



# Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe<sup>1</sup>

This standard is issued under the fixed designation D2609; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This specification covers plastic insert fittings for polyethylene (PE) plastic pipe, and also PVC insert fittings for PE to PVC pipe transitions. Included are requirements for materials, workmanship, dimensions, and burst pressure.

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

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 safety hazards 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, 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:<sup>2</sup>

- D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- D618 Practice for Conditioning Plastics for Testing
- D638 Test Method for Tensile Properties of Plastics

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.10 on Fittings.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D789 Test Method for Determination of Relative Viscosity of Concentrated Polyamide (PA) Solutions
- D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1784 Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
- D2239 Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- D2466 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- F412 Terminology Relating to Plastic Piping Systems
- F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings
- 2.2 NSF/ANSI Standards:<sup>3</sup>
  - NSF/ANSI Standard No. 14 for Plastic Piping Components and Related Materials
  - NSF/ANSI Standard No. 61 for Drinking Water System Components—Health Effects

## 3. Terminology

3.1 Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

## 4. Classification

4.1 This specification covers one class of fittings suitable for use with PE plastic pipe that meet the requirements of applicable ASTM specifications, at present, this is Specification D2239.

4.2 This specification also covers fittings that transition from PE plastic pipe to Socket Type IPS PVC plastic pipe.

## 5. Materials

5.1 *Types of Plastics*—The fittings shall be made from one of the following plastics:

<sup>3</sup> Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.

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

5.1.1 Nylon plastics (NP) meeting the requirements of either Type I or Type II (except Grade 2A) in Test Methods D789.

5.1.2 Propylene plastic (PP) with a minimum tensile strength at yield of 24.0 MPa (3410 psi) when tested in accordance with Test Method D638 at a speed of 51 mm/min (2.0 in./min), an Izod impact resistance at 23 °C of at least 30 J/m (0.6 ft–lbf/in.) when tested in accordance with Method A of Test Methods D256, and a minimum deflection temperature of 64 °C at 455 KPa stress when tested in accordance with Test Method D648.

5.1.3 Poly(vinyl chloride) plastics (PVC) meeting the requirements of 12454 or 14333, in Specification D1784.

5.2 *Rework Material*—The manufacturers shall use only their own clean rework fitting material and the fittings produced shall meet all the requirements of this specification. The types of materials specified in 5.1 shall not be mixed with one another.

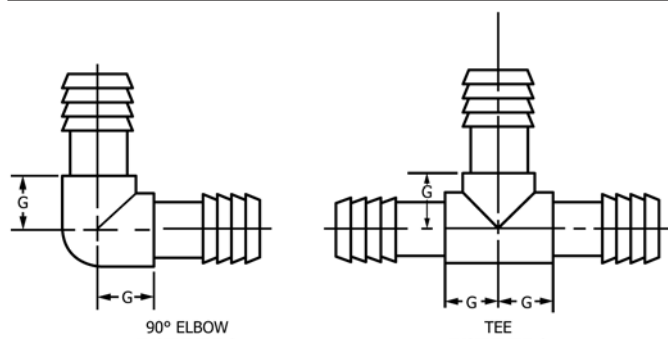
## 6. Requirements

6.1 *Dimensions and Tolerances*—The dimensions and tolerances shall be as shown in Tables 1-3 when measured in accordance with 8.4. The negative tolerance on all minimum dimensions is zero.

6.1.1 *Alignment*—The alignment of all openings of fittings shall be within ¼ in./ft.

6.1.2 *Fittings Not Illustrated*—All fittings, whether illustrated in Tables 1-3 or not, shall have insert ends in accordance with Table 1 or threaded ends in accordance with Table 3. For insert ends, which have more than four barbs, the first four barbs, starting from the open end of the fitting connection, shall meet all requirements of Table 1. The remaining barbs shall also meet Table 1, with the exception that mold marks left as a result of the manufacturing process, such as ejector pin marks, are exempt from the “V” dimension requirement, and

TABLE 2 Dimensions<sup>A</sup> of Insert Elbow and Tee, in. (mm)



Nominal Pipe Size <sup>B</sup>	Laying Length Tee and Elbow, min G
½	0.344 (8.7)
¾	0.453 (11.5)
1	0.625 (15.9)
1¼	0.781 (19.8)
1½	0.875 (22.2)
2	1.125 (28.6)
2½	1.625 (41.3)
3	1.875 (47.6)
4	2.438 (61.9)

<sup>A</sup> The sketches and designs of fittings shown are illustrative only.

