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.

Designation: F667/F667M – 16 (Reapproved 2021)

Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings[1]

This standard is issued under the fixed designation F667/F667M; 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 requirements and test methods for materials, workmanship, dimensions, perforations, pipe stiffness, elongation, joint separation resistance, quality of extruded polyethylene, brittleness, bond, and marking of corrugated polyethylene (PE) pipe and fittings. It covers nominal sizes 3 in. [76 mm], 4 in. [102 mm], 5 in. [127 mm] 6 in. [152 mm], 8 in. [203 mm], 10 in. [254 mm], 12 in. [305 mm], 15 in. [381 mm], 18 in. [457 mm], and 24 in. [610 mm].

1.2 This specification covers tubularly extruded, spirally laminated, and rotationally molded corrugated polyethylene pipe.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 The following precautionary caveat pertains only to the test method portion, Section 9, 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]

D618 Practice for Conditioning Plastics for Testing

D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

D2444 Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

F412 Terminology Relating to Plastic Piping Systems

F449 Practice for Subsurface Installation of Corrugated Polyethylene Pipe for Agricultural Drainage or Water Table Control

2.2 *Federal Standard:*[3]

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.3 *Military Standard:*[3]

MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 *Definitions*—Definitions used in this specification are in accordance with Terminology F412, unless otherwise noted.

3.2 *Definitions:*

3.2.1 *split*—any break or crack that extends through the wall.

3.2.2 *crease*—a deformation that cannot be removed like a dent: generally associated with wall buckling.

4. Significance and Use

4.1 Corrugated PE pipe and fittings are intended for underground applications where soil provides support to their flexible walls. Their major use is to collect or convey drainage water, or both.

4.2 *Exclusions from Recommended Use:*

4.2.1 Exposure to flame at any time,

4.2.2 Permanent exposure to sunlight or weathering, or both, and

4.2.3 Exposure to chemicals, other than those normally found in ground water, whose compatibility with the tubing and fittings is not known.

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.65 on Land Drainage.

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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] DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 http://quicksearch.dla.mil/

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

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5. Materials

5.1 *Basic Materials*—Compounds used in the manufacture of corrugated PE drainage pipe and fittings shall have a minimum cell classification of 323410C or 333410C as defined and described in Specification D3350. Compounds that have a higher cell classification in one or more properties are acceptable, provided the product requirements are met.

NOTE 1—Class B pigments may be substituted for Class C provided that ultraviolet protection is acceptable to the publisher as satisfactory for the intended use.

5.2 *Rework Material*—Clean rework material, generated from the manufacturer's own production of the product, may be used by the manufacturer provided that the tubing and fittings produced meet all requirements of this specification.

6. General Requirements

6.1 *Workmanship*—The pipe and fittings shall be homogenous throughout and essentially uniform in color, opacity, density, and other properties. The inside and outside surfaces shall be semimatte or glossy in appearance (depending on the type of plastic) and free of chalking, sticky, or tacky material. The pipe and fitting walls shall be free of cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that may affect the wall integrity. Holes deliberately placed in perforated pipe are acceptable. The surface shall be free of excessive bloom. Bloom or chalking may develop in pipe exposed to the direct rays of the sun (ultraviolet radiant energy) for extended periods; consequently, these requirements do not apply to pipe and fittings after extended exposure to direct rays of the sun.

NOTE 2—Wall thickness may vary within each corrugation. Variation is acceptable provided the tubing meets all physical requirements.

7. Detail Requirements

7.1 *General:*

7.1.1 The following requirements shall be met by perforated or nonperforated pipe, as applicable.

7.1.2 Individual results shall be used to determine compliance with the requirements, unless otherwise stated.

7.2 *Dimensions and Tolerances:*

7.2.1 *Pipe:*

7.2.1.1 *Nominal Diameter*—The nominal diameter of the pipe shall be the average inside diameter rounded to the nearest whole number.

7.2.1.2 *Inside Diameter*—The tolerance on the nominal inside diameter shall be +3 %; −1.5 %, when measured in accordance with 9.3.

7.2.1.3 *Length*—The pipe may be sold in any length agreeable to the user. Length shall not be less than 99 % of stated quantity, when measured in accordance with 9.4.

7.2.2 *Fittings:*

7.2.2.1 The maximum allowable gap between pipe and fitting shall not exceed ⅛ in. [3 mm] unless otherwise specified.

7.3 *Perforations:*

7.3.1 *Drainage Pipe*—When perforations are necessary, they shall be cleanly cut and uniformly spaced along the length and circumference of the pipe in a size, shape, and pattern suited to the needs of the user.

