Designation: B 279 – 98

Standard Test Method for Stiffness of Bare Soft Square and Rectangular Copper and Aluminum Wire for Magnet Wire Fabrication[1]

This standard is issued under the fixed designation B 279; 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 test method, known as the low-stress elongation (LSE) test, covers the procedure for determining the stiffness of bare soft square and rectangular copper and aluminum wire in terms of the permanent elongation resulting from the application of a tensile stress.

1.2 The SI values for weighing the specimen are regarded as the standard. The inch-pound values are to be regarded as standard and the SI units may be approximate for all other properties.

2. Referenced Document

2.1 The following document of the issue in effect at the time of reference forms a part of this test method to the extent referenced herein:

2.2 *ASTM Standards:*

E 4 Practices for Force Verification of Testing Machines[2]

3. Significance and Use

3.1 This test method is designed as an inspection or acceptance test of new bare soft square and rectangular wire intended for subsequent fabrication into magnet wire.

NOTE 1—Since the applied unit stress and the time of application are constant for all wire sizes, the test enables comparisons of hardness (stiffness or springiness) to be made between wires of the same or different size on the basis of the permanent elongation resulting from the application of a low unit stress.

4. Apparatus

4.1 Tensile testing machines used for the low-stress elongation test shall conform to the requirements of Practices E 4.

5. Test Specimens

5.1 The test specimens shall be taken from the finished reel or coil with a minimum amount of handling and distortion, retaining as much as possible the original curvature of the package. Test specimens having the full cross-sectional area of the wire shall be used. The standard gage length for the measurement of elongation of wire shall be 10 in. (254 mm). The total length of the specimens shall be at least equal to the gage length plus the length of wire required for the full use of the grips employed.

6. Procedure

6.1 Straighten the test specimens carefully by hand with a minimum amount of distortion or cold work. Improperly prepared test specimens often cause unsatisfactory test results.

6.2 Cut off a test specimen of sufficient length. Measure the length to the nearest 0.01 in. (0.25 mm) with any measuring device accurate to 0.1 % (Note 2). Weigh this specimen to the nearest 0.01 g on a balance accurate to 0.1 %. The pound (N) load required to apply a stress to the specimen equal to 15 000 psi (103 MPa) for copper, and 8 000 psi (55 MPa) for aluminum shall be obtained from the following:

$$\text{Requiredload, lb} = W \times 102.74/L \quad \text{. . . . Copper}$$

$$\text{N} = W \times 11612.7/\text{L}' \text{ . . . . Copper}$$

$$\text{lb} = W \times 180.5/L \text{ . . . . Aluminum}$$

$$\text{N} = W \times 20401.9/\text{L}' \text{ . . . . Aluminum}$$

where:

W = weight of specimen, g,
L = length of weighed specimen, in., and
L' = length of weighed specimen, mm.

NOTE 2—To facilitate the cutting and measuring of the length of the test specimen, a jig or set of vises with jaws of carefully predetermined distance apart can be used to advantage, particularly where a large number of specimens have to be tested. This predetermined distance L will reduce the expression $102.74/L$ or $180.5/L$ ($11612.7/L'$ or $20401.9/L'$) to a constant K thus making the required pound (N) load equal to $W \times K$.

Where the cross-sectional area of the test specimen is such that the weight of the full-length specimen would exceed the capacity of the available weighing balance, an adjacent shorter specimen may be used for determination of the weight provided that its length is measured to an accuracy of at least 0.2 %.

[1] This test method is under the jurisdiction of ASTM Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B01.02 on Methods of Test and Sampling Procedure.

Current edition approved Sept. 10, 1998. Published November 1998. Originally published as B 279 – 53. Last previous edition B 279 – 93.

[2] *Annual Book of ASTM Standards,* Vol 03.01.