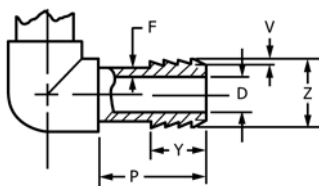
<sup>B</sup> For dimensions not given in this table, see Table 1.

the minimum requirement for “Z.” D, Z<sub>max</sub>, and F apply in all cases. For designs where the entire fitting end is barbed, such as “F” cannot be readily measured, “F” shall be calculated as  $[(Z - 2V) - D] / 2$ .

6.1.3 *Threads*—For all fittings having taper pipe threads, threads shall conform to Specification F1498 and be gaged in accordance with 8.6.

6.1.4 *Fittings that transition from PE plastic pipe to IPS size PVC plastic pipe*—All PE and IPS PVC transition fittings shall

TABLE 1 Dimensions of Insert End,<sup>A</sup> in. (mm)

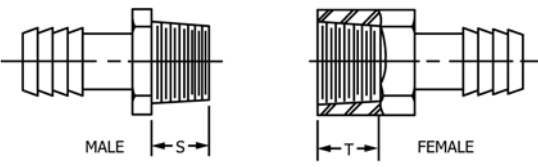


Nominal Pipe Size	Insert Length, P min	Barbs				Depth, V min	Wall Thickness, F min	Inside Diameter of Fitting, D min
		Length, Y min	Outside Diameter, Z <sup>B</sup>		Number			
			max	min	min			
½	1¼ (31.8)	¾ (19.0)	0.665 (16.9)	0.635 (16.1)	4	0.015 (0.4)	0.080 (2.0)	0.406 (10.3)
¾	1¼ (31.8)	¾ (19.0)	0.865 (22.0)	0.835 (21.2)	4	0.015 (0.4)	0.085 (2.2)	0.562 (14.3)
1	1¼ (31.8)	¾ (19.0)	1.095 (27.8)	1.065 (27.0)	4	0.020 (0.5)	0.100 (2.5)	0.750 (19.0)
1¼	1¼ (31.8)	¾ (19.0)	1.425 (36.2)	1.395 (35.4)	4	0.025 (0.6)	0.110 (2.8)	0.995 (25.3)
1½	1½ (38.1)	¾ (19.0)	1.665 (42.3)	1.630 (41.4)	4	0.030 (0.8)	0.110 (2.8)	1.125 (28.6)
2	1½ (38.1)	¾ (19.0)	2.125 (54.0)	2.085 (53.0)	4	0.030 (0.8)	0.110 (2.8)	1.656 (42.1)
2½	2 (50.8)	1 (25.4)	2.520 (64.0)	2.487 (63.2)	4	0.030 (0.8)	0.120 (3.0)	2.062 (52.4)
3	2½ (54.0)	1½ (28.6)	3.125 (79.4)	3.086 (78.4)	4	0.030 (0.8)	0.125 (3.2)	2.600 (66.0)
4	3 (76.2)	1¼ (31.8)	4.090 (103.9)	4.044 (102.7)	4	0.030 (0.8)	0.130 (3.3)	3.525 (89.5)

<sup>A</sup> The sketches and designs of fittings shown are illustrative only. The dimensions specified shall govern in all cases.

<sup>B</sup> Outside diameter maximum and minimum apply to each individual measurement, not the average of the four (see 8.4).

