</sup>

This standard is issued under the fixed designation B 47; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers round and grooved hard-drawn copper and silver-bearing copper trolley wire.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

B 49 Specification for Copper Redraw Rod for Electrical Purposes<sup>2</sup>

B 193 Test Method for Resistivity of Electrical Conductor Materials<sup>3</sup>

### 3. Ordering Information

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

3.1.1 Quantity of each size and section,

3.1.2 Wire size: diameter in inches (see 6.1 and Table 1) or area in circular mils (see 10.1 and Fig. 1),

3.1.3 Shape of section (Section 1),

3.1.4 Type of copper, if the addition of silver of 25 troy oz./short ton minimum, is required (see Section 4 and Explanatory Note 1),

3.1.5 Package size (see 18.3),

3.1.6 Lagging, if required (see 18.1),

3.1.7 Relation between vertical axis of grooved wire and axis of reel (see 18.1),

3.1.8 Size of arbor hole, if special (see 18.2),

3.1.9 Special package marking, if required (see 18.4), and

3.1.10 Place of inspection (Section 16).

### 4. Materials and Manufacture

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.

NOTE 1—Specification B 49 defines the materials suitable for use.

4.2 Copper redraw rod of special qualities, forms, or types,

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<sup>2</sup> Annual Book of ASTM Standards, Vol 02.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 02.03.

TABLE 1 Tensile Requirements (See Explanatory Note 2)

Diameter, in.	Area, cmils	Tensile Strength, min. psi		Elongation in 10 in., min. %
		No silver added	25 troy oz. min./short ton added	
0.5477	300 000	46 400	48 500	4.50
0.4600	211 600	49 000	51 500	3.75
0.4096	167 800	51 000	53 000	3.25
0.3648	133 100	52 800	54 000	2.80
0.3249	105 600	54 500	55 000	2.40

as may be agreed upon between the manufacturer and the purchaser, and that will conform to the requirements prescribed in this specification may also be used.

4.3 Either oxygen-free or tough pitch copper may be supplied. Tests for oxygen content of the copper are not a requirement of this specification.

### ROUND WIRE

### 5. Tensile Properties

5.1 Round wire shall conform to the requirements as to tensile properties specified in Table 1.

5.2 Tests on a specimen of round wire containing a joint shall show at least 95 % of the tensile strength specified in Table 1. Elongation tests shall not be made on specimens containing joints.

5.3 Tension tests shall be made 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. apart upon the test specimen (Explanatory Note 2). The fracture shall be between the gage marks and not closer than 1 in. to either gage mark.

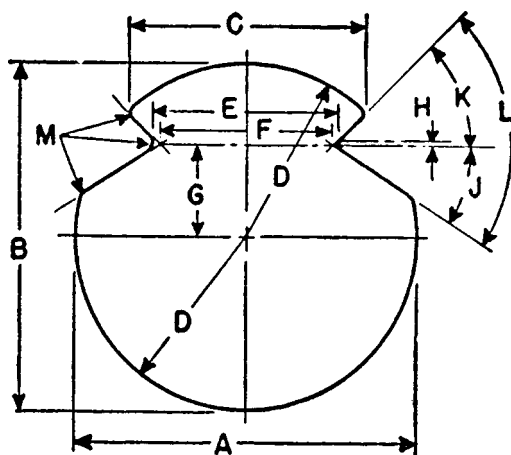
### 6. Dimensions and Permissible Variations

6.1 The size of round trolley wire shall be expressed as the diameter of the wire in decimal fractions of an inch, to the nearest 0.1 mil (0.0001 in.).

6.2 Wire shall be truly cylindrical in form. The diameter shall not vary more than plus and minus 1 % from that specified.

### 7. Twist Test

7.1 For the purpose of determining and developing defects which may be prejudicial to the life of trolley wire, owing to its peculiar service as compared to that of wire for other purposes, round wire shall be subjected to the twist test described in 7.2.



Nominal size, cmils	133 100	167 800	211 600	300 000	350 000
Area, in. <sup>2</sup> (Explanatory Note 6)	0 .1083	0 .1314	0 .1665	0 .2355	0 .2758
Area, cmils (Explanatory Note 6)	137 900	167 300	212 000	299 800	351 200
Weight, lb/mile (Explanatory Note 6)	2205	2674	3389	4792	5612
Dimensions for Inspection, in.					
A	0.388 + 0.006 - 0.012	0.429 + 0.006 - 0.012	0.482 + 0.006 - 0.012	0.574 + 0.010 - 0.020	0.620 + 0.010 - 0.020
B	0.392 ± 0.007	0.430 ± 0.008	0.482 ± 0.009	0.574 ± 0.011	0.620 ± 0.012
C	0.318 ± 0.007	0.340 ± 0.007	0.376 ± 0.007	0.376 ± 0.007	0.376 ± 0.007
Dimensions for Reference, in.					
D—radius	0.196	0.215	0.241	0.287	0.310
E	0.217 + 0.005 - 0.010	0.237 + 0.005 - 0.010	0.267 ± 0.010	0.267 ± 0.010	0.267 ± 0.010
F	0.200	0.220	0.250	0.250	0.250
G	0.031	0.047	0.063	0.127	0.156
H	0.005	0.005	0.005	0.005	0.005
J	27 ± 2°	27 ± 2°	27 ± 2°	27 ± 2°	27 ± 2°
K	51 ± 2°	51 ± 2°	51 ± 2°	51 ± 2°	51 ± 2°
L	78°	78°	78°	78°	78°
M—radius	0.015 + 0.010 - 0.005	0.015 + 0.010 - 0.005	0.015 + 0.010 - 0.005	0.015 + 0.010 - 0.005	0.015 + 0.010 - 0.005

NOTE—Dimension *H* is defined by two center lines, of which the upper is the center line of the radius of the groove and the lower is the center line of the groove.

FIG. 1 Standard Sections Grooved Trolley Wire

Round wire that does not withstand at least 9 twists without breaking shall not be considered satisfactory.

7.2 Three twist tests shall be made on specimens 10 in. (254 mm) in length between the holders of the testing machine. The twisting machine shall be so constructed that there is a linear motion of the tail stock with respect to the head. The twist shall be applied not faster than 10 turns/min. All three specimens shall be twisted to destruction and shall not reveal under test any seams, pits, slivers, or surface imperfections of sufficient magnitude to indicate inherent defects or imperfections in the wire. At the time of fracture, the wire shall twist with reasonable uniformity.

**GROOVED WIRE**

**8. Tensile Properties**

8.1 Grooved wire shall conform to the requirements as to tensile properties specified in Table 2.

8.2 Tests on a specimen of grooved wire containing a joint shall show at least 95 % of the tensile strength specified in

TABLE 2 Tensile Requirements (See Explanatory Note 2)

Nominal Area, cmils	Tensile Strength, min. psi		Elongation in 10 in., min, %
	No silver added	25 troy oz min./short ton added	
350 000	42 800	44 600	4.50
300 000	44 200	48 000	4.50
211 600	46 600	51 300	3.75
167 800	48 500	52 700	3.25
133 100	50 200	53 000	2.80

Table 2. Elongation tests shall not be made on specimens containing joints.

8.3 The tension and elongation tests for grooved wire shall be made in the same manner as those on round wire as described in 5.3.

**9. Sections**

9.1 Standard sections of grooved trolley wire shall be those known as the “American Standard Grooved Trolley Wire