



Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock¹

This standard is issued under the fixed designation F2206; 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 establishes requirements for fabricated fittings intended for use with outside-diameter controlled polyethylene pipe and tubing. These fittings are manufactured by heat-fusion joining shape-modified polyethylene components prepared from pipe, molded fittings, sheet, or block. Included are requirements for materials, design, workmanship, minimum dimensions, marking, test methods, and quality control.

1.2 Pressure rating of the fabricated-fitting design is beyond the scope of this standard and shall be established by the fitting manufacturer. This specification includes requirements for both ~~room~~elevated temperature pressure-tests and ~~elevated temperature~~ pressure-testsshort-term pressurization tests to demonstrate a reasonable level of performance of the fabricated-fitting design at the pressure rating established by the fitting manufacturer.

1.3 The pressure-tests requirements are specified by the fittings' equivalent (E) DR. The EDR specified is ~~that~~the DR of the piping system for which the fabricated fitting is intended to be butt-fused.

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

1.5 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units which are provided for information only and are not considered standard.

1.6 The following safety hazards caveat pertains only to the test methods 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*² ~~D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure~~

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2513 Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings

~~D3035 Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter~~

D3261 Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

~~D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials~~

F412 Terminology Relating to Plastic Piping Systems

F714 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F2619/F2619M Specification for High-Density Polyethylene (PE) Line Pipe

F2880 Specification For Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3/4 in. to 65 in.

2.2 *Federal Standards:*³

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

OPS Part 192 Title 49, Code of Federal Regulations

2.3 *Military Standard:*³

MIL-STD-129 Marking for Shipment and Storage

¹ 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. Current edition approved April 1, 2010; 2011. Published May 2010; April 2011. Originally approved in 2002. Last previous edition approved in 2002 as F2206 – 02(2010). DOI: 10.1520/F2206-02R10-10.1520/F2206-11.

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 Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

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

2.4 *ANSI/NSF Standard:*⁴

ANSI/NSF 61 for Drinking Water System Components—Health Effects

2.5 *Plastic Pipe Institute:*⁵

TR-4 Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) for Thermoplastic Materials or Pipe.

3. Terminology

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

3.2 *Definitions:*

3.2.1 *butt-fusion end(s), n*—the butt end(s) of the fabricated fitting intended for field fusion by the installer.

3.2.2 *fabricated fitting, n*—a fitting constructed from manufactured polyethylene components or materials.

3.3 *Abbreviations:*

3.3.1 *DIPS*—ductile iron pipe size.

3.3.2 *DR*—dimension ratio.

3.3.3 *EDR*—equivalent dimension ratio. The DR of the pipe to which the fitting is to be joined.

3.3.4 *IPS*—iron pipe size.

3.3.4

3.3.5 *OD*—outside diameter.

4. Classification

4.1 *General*—This specification establishes requirements for fabricated fittings intended for butt-fusion joining to polyethylene pipe.

4.1.1 Fabricated fitting components may be machined from extruded polyethylene or molded polyethylene stock and heat-fused to form the final part.

4.1.2 Fabricated fittings intended for use in the distribution of natural gas or other fuel gases shall also meet the requirements of Specification D2513.

5. Ordering Information

5.1 When ordering fittings under this specification include the following information:

5.1.1 Polyethylene compound (material designation or trade name).

5.1.2 Style of fitting (3 piece tee, 5 segment 90° ell, etc.).

5.1.3 Size:

5.1.3.1 Nominal size of end connections.

5.1.3.2 End configurations (for example, IPS or DIPS).

5.1.3.3 System design ratio.

5.1.3.3 System DR.

6. Material

~~6.1 *Material Classification*—Polyethylene materials allowable for use in this specification shall be classified in accordance with Specification D3350 as shown in Table 1. Consult with the manufacturer for cell classification applicable to their materials.~~

Material

6.1 Polyethylene materials allowed for use in fittings produced in accordance with this specification shall be in accordance with the manufacturer's fabricated-fitting design specifications. In addition:

6.1.1 Polyethylene pipe used in the production of fittings in accordance with this specification shall meet the requirements of Specification F714, D3035, F2619/F2619M or D2513.

