Designation: A1061/A1061M – 26

Standard Test Methods for Testing Multi-Wire Steel Prestressing Strand[1]

This standard is issued under the fixed designation A1061/A1061M; 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 These test methods describe procedures for testing the mechanical properties of multi-wire steel prestressing strand.

1.2 These test methods are intended for use in evaluating specific strand properties prescribed in specifications for multi-wire steel prestressing strand, but they do not quantify acceptance criteria specified in the applicable specification for the strand being tested.

1.3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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]

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

E4 Practices for Force Calibration and Verification of Testing Machines

E83 Practice for Calibration, Verification, and Classification of Extensometer Systems

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E328 Test Methods for Stress Relaxation for Materials and Structures

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *breaking strength, n*—maximum force at or after which one or more wires fracture.

3.1.2 *free span, n*—the distance between the gripping jaws occupied by the length of strand to be tested in which the strand is not contacted or detrimentally influenced by the gripping system.

3.1.3 *lay length, n*—the axial distance required to make one complete revolution of any wire of a strand.

3.1.4 *strand, n*—a group of two, three or seven steel wires wound together in a helical form with uniform lay length of not less than 12 and not more than 16 times the nominal diameter of the strand.

3.1.5 *yield strength, n*—measured force at 1.0 % extension under load (EUL).

4. Significance and Use

4.1 The breaking strength and elongation of the strand are determined by one or more tensile tests in which fracture of the specimen ideally occurs in the free span.

4.2 Mechanical properties of the strand will be negatively affected if proper care is not taken to prevent damage such as severe bending, abrasion, or nicking of the strand during sampling.

4.3 Premature failure of the test specimens may result if there is appreciable notching, cutting, or bending of the specimen by the gripping devices of the testing machine.

4.4 Errors in testing will result if the wires constituting the strand are not loaded uniformly.

4.5 The mechanical properties of the strand will be materially affected by excessive heating during test specimen collection or preparation.

[1] These test methods are under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.05 on Steel Reinforcement.

Current edition approved April 1, 2026. Published April 2026. Originally approved in 2009. Last previous edition approved in 2020 as A1061/A1061M – 20a$^{\varepsilon1}$. DOI: 10.1520/A1061_A1061M-26.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

5. Apparatus

5.1 Tensile testing machine calibrated in accordance with Practices E4.

5.2 Class B-1 extensometer as described in Practice E83.

5.3 Class D extensometer as described in Practice E83; alternately, a linear dial gauge or ruler with precision of ±1⁄16 in. [1.5 mm].

6. Sampling

6.1 Unless otherwise specified in the applicable specification for the strand being tested, test specimens shall be taken from the finished strand prior to packaging. The number of test specimens shall be taken as specified in the applicable specification for the strand being tested.

7. Gripping Devices

7.1 Due to inherent physical characteristics of individual tensile testing machines, it is not practical to recommend a universal gripping method that is suitable for all tensile testing machines. Therefore, it is necessary to determine which of the methods of gripping described in 7.1.1 – 7.1.3 is most suitable for the tensile testing machine available. The gripping devices shall be designed such that during testing the load is distributed along the entire length of the grips. The minimum effective gripping length should be equal to or greater than the lay length of the strand.

7.1.1 *Standard V-Grips with Serrated Teeth (Note 1).*

7.1.2 *Standard V-Grips with Serrated Teeth (Note 1), Using Cushioning Material*—In this method, material is placed between the grips and the test specimen to minimize the notching effect of the teeth. Materials that have been used include, but are not limited to lead foil, aluminum foil, carborundum cloth, and brass shims. The type and thickness of material required is dependent on the shape, condition, and coarseness of the teeth.

7.1.3 *Special Grips with Semi-Cylindrical Grooves (Note 2, Fig. 1)*—The grips can be used as is or in conjunction with an abrasive medium (typically, a slurry or coating) applied to prevent slippage to the grooves of the grips, the gripped portion of the test specimen, or both.

7.1.4 *Chucking Devices*—Use of chucking devices of the type generally used for applying tension to strands in casting beds or post-tensioning anchorages shall not be used as primary gripping devices for testing purposes. Tests involving chuck devices or post-tensioning anchorages as the primary gripping device shall be considered invalid. It shall be permissible to use chucking devices or post-tensioning anchorages as a secondary gripping system, coupled with one of the methods listed above, to prevent strand slippage.

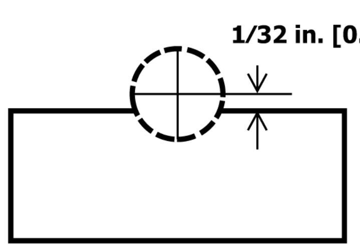

FIG. 1 Note the 1⁄32 in. [0.79 mm] Spacing Between the Flat Face and the Radius of the Grip

NOTE 1—The number of teeth should be 10 to 30 per inch [25 mm].

NOTE 2—The radius of curvature of the grooves should be approximately the same as the radius of the strand being tested. To prevent the two grips from closing tightly when the test specimen is in place, each groove should be located 1⁄32 in. [0.79 mm] above the flat face of the grip (see Fig. 1).

8. Speed of Testing

8.1 The speed of testing shall not be greater than that at which load and strain readings can be made accurately. Refer to speed of testing in Test Methods and Definitions A370, section on Testing Apparatus and Operations.

9. Test Procedures

9.1 *Yield Strength:*

9.1.1 As listed in 5.2, a Class B-1 extensometer (Note 3) shall be used as described in Practice E83 with a gauge length equal to or greater than the lay length of the strand. Typically, an extensometer with a 24 in. [600 mm] gauge length is used.

9.1.2 Immediately prior to starting the test, apply a preload of approximately 10 % of the required minimum breaking strength to correct for gripper seating losses and other sources of elongation error normally present during the initial loading of the test specimen. Use a computerized data acquisition system with a software-based test procedure to collect the data used to generate the test curve. The force-elongation data collected while loading, when plotted, shall produce a smooth curve free of irregular step-wise movements or other evidence of nonuniform force-elongation loading of the test specimen. Towards the end of the test, due to the sensitive nature of extensometers often used in A1061/A1061M testing, the extensometer may be removed after the data used to determine the yield strength is collected (typically by 1.3 % extension) to avoid possible extensometer damage due to strand rupture.

9.1.3 Use appropriate computer software to calculate the elastic modulus of the specimen from the test data collected. The calculation of the elastic modulus shall use either the actual cross-sectional area of the specimen or the nominal cross-sectional area as defined in the applicable specification for the size and grade of strand being tested. The elastic modulus shall be calculated using a sum-of-least squares linear regression in the linear-elastic portion of the curve. To prevent errors potentially introduced during the initial loading phase, the linear regression shall not utilize data points measured until a minimum of 20 % of the minimum breaking strength is reached. Also, to safely avoid the nonlinear elastic portion of the force-elongation curve as the yielding process starts, the linear regression shall not use data points collected after 65 % of the minimum breaking strength is reached. Data corresponding to at least 70 % of the range between 20 % and 65 % of the minimum breaking strength (inclusive) shall be used for the linear regression used to calculate the elastic modulus. Once the elastic modulus is determined, the force-elongation curve shall be extrapolated using the measured slope of the elastic modulus to identify the intersection with the elongation axis zero force point. This is the origin from which the 0.2 % offset