**TABLE 3 Dimensions<sup>A</sup> of Insert Adapters with Pipe Thread End, in. (mm)**



Nominal Pipe Size, <sup>B</sup> Insert End and Pipe Thread <sup>C</sup>	Length of Thread, min	
	Male, S	Female, T
1/2	0.53 (13.5)	0.64 (16.2)
3/4	0.55 (14.0)	0.65 (16.5)
1	0.68 (17.3)	0.81 (20.6)
1 1/4	0.71 (18.0)	0.85 (21.6)
1 1/2	0.72 (18.3)	0.85 (21.6)
2	0.76 (19.3)	0.90 (22.9)
2 1/2	1.14 (28.9)	1.21 (30.7)
3	1.20 (30.5)	1.30 (33.0)
4	1.30 (33.0)	1.38 (35.0)

<sup>A</sup> The sketches and designs of fittings shown are illustrative only.

<sup>B</sup> For dimensions of insert ends, see [Table 1](#).

<sup>C</sup> For threads on threaded end, see [6.1.3](#).

be molded from PVC meeting the requirements of [5.1.3](#). The sockets and spigots shall comply with the dimensions of Specification [D2466](#).

**6.2 Burst Pressure**—The minimum burst pressure for the fittings shall be as shown in [Table 4](#), when determined in accordance with [8.5](#).

## 7. Workmanship, Finish, and Appearance

**7.1** The fittings shall be homogeneous throughout and free of cracks, holes, foreign inclusions, or other defects. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

## 8. Test Methods

**8.1 Conditioning**—Condition the specimens at 73 °F ± 4 °F (23 °C ± 2 °C) and 50 % ± 10 % relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice [D618](#), for those tests where conditioning is required.

**TABLE 4 Burst Pressure Requirements for Water at 73.4°F (23°C) for Plastic Insert Fittings for PE Plastic Pipe**

Nominal Pipe Size, in.	Minimum Burst Strength, psi (MPa)	
	NP, PP, and PVC Materials	
1/2	750 (5.7)	
3/4	630 (4.34)	
1	630 (4.34)	
1 1/4	630 (4.34)	
1 1/2	500 (3.45)	
2	500 (3.45)	
2 1/2	400 (2.76)	
3	400 (2.76)	
4	400 (2.76)	
6	250 (1.72)	

**8.2 Test Conditions**—Conduct the tests in the standard laboratory atmosphere of 73 °F ± 4 °F (23 °C ± 2 °C) and 50 ± 10 % relative humidity, unless otherwise specified in the test methods or in this specification.

**8.3 Sampling**—A sample of the fittings sufficient to determine conformance with this specification shall be taken at random.

**8.4 Dimensions**—Fittings used to determine dimensions shall be randomly selected. Measurements shall be made with micrometers, calipers, gages, or other devices accurate to within ±0.001 in. (±0.025 mm). Determine the diameters by making measurements at four points spaced at approximately 45° apart around the circumference.

**8.5 Burst Pressure**—Determine the minimum burst pressure with at least three specimens in accordance with Test Method [D1599](#). Join the fittings as insert fittings to the pipe sufficiently strong and in such a manner that no failure shall occur in the fitting at least than the pressures given in [Table 4](#). The time of testing each assembly shall be between 60 s and 70 s.

**8.6 Threads**—All taper pipe threads shall be gaged in accordance with Specification [F1498](#).

## 9. Retest and Rejection

**9.1** If the results of any test(s) do not meet the requirements of this specification, the tests(s) shall be conducted again only by agreement between the purchaser and seller. Under such agreement, minimum requirements shall not be lowered, changed, or modified, nor shall specification limits be changed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

## 10. Marking

**10.1** Fittings shall be marked with the following:

**10.1.1** Manufacturers' name or trademark,

**10.1.2** Material designation: NP, PP, or PVC,

**10.1.3** Fittings intended for the transport of potable water shall include the seal or mark of the laboratory making the evaluation for this purpose, and

**10.1.4** Size.

**10.2** Markings or symbols shall be molded, hot-stamped, or applied by printing methods.

**10.3** Where recessed marking is used, care shall be taken to see that in no case shall the marking cause cracks or reduce the wall thicknesses below the minimum specified.

## 11. Quality Assurance

**11.1** When the product is marked with this designation, D2609, 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.

## 12. Keywords

12.1 barb; fittings; insert; plastic; polyethylene