



# Standard Test Method for Strength of Fiber Reinforced Polymer (FRP) Bent Bars in Bend Locations<sup>1</sup>

This standard is issued under the fixed designation D7914/D7914M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method determines the quasi-static ultimate strength of fiber reinforced polymer (FRP) composite bent bars commonly used as anchorages for stirrups in reinforced, prestressed, or post-tensioned concrete structures. This test method only applies to bars with a solid cross section.

1.2 FRP bent bars are often used in reinforced concrete applications to shorten the development length of the bar or to act as a tie or a stirrup to resist shear forces. Bent bars can be produced with varying angles of bend in order to fit their intended purpose.

1.3 For this test method, the FRP bars are bent at a 90 degree angle. In general, bars have a regular pattern of surface undulations, a coating of bonded particles, or both, that promote mechanical interlock between the bar and concrete.

1.4 The strength values provided by this method are short-term, quasi-static tensile strengths that do not account for sustained static or cyclic loading. If bars are to be used under high levels of sustained or repeated loading, additional material characterization may be required.

1.5 The characteristic values obtained from this test method are intended to represent the quasi-static ultimate strength of FRP bent bars with a tail length of twelve bar diameters.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.6.1 Within the text, the inch-pound units are shown in brackets.

1.7 *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 appro-*

*priate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
- C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D883 Terminology Relating to Plastics
- D3171 Test Methods for Constituent Content of Composite Materials
- D3878 Terminology for Composite Materials
- D5229/D5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials
- D7205/D7205M Test Method for Tensile Properties of Fiber Reinforced Polymer Matrix Composite Bars
- E4 Practices for Force Verification of Testing Machines
- E6 Terminology Relating to Methods of Mechanical Testing
- E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process
- E456 Terminology Relating to Quality and Statistics

## 3. Terminology

3.1 Terminology in **D3878** defines terms relating to high-modulus fibers and their composites. Terminology in **D883** defines terms relating to plastics. Terminology in **E6** defines terms relating to mechanical testing. Terminology in **E456** and in Practice **E122** define terms relating to statistics and the selection of sample sizes. In the event of a conflict between

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.