



Designation: D8505/D8505M – 23

Standard Specification for Basalt and Glass Fiber Reinforced Polymer (FRP) Bars for Concrete Reinforcement¹

This standard is issued under the fixed designation D8505/D8505M; 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 specification covers basalt and glass fiber reinforced polymer (BFRP and GFRP, respectively) bars, provided in straight (longitudinal) cut lengths, of solid round cross-section, and having a surface enhancement for internal concrete reinforcement applications. Bars covered by this specification shall meet the requirements for geometric, material, mechanical, and physical properties as described herein.

1.2 Subsection 1.6 defines the type of FRP bars that are out of the scope of this specification.

1.3 Bars produced according to this standard are qualified using the test methods and must meet the requirements given in Table 1. Quality control and certification of production lots of bars are completed using the test methods and must meet the requirements given in Table 2.

1.4 The standard sizes and dimensions of FRP bars and their number designations are given in Table 3.

1.5 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables) shall not be considered as requirements of the specification.

1.6 The following FRP bar materials are not covered by this specification:

1.6.1 Bars made of more than one load-bearing fiber types or different grade fibers (that is, hybrid FRP).

1.6.2 Bars made from fibers other than glass or basalt.

1.6.3 Bars having no external surface enhancement (that is, plain or smooth bars, or dowels).

1.6.4 Bars with geometries other than solid, round cross sections.

1.6.5 Pre-manufactured grids and gratings made with FRP materials.

1.6.6 Bent bars (that is, bars that are not made of straight, continuous lengths).

NOTE 1—Bent bars may include stirrups and hoops. Refer Specification D7957/D7957M for GFRP bent bar specifications.

1.7 This specification is applicable for either SI (as Specification D8505M) or US units (as Specification D8505).

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.10 *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.*

¹ This specification 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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TABLE 1 Property Limits and Test Methods for Qualification^A

Property	Limit	Test Method
Mean Glass Transition Temperature	≥ 100 °C [212 °F] (DSC) ≥ 110 °C [230 °F] (DMA)	E1356 D7028 E2160
Mean Degree of Cure	≥ 95 %	
Mean Measured Cross-Sectional Area	Table 3	D7205/D7205M, subsection 11.2.4.1
Guaranteed ^B Ultimate Tensile Force	Table 3	
Guaranteed Ultimate Tensile Strength	Report value	
Mean Tensile Modulus of Elasticity	≥ 60 000 MPa [8 700 000 psi]	D7205/D7205M
Mean Tensile Modulus of Elasticity (using measured Cross-Sectional Area)	Report value	
Mean Ultimate Tensile Strain	≥ 1.1 %	
Mean Transverse Shear Strength	≥ 152 MPa [22 000 psi]	D7617/D7617M
Mean Apparent Horizontal Shear Strength	≥ 37.9 MPa [5 500 psi]	D4475
Mean Bond Strength	Table 3	D7913/D7913M
Mean Moisture Absorption	≤ 0.25 % in 24 hrs. at 50 °C [122 °F], and ≤ 1.0 % to saturation at 50 °C [122 °F]	D570, subsection 7.4
Mean Alkaline Resistance	≥ 80 % of initial mean ultimate tensile force following 90 days at 60 °C [140 °F]	D7705/D7705M, Procedure A
	≥ 75 % of initial mean ultimate tensile force following 90 days at 60 °C [140 °F]	D7705/D7705M, Procedure B set an initial tensile strain equal to 3000 microstrain

^A For the determination of the mean and guaranteed properties, at least 24 specimens (that is, test repetitions) shall be obtained in groups of eight or more from three or more different production lots. The mean and guaranteed properties shall satisfy the limits.

^B Guaranteed property is defined in 3.2.2.

TABLE 2 Property Limits and Test Methods for Quality Control and Certification of Production Lots^A

Property	Limit	Test Method
Fiber Mass Content	≥ 70 %	D2584 or D3171
Glass Transition Temperature	≥ 100 °C [212 °F] (DSC) ≥ 110 °C [230 °F] (DMA)	E1356 D7028 E2160
Degree of Cure	≥ 95 %	
Measured Cross-Sectional Area	Table 3	D7205/D7205M, subsection 11.2.4.1
Ultimate Tensile Force	Table 3	
Guaranteed Ultimate Tensile Strength	Report value	
Mean Tensile Modulus of Elasticity	≥ 60 000 MPa [8 700 000 psi]	D7205/D7205M
Mean Tensile Modulus of Elasticity (using measured Cross-Sectional Area)	Report value	
Ultimate Tensile Strain	≥ 1.1 %	
Mean Apparent Horizontal Shear Strength	≥ 37.9 MPa [5 500 psi]	D4475
Moisture Absorption in 24 h	≤ 0.25 % in 24 hrs. at 50 °C [122 °F]	D570, subsection 7.1

^A For the determination of each of the property limits, five random specimens (i.e. test repetitions) shall be obtained from each production lot. Each individual specimen shall satisfy the property limits.

TABLE 3 Geometric and Mechanical Property Requirements

Bar Designation Number	Nominal Dimensions		Measured Cross-Sectional Area Limits mm ² [in. ²]		Minimum Guaranteed Ultimate Tensile Force kN [kip]	Minimum Bond Strength MPa [psi]
	Diameter mm [in.]	Cross-Sectional Area mm ² [in. ²]	Minimum	Maximum		
M6 [2]	6.3 [0.250]	32 [0.049]	30 [0.046]	55 [0.085]	33 [7.4]	
M10 [3]	9.5 [0.375]	71 [0.11]	67 [0.104]	104 [0.161]	71 [16.0]	
M13 [4]	2.7 [0.500]	129 [0.20]	119 [0.185]	169 [0.263]	124 [27.9]	9.6
M16 [5]	15.9 [0.625]	199 [0.31]	186 [0.288]	251 [0.388]	181.5 [40.8]	[1400]
M19 [6]	19.1 [0.750]	284 [0.44]	268 [0.415]	347 [0.539]	254.9 [57.3]	
M22 [7]	2.2 [0.875]	387 [0.60]	365 [0.565]	460 [0.713]	337.2 [75.8]	
M25 [8]	25.4 [1.000]	510 [0.79]	476 [0.738]	589 [0.913]	422.1 [94.9]	7.6
M29 [9]	8.7 [1.128]	645 [1.00]	603 [0.934]	748 [1.159]	511.5 [115.0]	[1100]
M32 [10]	32.3 [1.270]	819 [1.27]	744 [1.154]	950 [1.473]	617.0 [138.7]	