6.1.2 Molded PE fittings used in the production of fabricated fittings in accordance with this specification shall meet the requirements of Specification D3261.

6.1.3 Flange adaptors used in the production of fabricated fittings in accordance with this specification shall meet the requirements of Specification F2880.

6.1.4 Sheet, block or plate stock used in the production of fabricated fittings shall be produced from stress-rated polyethylene compounds listed in PPI's TR-4.

NOTE 1—Manufacturers should use appropriate quality assurance procedures to ensure that sheet, block and plate are free from voids, laminations, foreign inclusions, cracks, and other injurious defects.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.

7. Requirements

7.1 Dimension and Tolerances—Butt-fusion ends shall be produced from fittings or pipe conforming to Specification D3261, or by machining block, sheet, plate, or pipe to the required dimensions.

7.1.1 Diameter—Nominal outside-diameter of the butt-fusion end shall conform to the IPS or DIPS dimension at area of fusion. Outer-diameter dimensions and tolerances at the area of fusion shall be as shown in Table 2 Table 1 or Table 3 Table 2.

7.1.2 Wall Thickness—The minimum wall thickness of the butt-fusion end shall be in accordance with Table 2 Table 1 or Table 3 Table 2 when measured in accordance with Test Method D2122. Conditioning to standard temperature but not to standard humidity is required.

7.1.3 Eccentricity—The wall thickness variability of the butt-fusion end as measured and calculated in accordance with Test Method D2122, in any diametrical cross-section of the pipe shall not exceed 12 %.

7.1.4 Measurements—These shall be made in accordance with Test Method D2122 for roundable pipe.

7.1.5 Laying Lengths—Laying length dimensions shall be defined by the manufacturer.

7.1.6 Special Sizes—Where existing system conditions or special local requirements make other diameters or dimension ratios necessary, other sizes or dimension ratios, or both, shall be acceptable for engineered applications when mutually agreed upon by the customer and the manufacturer, if the fitting is manufactured from plastic compounds meeting the material requirements of this specification, and the fitting performs in accordance with the requirements in this specification. For diameters not shown in Table 2 Table 1 or Table 3 Table 2, the tolerance shall be the same percentage as that shown in the corresponding tables for the next smaller listed size. Minimum wall thickness at the butt-fusion end for these special sizes shall not be less than the minimum wall thickness specified for the pipe the fitting is designed to be used with.

7.2 Physical Requirements—Fabricated fittings using miter cut pipe stock shall be manufactured from pipe stock with a wall thickness 25%—that is at least 22% greater than that of the pipe to which the fitting is to be joined. (For example: A SDR11 fitting shall be made using SDR9 pipe stock.)

7.3 Pressure Test Requirements—One size and DR of each style fitting manufactured in each of the following size ranges—12 in. (300 mm) and smaller, greater than 12 to less than 24 in. (300 to less than 600 mm), and 24 in. (600 mm) and larger—in each particular material shall be evaluated. The size and DR of each style fitting selected shall be tested per 7.3.1 and 7.3.2. Fitting styles are characterized as elbows, tees, wyes, crosses, reducing tees, reducing laterals, branch saddles, flange adapters, mechanical joint adapters, and end caps.

7.3.1 Sustained Pressure Test—The fitting shall not fail, as defined in Test Method D1598, when tested at the time, pressures, and test temperatures per Test A in Table 4. The test specimens shall be prepared for testing in the manner prescribed in 9.5.1.

7.3.2—Design validation tests per 7.3.1 and 7.3.2 shall be conducted on “test samples” that are representative of:

- Each of three (3) size groupings - 12 in. (300 mm) and smaller, greater than 12 to less than 24 in. (300 to less than 600 mm), and 24 in. (600 mm) and larger.

- Each style of fitting (for example, 4 segment 90 Elbow, Straight Tee, etc.).

A single EDR sample shall be considered as representative of all of the wall thickness’ produced in that size and style grouping.