7.3.2 The inlet area of the perforations shall be a minimum of 1 in.^{2}/ft [21 cm^2/m] of pipe, unless otherwise specified by the user.

7.4 *Pipe Stiffness*—The pipe shall have a minimum pipe stiffness of 30 psi [0.21 MPa] at 5 % deflection and 25 psi [0.18 MPa] at 10 % deflection, when tested in accordance with 9.5.

7.5 *Elongation*—Continuously extruded pipe that elongates more than 5 %, but less than 10 %, when tested in accordance with 9.6, shall meet the requirements of 7.4 when tested in accordance with 9.7. Pipe that elongates more than 10 % shall be rejected.

7.6 *Brittleness*—Pipe and fitting specimens shall be tested in accordance with 9.9.

7.7 *Bond*—The bond between layers of spirally laminated pipe shall be strong and uniform. There shall be no separation of layers when the pipe is deflected 20 %, in accordance with Test Method D2412, nor shall it be possible to separate the layers with the point of a knife when the pipe is in the deflected condition.

NOTE 3—This test may be conducted as a continuation of pipe stiffness testing as specified in 9.5.

NOTE 4—Until an ASTM specification for an acceptable stress-crack test is published, environmental stress cracking should be evaluated by the user on the basis of data furnished by the manufacturer.

7.8 *Fitting Requirements:*

7.8.1 The fittings shall not reduce or impair the overall integrity or function of the pipe line.

NOTE 5—Common corrugated fittings include in-line joint fittings, such as tees, Y's, reducers, couplers, elbows, and end caps. These fittings are installed internally or externally by various methods, such as snap-on, V-insertion, screw-on, or wrap around.

NOTE 6—Some corrugated fittings will not fit all pipe. Only fittings supplied or recommended by the pipe manufacturer should be used.

7.8.2 Joints made with couplers, installed in accordance with the manufacturer's instructions, shall not separate when tested in accordance with 9.8.

7.8.3 Fitting specimens shall not crack or split when tested in accordance with 9.9.

8. Sampling and Retest

8.1 *Sampling*—Samples of pipe and fittings sufficient to determine conformance with this specification shall be taken at random from stock by the testing agency. Samples shall be representative of the product type under consideration.

8.2 *Retest and Rejection*—If any test failure occurs, the pipe or fitting may be retested to establish conformity. The test shall be repeated on two additional samples from the same lot or shipment. If either of these two additional samples fail, the pipe or fitting does not comply with this specification.

9. Test Methods

9.1 *Conditioning Test Specimens*—Condition the specimen prior to test at 73.4 °F ± 3.6 °F [23 °C ± 2 °C] and 50 % ± 5 % relative humidity for not less than 40 h prior to the test, in

accordance with Procedure A in Practice D618 for those tests where conditioning is required, unless otherwise specified.

9.2 *Test Conditions*—Conduct tests in laboratory atmosphere of 73.4 °F ± 3.6 °F [23 °C ± 2 °C] and 50 % ± 5 % relative humidity, unless otherwise specified.

9.3 *Inside Diameter*—Measure the inside diameter of three 1 ft [300 mm] specimens, with any suitable device accurate to ±1/32 in. [0.8 mm], at two positions, namely, the block seam and 90° from the block seams, and average the six measurements.

9.4 *Length*—Measure pipe with any suitable device accurate to ±1/32 in. in 10 ft [1 mm in 3 m]. Make all measurements on the pipe while it is resting on a relatively flat surface, in a straight line, with no external tensile or compressive forces exerted on the pipe.

9.5 *Pipe Stiffness*—Select a minimum of three pipe specimens and test for pipe stiffness $F/\Delta y$, as described in Test Method D2412, except for the following conditions: (*1*) The test specimens shall be at least as long as the outside diameter; the exact length shall be an integer multiple of corrugation pitch. (*2*) Locate the first specimen of all tubularly extruded pipe in the loading machine with the imaginary line between the two corrugator seams (end view) parallel to the loading plates. The specimen must lay flat on the plate within 1/8 in. [3 mm] and may be straightened by hand bending at room temperature. Use the first location as a reference point for rotation of the other two specimens. Rotate the second specimen 45° and the third specimen 90°. Test each specimen in one position only. (*3*) The deflection indicator shall be readable and accurate to ±0.001 in. [±0.02 mm]. (*4*) The parallel plates must exceed the samples in length. (*5*) If the pipe under test has selfcoupling end sections, include a selfcoupling assembly as one of the three test lengths.

