



# Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings<sup>1</sup>

This standard is issued under the fixed designation F405; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 This specification covers requirements and test methods for materials, marking dimensions, workmanship, elongation, brittleness, pipe stiffness, and perforations for corrugated polyethylene (PE) pipe and fittings in nominal sizes of 3 to 6 in., inclusive.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

NOTE 1—Sizes 8 to 15 in. are described in Specification F667.

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

1.4 The following precautionary caveat pertains only to the test methods portion, Section 8, 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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

- D618 Practice for Conditioning Plastics for Testing
- D1248 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

<sup>1</sup> 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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<sup>2</sup> 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.

- D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- F412 Terminology Relating to Plastic Piping Systems
- F667 Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

## 3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise specified. The abbreviation for polyethylene is PE.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *crack*—any break or split 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 support is given to the flexible walls. Their major uses are in soil drainage and septic field leach beds (see appendix for installation guidelines).

4.2 Corrugated fittings complying with the requirements of this specification may be used with either standard or heavy-duty pipe as defined by the requirements of Table 1.

## 5. Materials

5.1 *General*—Compounds used in the manufacture of corrugated PE drainage pipe and fittings shall conform with the requirements of Grade P14 Class C, Grade P23 Class C, Grade P33 Class C, or Grade P34 Class C, as defined and described in Specification D1248.

NOTE 2—Class B pigments may be substituted for Class C provided that ultraviolet protection is acceptable to the purchaser as satisfactory for the intended use.

5.2 *Rework Material*—The manufacturer shall use only his own clean pipe or fitting rework material; the pipe and fittings produced shall meet all the requirements of this specification.

## 6. Requirements

6.1 The pipe and fittings shall be homogeneous throughout and free of foreign inclusions or visible defects. The pipe and

**TABLE 1 Physical Test Requirements for Corrugated Plastic Pipe**

Physical Property Specified	Standard Pipe	Heavy-Duty Pipe
Pipe stiffness at 5 % deflection, min, MPa (psi)	0.17 (24)	0.21 (30)
Pipe stiffness at 10 % deflection, min, MPa (psi)	0.13 (19)	0.175 (25)
Elongation, max, %	10	5

fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties. The ends shall be cut squarely and cleanly. They shall be free of internal obstructions, including defective seams or mold registration lines. The product function shall be considered when judging external defects.

6.1.1 *Visible Defects*—Cracks, creases, splits, obstructions to flow in perforations or in pipe, uncolored or “pale” pipe, and obvious thin spots are not permissible.

NOTE 3—Wall thickness may vary within each corrugation. This variation is acceptable provided that the pipe meets all physical requirements.

NOTE 4—Defective sections may be removed and the line spliced in the field, where practical.

## 6.2 Dimensions:

6.2.1 *Nominal Size*—The nominal size for pipe and fittings shall be the inside diameter. Nominal diameters shall be sized in 1-in. increments beginning at 3 in.

6.2.2 *Inside Diameter*—The tolerance on the specified inside diameter shall be  $\pm 3\%$  when measured in accordance with 8.7.1.

6.2.3 *Length*—Corrugated PE pipe is an extruded product and 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 8.7.

6.2.4 *Perforations*—Perforations shall be cleanly cut and uniformly spaced along the length of the pipe, in a size, shape, and pattern to suit the needs of the specifier. Unless otherwise specified, each bed pipe shall have at least two rows of holes nominally  $\frac{1}{4}$  to  $\frac{3}{4}$  in. in diameter at a maximum of 5-in. (125-mm) centers, when measured in accordance with 8.7.3. Pipe shall be clearly marked with a locating stripe or embossment.

6.2.5 The actual inside diameter of a fitting will normally exceed the nominal diameter to permit the connection to be external to the pipe.

6.2.6 The maximum allowable gap between fitting and pipe shall not exceed the pipe perforation width unless otherwise specified.

6.2.7 All fittings shall be within an overall length dimension tolerance  $\pm \frac{1}{2}$  in. (12.7 mm) of the manufacturer’s specified dimensions.

## 6.3 Pipe Requirements:

6.3.1 *Pipe Stiffness*—Corrugated PE pipe shall have a minimum pipe stiffness as described in Table 1 when tested in accordance with 8.3. Pipe tested shall contain perforations if applicable.

NOTE 5—The 5 and 10 % deflection criteria, which were arbitrarily selected for testing convenience, should not be considered as limitations

with respect to in-use deflection. The engineer is responsible for establishing the acceptable deflection limit.

NOTE 6—The strength and load carrying capabilities of plastic drain and sewer pipe are measured and reported as pipe stiffness which is determined in accordance with Test Method D2412. The term “crush strength” is not applicable to plastic piping because ( 1 ) the values obtained can be significantly different, depending on the bedding, loading, or testing technique used; and ( 2 ) the term derives from rigid pipe and refers to its ultimate strength at rupture.

## 6.3.2 Elongation:

6.3.2.1 The pipe shall be tested in accordance with 8.4. The test specimens shall contain perforations if applicable. Three specimens shall be tested and the average elongation calculated.

6.3.2.2 This test is intended for continuously extruded pipe only. Individually blown molded pipe, due to its short length, is exempted from the test unless installed in tension.

6.3.2.3 The average elongation shall meet the requirements of Table 1. For pipe having a higher elongation, the specimens shall meet the requirements of 6.3.3.

6.3.3 *Pipe Stiffness While Elongated*— Pipe having an elongation greater than permitted by Table 1 shall be further tested in accordance with 8.5. Three specimens shall be tested; the average value shall meet the pipe stiffness requirements of Table 1 in the stretched condition in order to be considered acceptable under this specification.

## 6.4 Fitting Requirements:

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

6.4.2 Common corrugated fittings include in-line joint fittings, such as couplings and reducers, and branch or complementary assembly fittings, such as tees, Y’s, downspout adapters, and end caps. These fittings are installed by various methods, such as snap-on, screw-on, or wrap around.

NOTE 7—Some corrugated fittings will not fit all pipes. Only pipe supplied or recommended by the pipe manufacturer should be used.

6.4.3 Fittings shall not reduce the waterway of the pipe being joined. Reducer fittings shall not reduce the cross-sectional area of the smaller size.

6.4.4 Pipe and joint fittings shall not separate when tested in accordance with 8.8.

6.4.5 The fitting shall not crack, split, or crease when tested in accordance with 8.9.

6.4.6 The design of the fittings shall be such that when connected with the pipe, the axis of the assembly will be level and true when tested in accordance with 8.10.

6.5 *Brittleness*—There shall be no cracking of the pipe wall when tested in accordance with 8.6, except as specified in 6.5.1 and 6.5.2.

6.5.1 Cracks with a maximum chord length of 10 mm that originate at a perforation or at either end of the sample shall not be cause for rejection.

6.5.2 Splitting along a pipe seam or mold parting line is not caused by brittleness and should be evaluated as a workmanship defect as described in 6.1, if no split exceeds 50 mm in chord length.