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Standard Test Method for Determining Strength and Setting Time of Synthetic Water-Activated Polyurethane Fiberglass Orthopaedic Casting Tape[1]

This standard is issued under the fixed designation F1536; 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.

ε1 NOTE—Editorial corrections were made in June 2016.

1. Scope

1.1 This test method covers the functional diametral compression strength of cylindrical test specimens formed from synthetic fiberglass polyurethane casting materials. The test specimens employed in this test method are similar in geometry and construction to casts used in orthopaedic applications. This test method is not intended to determine the strength of the base materials used for fabrication of the test specimen.

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

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.* Specific warning statements are given in 6.7.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E4 Practices for Force Verification of Testing Machines

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 *diametral compression strength*—the load per unit width in lbs/in. (Newtons/mm), calculated by dividing either the peak failure load or the maximum deflection load by the nominal sample length (that is, manufacturer's stated tape width).

3.1.2 *maximum deflection load*—the test cylinder is compressed 0.4 in. (10 mm) from the initial load position without noticeable failure or a measurable decrease in load. The load at 0.4 in. (10 mm) deflection shall be called the maximum deflection load.

3.1.3 *peak failure load*—failure of the test cylinder with a concomitant decrease in load prior to 0.4 in. (10 mm) diametral compression. The highest load attained prior to the decrease shall be called the peak failure load.

4. Summary of Test Method

4.1 A test cylinder is prepared by immersing the casting tape in 75 ± 2°F (23.9 ± 1.1°C) water, squeezing per the manufacturer's instructions under the surface of the water, and then wrapping around either a 2.0 in. (50.8 mm) or 2.5 in. (63.5 mm) outside diameter cylindrical mandrel. The tape is wrapped layer upon layer producing a five layer cylinder. The test cylinder is removed from the mandrel after an initial setting period. After a specified time, the test specimen is positioned on its side between two flat platens in the testing machine and compressed to determine its strength. Ambient temperature and humidity are specified because of their pronounced effect on material properties during the curing period.

5. Significance and Use

5.1 Diametral compression strength is an important measure of the mechanical properties of casting materials. This test method simulates the loading pattern seen in lower extremity casting applications during ambulation. This test method cannot be used to determine cast life or measure bending or other modes of cast failure.

5.2 This test method measures but does not prescribe values.

6. Apparatus

6.1 *Testing Machines*—Machines used for compression testing shall conform to the requirements of Practices E4. For

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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.

universal machines with a common test space, calibration shall be performed in compression.

6.1.1 The surfaces of the flat platens shall be perpendicular to the loading axis and parallel at all times within 0.005 in./in. (1.3 mm/mm). Platen surfaces should be clean and free of corrosion.

6.1.2 The testing machine shall be capable of producing a constant compression rate between 1 to 10 in./min (25.4 to 254 mm/min).

6.1.3 The testing machine shall be capable of measuring the compressive load within ±0.5 lbs (2.2 N).

6.2 *Test Specimen Preparation Mandrel*—A solid, cylindrical aluminum mandrel of sufficient length to accommodate three test specimens without end contact shall be mounted in a horizontal position (see Fig. 1). Either of two mandrel diameters may be used: Type I—2.00 in. (50.8 mm) diameter, or Type II—2.50 in. (63.5 mm) diameter.

6.2.1 *Option*—Three individual mandrels, either Type I or Type II, each capable of holding one test specimen, may be substituted for a single, solid mandrel.

6.3 *Constant Tension Method*—Each layer of tape shall be wrapped on the mandrel at a constant tension of 0.25 lbs/in. (4.5 g/mm) width of tape. Suggested methods for accomplishing this include the use of a dead weight clamped to the free end of the tape while the horizontally mounted mandrel is manually rotated (see Fig. 1), or the use of an automated constant torque winding mechanism (see Fig. 2).

6.4 *Water Container*—A container capable of holding at least 1 gal (3.78 L) of water and of sufficient depth to allow complete immersion of the casting tape.

