



Designation: F711 – 17 (Reapproved 2022)

Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools¹

This standard is issued under the fixed designation F711; 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 insulating rods and foam-filled tubes made from fiberglass-reinforced plastic (FRP) that are intended for use in live line tools.

1.2 This specification does not include insulating foam-filled tubes and rods from other materials. Specifications for fittings and attachments to rods and foam-filled tubes for complete tools are not covered in this specification.

1.3 This specification establishes the technical characteristics that the tubes and rods must satisfy.

1.4 The following safety hazards caveat pertains only to the test method portion, Section 12, of this specification. *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.*

1.5 *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

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D638 Test Method for Tensile Properties of Plastics

D695 Test Method for Compressive Properties of Rigid Plastics

¹ This specification is under the jurisdiction of ASTM Committee F18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.35 on Tools & Equipment.

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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. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *acceptance test*—a type of test made at the option of the purchaser.

3.1.2 *design test*—a type of test made on a sample treated as representative of an industrial product. These tests will not generally be repeated in quantity production.

3.1.3 *insulating tubes and rods*—fiberglass-reinforced plastic (FRP) products manufactured using processes so that the tubes and rods produced will meet the electrical and mechanical tests prescribed in this specification.

3.1.4 *interior foam-filled tube*—homogeneous unicellular thermosetting foam filling with closed cells blown with non-combustible gases. The foam filling shall be bonded to the interior tube wall. The foam filling should be free of voids, separations, holes, cracks, etc.

3.1.5 *routine test*—a type of test made regularly on production material.

3.1.6 *visual inspection*—a visual check made to detect constructional defects.

4. Ordering Information

4.1 *Outside Diameter Sizes*—Foam-filled FRP tube and solid FRP rod shall meet the outside diameter dimensions shown in Table 1. The tolerances shown will assist in ensuring interchangeability with interfacing equipment.

4.2 Inspection of the material shall be agreed upon between the purchaser and the seller as part of the purchase contract.

5. Materials and Manufacture

5.1 Except for those test methods leading to destruction, neither the FRP tube, foam, or the bond between them shall deteriorate during the prescribed mechanical and electrical tests of this specification.

6. Physical Requirements

6.1 The materials shall conform to the diameters prescribed in Table 1 for tube and rod.

6.2 The standard sizes listed by nominal diameter are recommended and do not preclude the manufacture of other sizes or shapes.

TABLE 1 Standard Tube and Rod Outside Diameters

TYPE	Nominal Diameter		Min Diameter		Max Diameter	
	in.	(mm)	in.	(mm)	in.	(mm)
Tube	1	(25.4)	0.98	(24.9)	1.02	(25.9)
	1¼	(31.8)	1.22	(31.0)	1.27	(32.3)
	1½	(38.1)	1.47	(37.3)	1.53	(38.9)
	1¾	(44.5)	1.73	(43.9)	1.78	(45.2)
	2	(50.8)	1.97	(50.0)	2.04	(51.8)
	2½	(63.5)	2.47	(62.7)	2.54	(64.5)
	3	(76.2)	2.97	(75.3)	3.04	(77.2)
Rod	¾	(9.5)	0.369	(9.4)	0.385	(9.8)
	½	(12.7)	0.490	(12.4)	0.510	(13.0)
	⅝	(15.9)	0.610	(15.5)	0.635	(16.1)
	¾	(19.1)	0.720	(18.3)	0.765	(19.4)

7. Weight

7.1 It has not been found necessary to specify the weight of the product produced under this specification in order for it to comply with performance requirements.

8. Workmanship, Finish, and Appearance

8.1 The external surface shall be uniform, symmetrical, and free of abrasions, scratches, blemishes, and surface defects.

8.2 Any defect that may capture an impurity or impair the dielectric integrity of the product shall be cause for rejection.

8.3 FRP rod or tube material after which a finish coating, such as paint, is applied must meet all physical, electrical, and mechanical requirements.

9. Sampling

9.1 *Design Test*—Perform the test on a minimum of three samples only when changes are made to a new or existing design of the product that may affect the mechanical and electrical characteristics.

9.1.1 The design test will be used to qualify a specific item and normally will not be repeated during production.

9.2 *Sample Test*—A test specimen shall consist of one or more items, dependent on 1 % of the lot being tested.

9.2.1 A lot is represented either by all items produced in one production run or in one shipment.

9.2.2 Lots of new, unused items shall have test specimens selected at random.

9.3 *Routine Test*—Perform the test on all pieces delivered to the purchaser.

9.4 *Acceptance Test*—A test made at the option of the purchaser.

10. Conduct of Tests on Samples

10.1 Mechanical:

Test	Type	Material
Wicking	design	tube
Bending deflection	design	tube
Horizontal crush	design	tube
	acceptance	tube
Tension	design	tube
	design	rod
Shear	design	tube
Compression	design	rod
Modulus of elasticity (tension)	design	rod
Mechanical aging (flexure)	design	tube

Visual

Dimensional

10.2 *Electrical:*

Test

Dielectric current (leakage)
(before moisture conditioning)
Dielectric current (leakage)
(after moisture conditioning)
Withstand (either method 1 or 2)

Typ

design	rod
design	tube
design	rod
design	tube
routine	rod
routine	tube

11. Number of Tests and Samples (Three each)

11.1 Tubes:

11.1.1 *Wicking Test*—Three samples, each 1-in. (25-mm) long.

11.1.2 *Bending Deflection Test*—8 ft, 5 in. (2.6 m) or longer. See Fig. 13.

11.1.3 *Horizontal Crush Test*—Three diameters long. See Fig. 14.

11.1.4 *Tension Test*—12-in. (300-mm) long, prepared in accordance with Fig. 1 and Test Method D638.

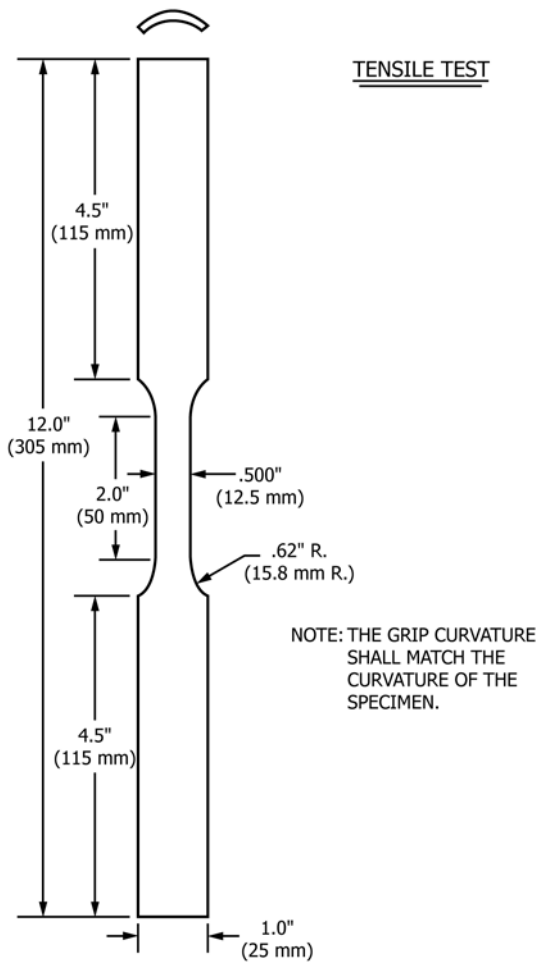


FIG. 1 Tension Test