9.6 *Elongation*—Test a minimum of three specimens, each 60 in. [1.5 m] in length, for stretch resistance. Subject each test specimen to a longitudinal stretching force equal to 5 lb/in. of nominal inside diameter to a maximum of 50 lb, excluding the weight of the specimen. Hang the specimens in a vertical manner with the test force applied as a dead (hanging) weight to the bottom end of the pipe. The gauge length for determining percent elongation shall be the middle 3 ft [1 m] portion of the unstretched specimen. Apply the test weight gently, and allow it to remain for 3 min; then quickly measure the gauge length to the nearest 0.125 in. [3 mm] to determine elongation. Calculate elongation (E) as follows:

$$E, \% = \frac{\text{elongation} \times 100}{\text{gauge length}}$$

Calculate the average of the three values.

9.7 *Pipe Stiffness While Elongated*—Test three 30 in. [762 mm] gauge lengths cut from the centers of the 60 in. [1.5 m] specimens for pipe stiffness at 5 % and 10 % deflection as described in Test Method D2412, except for the following conditions: (*1*) stretch the test specimen as shown in Fig. 1 to the same percent elongation as determined in 9.6 and test in this condition; (*2*) support the test specimen on a rigid base plate 12 in. [305 mm] in length; and (*3*) apply a load plate 12 in. [305 mm] in length to the center portion of the 30 in. [760 mm] specimen.

9.8 *Joint-Separation Test*—Repeat the elongation test specified in 9.6 on two specimens with a coupling in the center of the specimens. Separation shall be considered a failure. Gauge length and stretch are omitted in this test.

9.9 *Brittleness*—Test pipe and fitting specimens in accordance with Test Method D2444, except six specimens shall be tested. Use Tup B weighing 5.5 lb [2.5 kg]; the height of the drop shall be 5 ft [1.5 m] for nominal pipe sizes 8 in. [203 mm] through 24 in. [610 mm]; the height of the drop shall be 1.8 ft [0.55 m] for nominal pipe sizes 3 in. [76 mm] though 6 in. [152 mm]. Use a flat-plate specimen holder. Condition the specimens for 24 h at a temperature of 25 °F ± 3.6 °F [–3.9 °C ± 2 °C], and conduct all tests within 60 s of removal from this atmosphere. The center of the falling tup shall strike on a corrugation crown for three specimens and between crowns for three specimens. Five nonfailures are acceptable. Fittings shall be assembled on appropriate size pipe for testing.

10. Installation

10.1 It is recommended that pipe and fittings shall be installed in accordance with Practice F449.

10.2 Defective sections may be removed and the line spliced in the field, where practicable.

11. Certification

11.1 Upon request of the user, the manufacturer shall provide certification that the product was produced and tested in accordance with this specification. This certification shall be furnished at the time of shipment.

