



Designation: **D7992/D7992M—15 D7992/D7992M – 23**

Standard Practice for Elevated Temperature and Moisture Conditioning of Pultruded Fiber Reinforced Polymer (FRP) Composites Used in Structural Designs¹

This standard is issued under the fixed designation D7992/D7992M; 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~~ Scope*

1.1 In general, it is feasible that the mechanical properties of FRP composites will be affected by environmental conditions such as exposure to moisture at elevated temperatures. In order to make reliable comparisons between different materials under elevated temperature and moisture environmental conditions, it is necessary to standardize the elevated temperature and moisture conditions to which specimens of these materials are subjected prior to and during testing. This practice defines procedures for elevated temperature and moisture conditioning of pultruded FRP composites intended for use in structural design applications. The conditioning medium representing elevated temperature and moisture exposure described in this standard practice is distilled water maintained at $37.8 \pm 1.5^\circ\text{C}$ ($100 \pm 3^\circ\text{F}$) [$100 \pm 3^\circ\text{F}$] for 1000 hours.

1.2 *Units*—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~~ are not necessarily exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems ~~may~~ has the potential to result in nonconformance with the 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~~ safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[D618 Practice for Conditioning Plastics for Testing](#)

[D883 Terminology Relating to Plastics](#)

[D3918 Terminology Relating to Reinforced Plastic Pultruded Products](#) (Withdrawn 2020)³

[D6641/D6641M Test Method for Compressive Properties of Polymer Matrix Composite Materials Using a Combined Loading Compression \(CLC\) Test Fixture](#)

¹ 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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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.

³ The last approved version of this historical standard is referenced on www.astm.org.

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

D7290 Practice for Evaluating Material Property Characteristic Values for Polymeric Composites for Civil Engineering Structural Applications
D7745 Practice for Testing Pultruded Composites

3. Terminology

3.1 Definitions:

3.1.1 *standard laboratory temperature, n*—a temperature of $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$)[$73.4 \pm 3.6^\circ\text{F}$]

3.1.2 *standard laboratory atmosphere, n*—an atmosphere having a temperature of $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$)[$73.4 \pm 3.6^\circ\text{F}$] and a relative humidity of $50 \pm 10\%$.

3.1.3 *elevated temperature and moisture resistance, n*—the ability of a thermoset pultruded composite to withstand elevated temperature and moisture exposure at $37.8 \pm 1.5^\circ\text{C}$ ($100 \pm 3^\circ\text{F}$)[$100 \pm 3^\circ\text{F}$] for 1000 hours. This ability will be quantified in terms of the % retention of the mechanical property of interest as compared to samples held at standard laboratory atmosphere.

3.2 Terminology relating to pultruded composites is found in Terminology **D3918**.

4. Significance and Use

4.1 The elevated temperature and moisture conditioning procedures prescribed in this practice are designed to provide a standard procedure to be used to evaluate and compare the effect of elevated temperature and moisture conditioning under controlled laboratory conditions on pultruded FRP composites to be used in structural design applications. The conditioning procedures prescribed in this practice are designed to obtain reproducible results to compare and evaluate these materials but are not intended to produce equilibrium conditions or actual service conditions for these materials.

5. Sampling

5.1 Sampling shall be in accordance with the locations from which test specimens shall be taken from the reinforced pultruded composites as defined in Practice **D7745**.

5.2 Sampling shall be in accordance with the ASTM test methods for the specific mechanical properties to be determined.⁴

6. Test Specimens

6.1 The numbers and types of test specimens shall be in accordance with the ASTM test methods for the specific mechanical properties to be determined. If Practice **D7290** is to be used to determine characteristic values for a particular mechanical property, at least ten samples are needed for the control and ten samples are needed for the elevated temperature and moisture conditioning for a total of at least 20 samples.

6.2 Test specimens shall be machined or otherwise fabricated to the test coupon geometry specified by the ASTM test method for the property to be determined prior to their exposure to the environmental conditioning.

6.3 The thickness of the test specimens shall be the original product thickness without any machining of the surface. The specimen thickness needs to be compatible with the thickness requirements of the mechanical property test method that will be used to evaluate the samples.

6.4 All test specimens shall be conditioned in the standard laboratory atmosphere in accordance with Practice **D618**, Procedure A prior to initiating the elevated temperature and moisture conditioning procedures described here.

⁴ To evaluate the effect of elevated temperature and moisture conditioning on the matrix and fiber/matrix interface of a pultruded composite material, the use of Test Method **D6641/D6641M** for mechanical property determination is suggested. To evaluate the effect of freeze/thaw cycling on the matrix and fiber/matrix interface of a pultruded composite material, the use of Test Method **D6641/D6641M** for mechanical property determination is suggested. If other property effects are to be examined, appropriate test methods for the desired property should be selected.