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Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members[1]

This standard is issued under the fixed designation E1190; 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 determining the static axial tensile and shear strengths of power-actuated fasteners installed in structural members made of concrete, concrete masonry, and steel.

1.2 These test methods are intended for use with fasteners that are installed perpendicular to a plane surface of the structural member.

1.3 Tests for combined tension and shear, fatigue, dynamic, and torsional load resistance are not covered.

~~1.4The values stated in metric (SI) units are to be regarded as standard. The inch-pound units in parentheses are for information only.~~

1.4 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.5 *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.* Specific hazard statements are given in Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E4 Practices for Force Verification of Testing Machines

~~E171Specification for Atmospheres for Conditioning and Testing Flexible Barrier Materials~~

E575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies

E631 Terminology of Building Constructions

[1] These test methods are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.13 on Structural Performance of Connections in Building Construction.

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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.

2.2 ~~*ANSI Standard:*~~ *ANSI Standards:*[3]
ANSI A10.3 Safety Requirements for Powder-Actuated Fastening Systems

3. Terminology

3.1 Definitions of general terms may be found in Terminology E631.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 ~~*powder-actuated fastening system*—a system that uses explosive powder to embed the fastener in structural elements.~~ displacement—movement of a fastener relative to the structural member. In tensile tests, displacement is measured along the axis of the fastener; in shear tests it is measured in the direction of the applied load perpendicular to the axis of the fastener.

3.2.2 ~~*power-actuated fastening system*—a system that uses explosive powder, gas combustion, or compressed air or other gas to embed the fastener in structural elements.~~

~~3.2.3~~*drive pin*—a nail-like metal fastener designed to attach one material to another.

3.2.3 *edge distance, c*—the distance from the longitudinal axis (center) of a fastener to the nearest edge of the structural member in which it is installed.

3.2.4 ~~*threaded stud*—a round metal-wire fastener, with a pointed shank at one end and threads along the other end, designed to be used as a removable fastening or in conjunction with a threaded coupler.~~ embedment depth, h_{ef}—the distance from the surface of the structural member to the installed end of the fastener including its point, if any.

3.2.5 ~~*structural member*—an element of a structural system such as a beam, column, or truss.~~

~~3.2.6~~*static load*—a load or series of loads that are supported by or are applied to a structure so gradually that forces caused by change in momentum of the load and structural elements are negligible and all parts of the system at any instant are essentially in equilibrium.

~~3.2.7~~*tensile test*—a test in which a fastener is loaded axially in tension at a specified rate.

~~3.2.8~~*shear test*—a test in which a force is applied perpendicularly to the axis of the fastener and parallel to the surface of the structural member.

~~3.2.9~~*fastener spacing, s*—the distance between the longitudinal axes of two fasteners in the same plane. Also, distance between longitudinal axis of fastener and nearest edge of test-system supports (see *s* in Fig. 1).

3.2.6 *powder-actuated fastening system*—a system that uses explosive powder to embed the fastener in structural elements.

3.2.7 *power-actuated fastening system*—a system that uses explosive powder, gas combustion, or compressed air or other gas to embed the fastener in structural elements.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

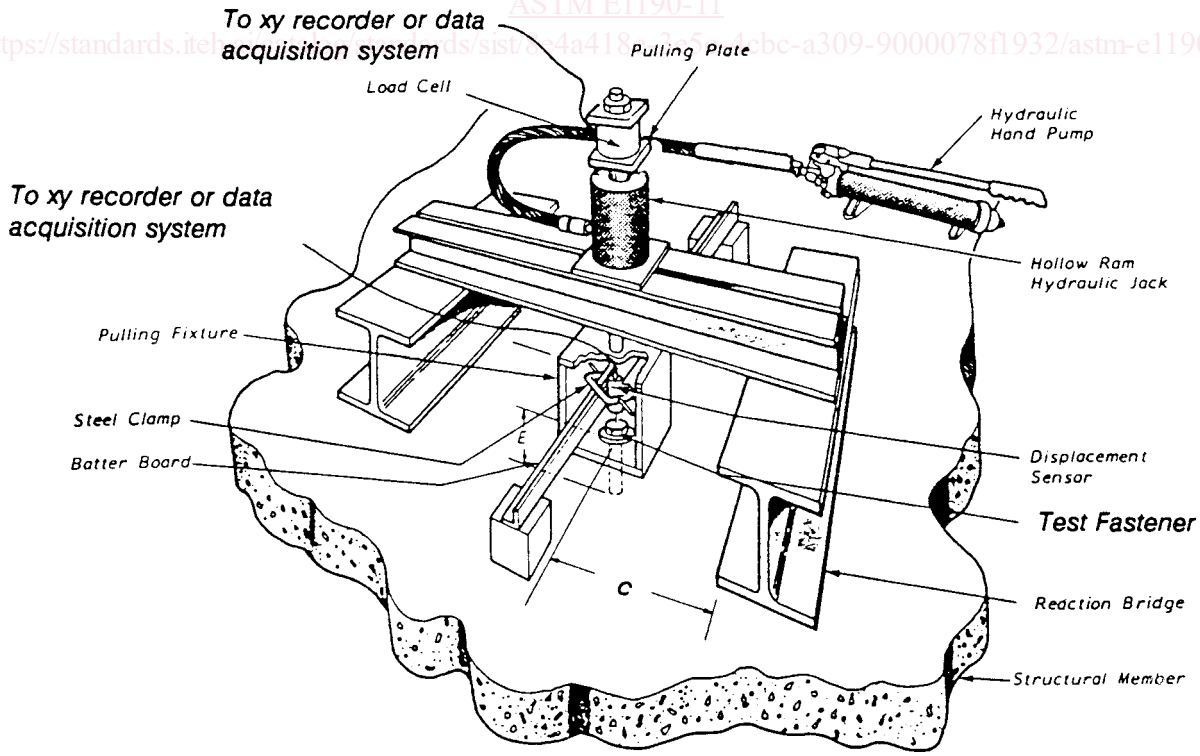

FIG. 1 Typical Static Tension Test Arrangement

3.2.8 *shear test*—a test in which a force is applied perpendicularly to the axis of the fastener and parallel to the surface of the structural member.

