Designation: A 938 – 97

Standard Test Method for Torsion Testing of Wire[1]

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1. Scope

1.1 This test method describes the torsion (or twist) testing of metallic wire.

1.2 The values stated in U.S. customary units are to be regarded as the standard. The SI equivalents of U.S. customary units may be approximate.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 6 Terminology Relating to Methods of Mechanical Testing[2]

3. Terminology

3.1 *Definitions*—The definitions related to torsion testing appearing in Terminology E 6 shall be considered as applying to the terms used in this test method.

4. Significance and Use

4.1 The complex stress and strain conditions that occur in the sample during the torsion test are sensitive to minor variations in materials, making the torsion test a useful tool in assessing wire ductility under torsional loading.

5. Apparatus

5.1 *Clamping Heads*:

5.1.1 The torsion test apparatus must have clamping heads that will remain coaxial (within 10°) during the test.

5.1.2 One clamping head shall be easily displaceable in the direction of the wire axis. This longitudinally displaceable clamping head shall be equipped with a device capable of applying the necessary tensile load.

5.1.3 The clamping heads shall clamp the wire firmly, but should not damage it to the extent that fracture occurs at the clamping point during twisting. The distance between the clamps is the test length. The wire shall be twisted only along the test length, and not at the point of clamping. These requirements can be satisfied by bending a short section at each end of the specimen to an angle of about 90° to the wire axis, as described in 6.3.

5.2 *Revolution Counter*—A mechanism to count the number of twists shall be provided.

5.3 *Protective Shield*—A protective shield shall be provided to protect the operator from flying fragments in cases when the wire breaks into more than two pieces.

6. Specimen Preparation

6.1 *Straightening*—The test piece, consisting of a length of wire, should be straight before being tested. If straightening is necessary, it shall, unless otherwise specified, be done by hand. Other straightening techniques are permitted provided surface damage is avoided. Since the shear stress is maximum at the surface of the wire during testing, even slight surface damage such as pits or scratches can cause early fracture, and the results may not be indicative of the full capability of the wire.

NOTE 1—During straightening, it is important that the properties and cross section remain unchanged as far as possible. In particular, the specimen shall not be subjected to any twisting.

6.2 *Test Length* :

6.2.1 Recommended test length is 8 in. (203 mm) (distance between the clamping heads). Sufficient material must also be provided to allow for gripping.

6.2.2 Other test lengths may be used as agreed upon between the producer and purchaser or as specified in the appropriate product specification.

6.2.3 When a test length other than 8 in. (203 mm) is used, the minimum torsions shall be revised in direct proportion to the change in the jaw spacing, or as determined by the following formula:

$$T_x = \frac{(T_L)\,(L_x)}{(L_L)} \quad (1)$$

where:

T_x = minimum torsions for new length,

T_L = minimum torsions for 8 in. (203 mm) length,

[1] This test method is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of A1.03on Steel Rod and Wire.

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