TABLE 2 1 IPS Sizing System: Butt-Fusion End Dimensions, in.

| Size IPS | Average OD ^A | Minimum Wall Thickness ^B versus DR | | | | | | | | | |
|----------|-------------------------|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 7.3 | 9 | 9.3 | 11 | 13.5 | 15.5 | 17 | 21 | 26 | 32.5 |
| 2 | 2.38 | ... | 0.26 | ... | 0.22 | 0.18 | ... | 0.14 | ... | ... | ... |
| 3 | 3.500 | 0.479 | 0.389 | 0.376 | 0.318 | 0.259 | 0.226 | 0.206 | 0.167 | 0.135 | 0.108 |
| 4 | 4.500 | 0.616 | 0.500 | 0.484 | 0.409 | 0.333 | 0.290 | 0.265 | 0.214 | 0.173 | 0.138 |
| 5 | 5.563 | 0.762 | 0.618 | 0.598 | 0.506 | 0.412 | 0.359 | 0.327 | 0.265 | 0.214 | 0.171 |
| 6 | 6.625 | 0.908 | 0.736 | 0.712 | 0.602 | 0.491 | 0.427 | 0.390 | 0.315 | 0.255 | 0.204 |
| 8 | 8.625 | 1.182 | 0.958 | 0.927 | 0.784 | 0.639 | 0.556 | 0.507 | 0.411 | 0.332 | 0.265 |
| 10 | 10.750 | 1.473 | 1.194 | 1.156 | 0.977 | 0.796 | 0.694 | 0.632 | 0.512 | 0.413 | 0.331 |
| 12 | 12.750 | 1.747 | 1.417 | 1.371 | 1.159 | 0.944 | 0.823 | 0.750 | 0.607 | 0.490 | 0.392 |
| 14 | 14.000 | 1.918 | 1.556 | 1.505 | 1.273 | 1.037 | 0.903 | 0.824 | 0.667 | 0.538 | 0.431 |
| 16 | 16.000 | 2.192 | 1.778 | 1.720 | 1.455 | 1.185 | 1.032 | 0.941 | 0.762 | 0.615 | 0.492 |
| 18 | 18.000 | 2.466 | 2.000 | 1.935 | 1.636 | 1.333 | 1.161 | 1.059 | 0.857 | 0.692 | 0.554 |
| 20 | 20.000 | ... | 2.222 | 2.151 | 1.818 | 1.481 | 1.290 | 1.176 | 0.952 | 0.769 | 0.615 |
| 22 | 22.000 | ... | 2.444 | 2.366 | 2.000 | 1.630 | 1.419 | 1.294 | 1.048 | 0.846 | 0.677 |
| 24 | 24.000 | ... | 2.667 | 2.581 | 2.182 | 1.778 | 1.548 | 1.412 | 1.143 | 0.923 | 0.738 |
| 26 | 26.000 | ... | ... | 2.796 | 2.364 | 1.926 | 1.677 | 1.529 | 1.238 | 1.000 | 0.800 |
| 28 | 28.000 | ... | ... | 3.011 | 2.545 | 2.074 | 1.806 | 1.647 | 1.333 | 1.077 | 0.862 |
| 30 | 30.000 | ... | ... | 3.226 | 2.727 | 2.222 | 1.935 | 1.765 | 1.429 | 1.154 | 0.923 |
| 32 | 32.000 | ... | ... | ... | 2.909 | 2.370 | 2.065 | 1.882 | 1.524 | 1.231 | 0.985 |
| 34 | 34.000 | ... | ... | ... | 3.091 | 2.519 | 2.194 | 2.000 | 1.619 | 1.308 | 1.046 |
| 36 | 36.000 | ... | ... | ... | 3.273 | 2.667 | 2.323 | 2.118 | 1.714 | 1.385 | 1.108 |
| 42 | 42.000 | ... | ... | ... | ... | ... | 2.710 | 2.471 | 2.000 | 1.615 | 1.292 |
| 48 | 48.000 | ... | ... | ... | ... | ... | 3.097 | 2.824 | 2.286 | 1.846 | 1.477 |
| 54 | 54.000 | ... | ... | ... | ... | ... | ... | 3.176 | 2.571 | 2.077 | 1.662 |

^A Tolerance on OD is ± 0.45 %.

^B Eccentricity of wall shall not exceed 12 %.