3.2.9 *static load*—a load or series of loads that are supported by or are applied to a structure so gradually that forces caused by change in momentum of the load and structural elements are negligible and all parts of the system at any instant are essentially in equilibrium.

3.2.10 ~~*edge distance, c*—the distance from the longitudinal axis (center) of a fastener to the nearest edge of the structural member in which it is installed.~~ structural member—an element of a structural system such as a beam, column, or truss.

3.2.11 ~~*embedment depth, h_{ef}*—the distance from the surface of the structural member to the installed end of the fastener including its point, if any.~~ tensile test—a test in which a fastener is loaded axially in tension at a specified rate.

3.2.12 ~~*displacement*—movement of a fastener relative to the structural member. In tensile tests, displacement is measured along the axis of the fastener; in shear tests it is measured in the direction of the applied load perpendicular to the axis of the fastener.~~ threaded stud—a round metal-wire fastener, with a pointed shank at one end and threads along the other end, designed to be used as a removable fastening or in conjunction with a threaded coupler.

4. Significance and Use

4.1 These test methods are intended to measure the anchoring capability and shear resistance of power-actuated fasteners to provide information from which applicable design values are to be derived for use in structural applications, such as in members of concrete, concrete masonry, and steel.

5. Apparatus

5.1 *Equipment*—Any system suitable for applying tensile and shear forces shall be used, provided the requirements for rate of loading in 9.4 are met, and the instrumentation is capable of measuring the forces to an accuracy within ± 2 % of the applied force, when calibrated in accordance with Practices E4. The device shall be of sufficient capacity to prevent yielding of its various components and shall ensure that the applied tensile forces remain parallel to the axes of the fasteners and that the applied shear forces remain parallel to the surface of the structural member during testing. Load cells shall be used for laboratory testing. If pressure gages are used for field testing, they shall be calibrated immediately prior to use.

5.1.1 *Tensile Test*—A system suitable for applying tensile forces is shown in Fig. 1 for a single fastener specimen. The test system supports shall be of sufficient size to prevent failure of the surrounding structural member. The loading rod shall be of a size to develop the ultimate strength of the fastener hardware with minimal elongation and shall be attached to the fastener by means of a connector that will minimize the direct transfer of bending forces through the connection. When displacements are measured, dial gages or a linear variable differential transformer (LVDT) shall be mounted in a manner so as to ensure accurate displacement measurement.

5.1.2 *Shear Test*:

5.1.2.1 A system suitable for applying shear forces is shown in Fig. 2. for a single fastener specimen. The components of the

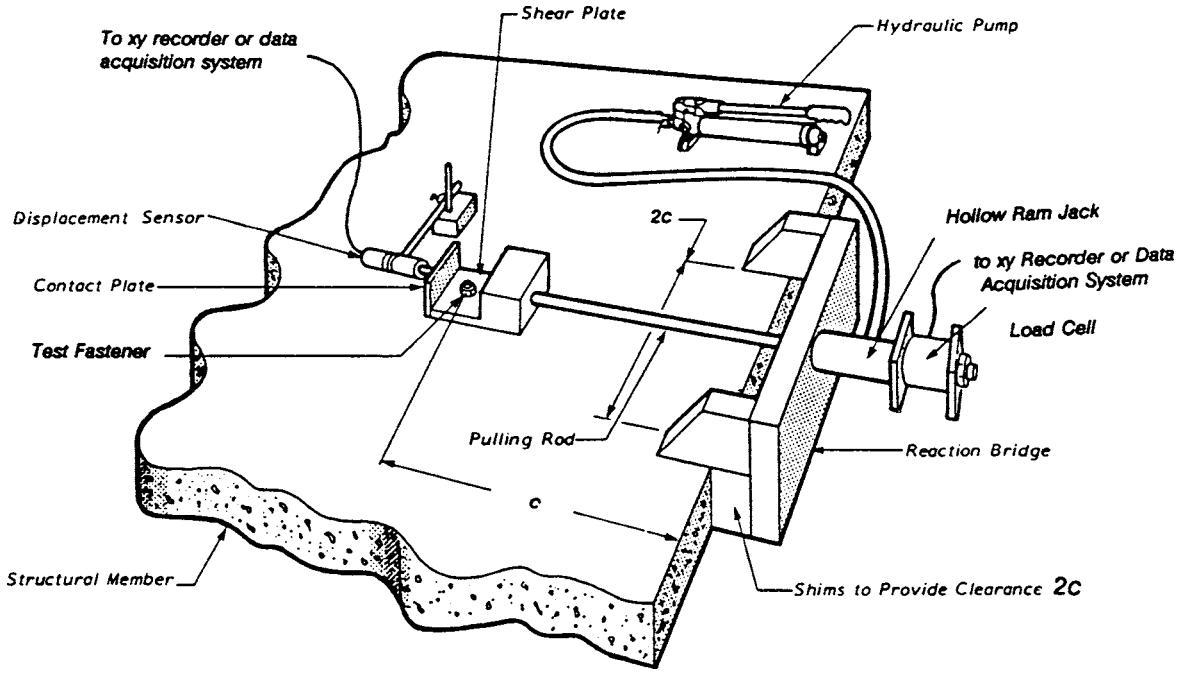

FIG. 2 Typical Static Shear Test Arrangement