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INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS

MATERIAL AND PROPERTY STANDARD

FOR

FIBERGLASS (GLASS FIBER REINFORCED THERMOSETTING RESIN) FITTINGS

IAPMO PS 82-95

I. PURPOSE

- 1.1** The purpose of this standard is to establish a generally acceptable standard for fiberglass (glass fiber reinforced thermosetting resin) fittings. Its purpose is to serve as a guide for producers, distributors, architects, engineers, contractors, installers, inspectors and users; to promote understanding regarding material, manufacture and installation; and to provide for identifying fiberglass (glass fiber reinforced thermosetting resin) fittings.
- 1.2** The provision of this standard are not intended to prevent the use of any alternate material or method of construction provided any such alternate meets the intent of this standard.

2. SCOPE

- 2.1** This standard covers glass fiber reinforced thermosetting resin adhesive joined pressure fittings for use with fiberglass pipe for conveyance of gases, petroleum products or corrosive fluids. This standard covers classification system and requirements for materials, mechanical properties, dimensions, performance, methods of test and methods of marking and identification.

3. REFERENCED DOCUMENTS

ASTM Standards:

D 543-87	Standard Test Method for Resistance of Plastic to Chemical Reagents
D 883-91a	Definitions of Terms Relating to Plastics
D 1599-88e1	Test Method for Short-Term Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
D 1600-91	Abbreviations of Terms Relating to Plastics
D 2444-84	Standard Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
D 2563-70(R87)e1	Standard Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts
D 3567-85	Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-

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4. DEFINITIONS

- 4.1 General.** Definitions are in accordance with ASTM D 883-91 and abbreviations with ASTM D 1600-91, unless otherwise indicated.
- 4.2** Description of terms specific to this standard are:
- 4.2.1 Reinforced Thermosetting Resin Fitting (RTRF).** Fiberglass fittings without aggregate.

5. MATERIALS

- 5.1 General.** The resins, reinforcements, colorants, fillers, and other materials, when combined as a composite structure, shall produce a fitting that shall be classified in accordance with this standard based on performance.

6. CLASSIFICATIONS & JOINING METHODS

- 6.1 General.** Fittings meeting this standard are classified by type, grade, class, pressure rating, and joining method. These types, grades, classes, pressure ratings and joining methods are as follows:
- 6.1.1 Types**
- 6.1.1.1 Type 1.** Compression molded fittings made from a molding compound containing glass, resin and other materials. External pressure and heat applied by a closed mold forms and cures the molding compound.
- 6.1.1.2 Type 2.** Resin transfer molded fittings made by injecting thermosetting resin into closed match molds containing glass reinforcement.
- 6.1.1.3 Type 3.** Contact molded fittings made by applying thermosetting resin impregnated fiberglass reinforcement to a mold or resin rich liner.
- 6.1.1.4 Type 4.** Mitered fittings made by connecting mitered fiberglass pipe (RTRP) with thermosetting resin impregnated fiberglass reinforcement applied to the pipe outside and/or diameter.
- 6.1.2 Grades**
- 6.1.2.1 Grade 1.** Glass fiber reinforced epoxy resin fittings.

6.1.2.2 Grade 2. Glass fiber reinforced polyester resin fittings.

6.1.2.3 Grade 7. Glass fiber reinforced furan resin fittings.

6.1.3 Classes

6.1.3.1 Class A. No liner.

6.1.3.2 Class B. Polyester resin liner, non-reinforced.

6.1.3.3 Class C. Epoxy resin liner, non-reinforced.

6.1.3.4 Class E. Polyester resin liner, reinforced.

6.1.3.5 Class F. Epoxy resin liner, reinforced.

6.1.3.6 Class I. Furan resin liner, reinforced.

6.1.4 Pressure rating designation in accordance with 7.3 are shown in Table 1.

Table 1
Pressure Categories

Designation	Pressure Rating, kPa (psig)
A	172 (25)
B	345 (50)
C	690 (100)
D	1034 (150)
E	1379 (200)
F	1724 (250)
G	2069 (300)
H	2758 (400)
I	3448 (500)
J	6895 (1000)

6.1.5 Joining Methods

6.1.5.1 Method 1. Butt and strap joint made by applying thermosetting resin impregnated fiber-glass reinforcement to the pipe and fittings outside diameters.

6.1.5.2 Method 2. Tapered adhesive joint where pipe and fittings with matching tapers are joined with a suitable adhesive.

6.1.5.3 Method 3. Straight socket adhesive joint where a constant outside diameter pipe is joined into an essentially straight fittings socket with a suitable adhesive. Slight tapering of the socket may be included to provide for an interference fit.

- 6.2 Designation Code.** The fitting designation code shall consist of the abbreviation RTRF followed by the type and grade in Arabic numerals, the class and pressure rating designation in capital letters and the joining method in Arabic numerals. Thus a complete fittings designed code consists of four letters, two numerals, two letters and one numeral.

Example RTRF-12-BD-3. Such a designation would describe a compression molded reinforced polyester resin fitting having a polyester resin liner (non-reinforced), a 1034 Kpa (150 psig) rating, and straight socket adhesive joints.

