



Standard Test Method for Pull-Off Strength for FRP Laminate Systems Bonded to Concrete Substrate¹

This standard is issued under the fixed designation D7522/D7522M; 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 This test method describes the apparatus and procedure for evaluating the pull-off strength of wet lay-up or pultruded (shop-fabricated) Fiber Reinforced Polymer (FRP) laminate systems adhesively bonded to a flat concrete substrate. The test determines the greatest perpendicular force (in tension) that an FRP system can bear before a plug of material is detached. Failure will occur along the weakest plane within the system comprised of the test fixture, FRP laminate, adhesive and substrate.

1.2 This test method is primarily used for quality control and assessment of field repairs of structures using adhesive-applied composite materials.

1.3 This test method is appropriate for use with FRP systems having any fiber orientation or combination of ply orientations comprising the FRP laminate.

1.4 This test method is not appropriate for use as an “acceptance” or “proof” wherein the FRP system remaining intact at a prescribed force is an acceptable result.

1.5 Pull-off strength measurements depend upon both material and instrumental parameters. Different adhesion test devices and procedures will give different results and cannot be directly compared.

1.6 This test method can be destructive. Spot repairs may be necessary. The test method will result in an exposed cut FRP section; repair methods must consider the potential for moisture uptake through this cut section.

1.7 Prior to the installation of some adhesively bonded FRP systems, the substrate concrete must be patched (often to replace lost concrete volume). This test method is not appropriate for determining the pull-off strength of the FRP from the patch material. An additional test method is required to determine the pull-off strength of the patch from the substrate

concrete. Throughout this standard, “substrate” is understood to mean the concrete or concrete patch material to which the FRP is adhered.

1.8 The values stated in either SI units or inch-pound units are to be regarded as standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.9 *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:²

C125 Terminology Relating to Concrete and Concrete Aggregates

D883 Terminology Relating to Plastics

D3878 Terminology for Composite Materials

D5229/D5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials

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

3. Terminology

3.1 *Definitions*—Terminology **D3878** defines terms relating to high-modulus fibers and their composites. Terminology **D883** defines terms relating to plastics. Terminology **E6** defines terms relating to mechanical testing. Terminology **C125** defines terms relating to concrete. In the event of a conflict between terms, Terminology **D3878** shall have precedence over the other standards.

¹ This test method is under the jurisdiction of ASTM Committee **D30** on Composite Materials and is the direct responsibility of Subcommittee **D30.10** on Composites for Civil Structures.

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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.