12. Marking

12.1 Corrugated PE drainage pipe complying with this specification shall be marked with the designation number of

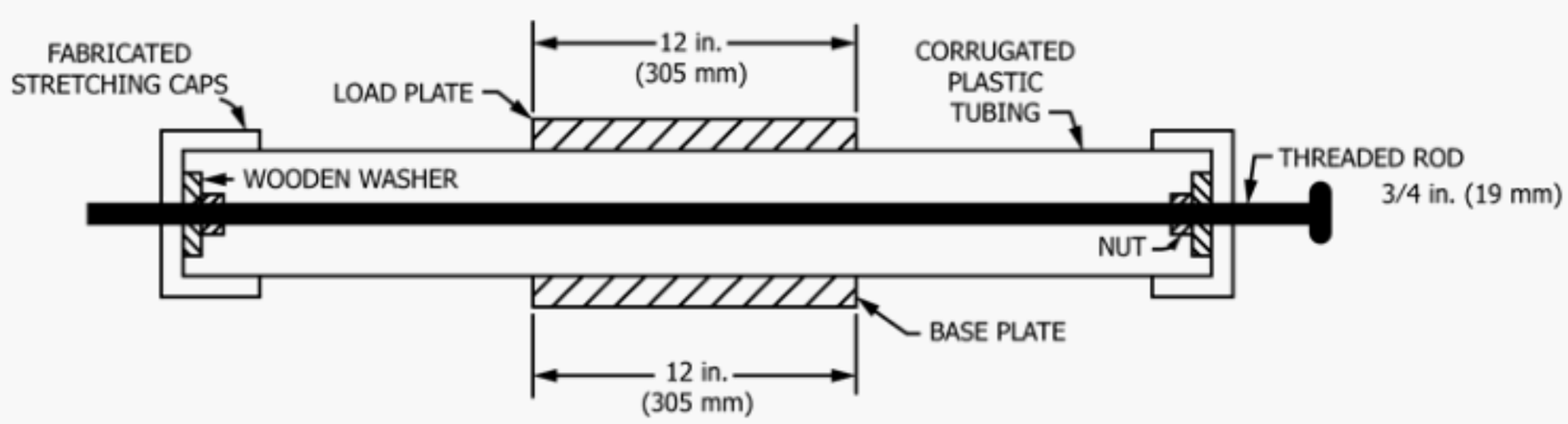

FIG. 1 Test Rig for Determining Stiffness While Elongated

this specification: ASTM F667, and with the manufacturer's identification symbol, regularly spaced at intervals not exceeding 10 ft [3 m].

12.1.1 *Dating*—Each unit of corrugated PE drainage pipe shall be marked with the day, month, and year. This date shall be permanently marked on the product.

12.2 Fittings for corrugated polyethylene pipe complying with this specification shall be marked with the designation number of this specification, ASTM F667, and with the manufacturer's identification symbol.

13. Report

13.1 The report shall include the following:

13.1.1 Date or dates of tests,

13.1.2 Complete identification of product tested, including size, nomenclature, manufacturer, previous history, if any, etc,

13.1.3 Description of manufacturer's product marking,

13.1.4 Conditioning method,

13.1.5 Details of sampling,

13.1.6 Weight per foot of each test specimen and the average weight,

13.1.7 Individual average test results of manufacture,

13.1.8 Notation describing any retest due to previous test failure, and

13.1.9 Description of terms.

14. Quality Assurance

14.1 When the product is marked with this designation, ASTM F667, the manufacturer affirms that the product was manufactured, inspected, sampled and tested in accordance with this specification and has been found to meet the requirements of this specification. When specified in the purchase order or contract, a report of the test results shall be furnished.

15. Keywords

15.1 corrugated; perforated; polyethylene; underdrain

SUPPLEMENTARY REQUIREMENTS

GOVERNMENT/MILITARY PRROCUREMENT

These requirements apply *only* to Federal/Military procurement, not domestic sales or transfers.

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification, where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1.1—In U.S. Federal contracts, the contractor is responsible for inspection.

S2. *Packaging and Marking for U.S. Government Procurement:*

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2.1—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this document.

APPENDIXES

(Nonmandatory Information)

X1. FITTINGS

X1.1 The actual inside diameter of a fitting typically exceeds the outside diameter of the pipe to permit the connection to be external to the pipe.

X1.2 The fittings should not reduce or impair the overall integrity or function of the pipe.

X1.3 Common corrugated fittings include in-line joint fittings, such as couplings and reducers, and branch or complementary assembly fittings, such as tees. These fittings may be installed by various methods, such as snap-on, screw-on, or wrap around, depending on the specific designs.

NOTE X1.1—Some corrugated fittings will not fit certain pipe. Only fittings supplied or recommended by the pipe manufacturer should be used.

X1.4 Fittings should not reduce the capacity of the pipe being joined. Reducer fittings should not reduce the cross-sectional area of the smaller size.

X2. AUTHORITIES

X2.1 Since this product has a wide variety of uses, approval for its use rests with various agencies. The installer should contact the relevant authority to obtain local installation guidelines. A partial list of authorities, according to product usage, is as follows:

X2.1.1 *Farm Drainage*—U.S. Department of Agriculture, Soil Conservation Service, local office: Reference, Engineering Standard 606.

X2.1.2 *Roadway Drainage*—Federal, state, county, or local highway authority.

X2.2 The pipe manufacturer should be able to provide proof of product acceptance by specific agencies, where appropriate.

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F667/F667M–15) that may impact the use of this standard. (Approved February 1, 2016)

(1) Section 7.3.2 was revised.

Committee F17 has identified the location of selected changes to this standard since the last issue (F667–12) that may impact the use of this standard.

(1) Section 9.9 was revised.

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