7. DETAIL REQUIREMENTS

- 7.1 Workmanship.** The fittings shall be free from all defects, including indentations, delaminations, bubbles, pinholes, foreign inclusions, and resin-starved areas which, due to their nature, degree or extent, detrimentally affect the strength and serviceability of the fitting. The fitting shall be as uniform as commercially practicable in color, opacity, density, and other physical properties. The fitting shall meet Visual Acceptance Level II in accordance with 8.1.
- 7.2 Dimensions and Tolerances.** The fittings shall be manufactured with center line to end dimensions, minimum wall thickness, joint dimensions, and tolerances as shown in Section 9. Dimensions shall be measured in accordance with Section 8.2.
- 7.3 Hydrostatic Pressure.** Each fitting and coupling in its field jointed configuration shall sustain an unrestrained hydrostatic test pressure of three times its rated pressure for fifteen (15) minutes without visible weeping and leakage. The field jointed configuration shall include any adhesive or butt and strap joint used with the fitting and coupling being tested. Hydrostatic testing is to be in accordance with 8.3.
- 7.4 Chemical Resistance.** The average percentage ultimate stress retention shall be at least 85% when tested in accordance with Section 8.4. The weight change of the corrosion barrier shall be +10% -1% when tested in accordance with Section 8.5.
- 7.5 Impact Resistance.** The average impact strength shall be a minimum of 3 ft. lbs. (4.1 Nm) when tested in accordance with Section 8.6.

8. TEST METHODS

- 8.1 Visual Acceptance Levels.** Determine in accordance with ASTM D 2563-70(R87)e1.
- 8.2 Dimensions and Tolerances.** Determine in accordance with ASTM D 3567-85.
- 8.3 Hydrostatic Pressure.** Determine in accordance with ASTM D 1599-88e1.
- 8.3.1 Sampling.** Samples of fittings to determine conformance of the material to short-term

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rupture requirements shall be taken at random on a weekly basis or on each production run, whichever is the most frequent.

- 8.4 Chemical Resistance to Standard Reagents.** Determine in accordance with Annex A for each standard reagents listed in Table 2. Tests are to be performed for each type, grade, class and pressure rating of fitting produced. The construction is to be typical for 4" (101.6 mm) nominal size fittings.

Caution: Safety precautions should be taken to avoid personal contact, to eliminate toxic vapors, and to guard against explosion hazards in accordance with the hazardous nature of the particular reagents being used.

Table 2
Standard Reagents With Percentage By Weight
When Mixed With Deionized Water

Acetic Acid	(25%) CH_3COOH
Acetone	(10%) H_3CCOCH_3
Aniline	(100%) $\text{C}_6\text{H}_5\text{NH}_2$
Ethanol	(95%) $\text{H}_3\text{CCH}_2\text{OH}$
Ethyl Acetate	(100%) $\text{H}_3\text{CCO}_2\text{CH}_2\text{CH}_3$
Hydrochloric Acid	(15%) HCL
Methanol	(100%) H_3COH
Nitric Acid	(5%) HNO_3
Sodium Hydroxide Solution	(5%) NAOH
Sodium Hypochlorite	(10%) NAOCL
Sulfuric Acid	(25%) H_2SO_4
Toluene	(100%) $\text{C}_6\text{H}_5\text{CH}_3$
Water, Deionized	(100%) H_2O

- 8.5 Corrosion Barrier Weight Gain.** Determine in accordance with ASTM D 543-87, the weight gain of a representative fitting corrosion barrier. The corrosion barrier tested shall have the same glass and resin construction as used in the class of fitting. Test shall be performed in standard reagents per Section 8.4.
- 8.6 Impact Strength.** Determine in accordance with ASTM D 2444-84 using a Type C tup; ten (10) samples to be tested for each type, grade, class and pressure rating of fitting produced.
- 8.6.1** Samples to be per Section A-A. Figure A1, Annex 1, for each type, grade, class and pressure rating of fitting produced. The construction is to be typical for 4" (101.6 mm) nominal size fittings.

9. DIMENSIONS

- 9.1 General.** This section provides standard fitting geometries and laying lengths for glass

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fiber reinforced thermosetting resin fittings.

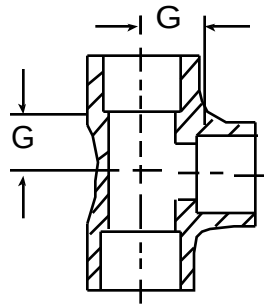
- 9.2** Fittings shall conform to the geometries and laying lengths as shown in Tables 3 through 16. Tolerance shall be as specified.

10. MARKINGS AND IDENTIFICATION

- 10.1** Each fitting shall be marked with the following:
- (a) Manufacturer's name or trademark;
 - (b) Nominal fitting size (e.g. 2 in. (50.8 mm)); and
 - (c) Identification of fiberglass fitting in accordance with the designation code given in Section 6.

Adopted: 1995

Table 3
Tees, mm (in.)



Nominal Pipe Size mm (in.)	90° Elbow $G \pm 1.6$ (1/16) mm (in.)
25 (1)	33 (1-5/16)
38 (1.5)	37 (1-7/16)
51 (2)	51 (2)
76 (3)	67 (2-5/8)
102 (4)	83 (3-1/4)
152 (6)	106 (4-3/16)
203 (8)	129 (5-1/16)
254 (10)	208 (8-3/16)
305 (12)	233 (9-3/16)
356 (14)	467 (18-3/8)