6.5 *Release Liner*—A sheet form liner of nominal thickness, such as waxed paper, shall be used to cover the mandrel and prevent adhesion of the resin to the mandrel. The liner shall allow release of the cured specimen from the mandrel with minimal force, and shall be easily removable from the specimen inner diameter prior to compression testing.

6.6 *Timer*—A timing device accurate to ±1 s.

6.7 *Gloves*—Gloves capable of protecting the hands from contact with the resin, for example, latex surgical gloves. (**Warning—**Contact with uncured or curing resins should be avoided. These resins may adhere to the skin and be difficult to remove. In addition, most polyurethane resins contain isocyanate to which some individuals are or may become sensitized. Gloves should be worn at all times when handling uncured or curing casting tape.)

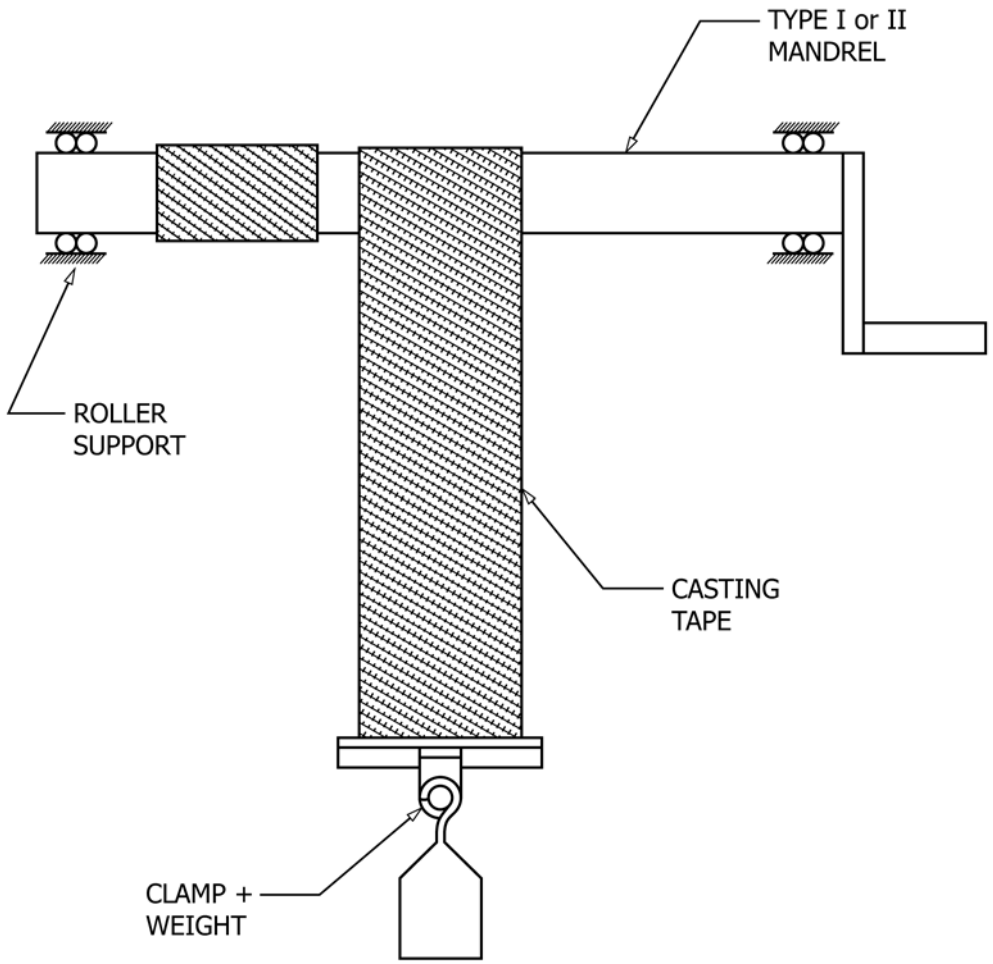

FIG. 1 Manual Preparation Method