



Designation: D 5117 – 03

# Standard Test Method for Dye Penetration of Solid Fiberglass Reinforced Pultruded Stock<sup>1</sup>

This standard is issued under the fixed designation D 5117; 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 dye-penetrant test method covers a means of evaluating solid fiberglass reinforced pultruded rod stock for longitudinal wicking. There are generally three mechanisms that promote wicking, any or all of which may be operating at a given time.

NOTE 1—The specimen's cross-section may reflect delaminations, longitudinal continuous voids, or the presence of hollow fibers, or all three. Occasionally these flaws may be detected by this test, but other tests are usually required.

1.2 The results of a wicking test are dependent on specimen type and size, penetrant type, time of exposure in the penetrant, penetrant viscosity, etc. Any attempt to use a wicking test to establish specification criteria should be made with great care.

1.3 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 nonconformance with the standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see 10.3 and 10.6.

NOTE 2—There is no similar or equivalent ISO standard.

## 2. Referenced Documents

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

D 618 Practice for Conditioning Plastics for Testing

D 3918 Definitions of Terms Relating to Reinforced Plastic Pultruded Products

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.18 on Reinforced Thermosetting Plastics.

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<sup>2</sup> 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.

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

## 3. Terminology

### 3.1 Definition of Term Specific to This Standard:

3.1.1 *wicking*—transmission of a gas or liquid due to pressure differential or capillary action along fibers incorporated in a fiberglass reinforced pultruded product.

## 4. Summary of Test Method

4.1 Pultruded rod stock of circular cross-section is tested by placing the specimen(s) on end into the dye penetrant to a specified depth and observing the wicking action as spots, or dots, on the opposite, dry face.

4.2 The wicking action through the length of the specimen is due to the capillary action of the penetrant through the open pathways in the composite. These pathways are typically occupied by air and can be caused by continuous voids, cracks, or hollow fibers, or all three, in the reinforcement.

## 5. Significance and Use

5.1 This test method is useful for establishing the integrity of composite rod. The presence of voids, cracks, and hollow fibers are considered detrimental to the structural integrity of the composite and may cause reduced electrical resistance and increased current leakage.

5.2 A perfect composite would be flaw-free, and there would be no possibility of wicking. Composites of this type are virtually nonexistent, as there will typically be entrapped air in the resin developed during manufacture, occasional hollow fibers, and occasional cracks due to thermal stresses.

5.3 This test method is intended to provide a tool for measuring the extent of flaws in a composite over very short lengths of material. The presence of wicking over 1 in. [2.54 cm] lengths may not necessarily imply that the composite will perform unsatisfactorily for its intended end-use. Therefore, interpretation of test results should be made with care.

5.4 This test method was developed as a technique for estimating quality and consistency of pultruded rod stock, which is a composite of resin and reinforcement. The process

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