



# Standard Specification for Electrofusion Type Polyamide-11 Fittings for Outside Diameter Controlled Polyamide-11 Pipe and Tubing<sup>1</sup>

This standard is issued under the fixed designation F2600; 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 polyamide-11 electrofusion fittings for use with outside diameter-controlled polyamide-11 pipe, covered by Specification [D2513](#). Requirements for materials, workmanship, and testing performance are included. Where applicable in this specification “pipe” shall mean “pipe” or “tubing.”

1.2 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.

1.3 The following safety hazards 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.*

1.4 *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>

- [D618 Practice for Conditioning Plastics for Testing](#)
- [D638 Test Method for Tensile Properties of Plastics](#)
- [D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure](#)
- [D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings](#)

- [D1600 Terminology for Abbreviated Terms Relating to Plastics](#)
- [D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings](#)
- [D2513 Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings](#)
- [D6779 Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials \(PA\)](#)
- [F412 Terminology Relating to Plastic Piping Systems](#)
- [F905 Practice for Qualification of Polyethylene Saddle-Fused Joints](#)

## 3. Terminology

3.1 **Definitions**—Definitions are in accordance with Terminology [F412](#), and abbreviations are in accordance with Terminology [D1600](#), unless otherwise specified.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 **electrofusion**—a heat fusion joining process where the heat source is an integral part of the fitting, such that when electric current is applied, heat is produced that melts and joins the plastics.

3.2.2 **fusion interface**—surface in the heat fusion process where the plastic materials of the products being joined bond together.

3.2.3 **fusion zone length**—total length of the melted material in the fitting cross-section under evaluation.

## 4. Materials and Manufacture

4.1 This specification covers fittings made from polyamide 11 (PA11) meeting the requirements for Group 3, Class 2, and Grade 3, (PA32312) as prescribed in Specification [D6779](#).

4.2 **Rework Material**—Clean rework polyamide-11 material of the same resin, free of any wire or contaminants generated from the fitting manufacturer’s own production, may be used by the same manufacturer, as long as the fittings produced conform to the requirements of this specification.

4.3 **Heating Mechanism**—The heat mechanism shall be of materials not detrimental to the performance of the fitting or the pipe to which it is intended to be joined.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee [F17](#) on Plastic Piping Systems and is the direct responsibility of Subcommittee [F17.60](#) on Gas.

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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.

## 5. Performance Requirements

5.1 The following requirements are for electrofusion joints that have been joined using the manufacturer's recommended joining procedures. These requirements must be met by each electrofusion joint design, on each size and type of pipe material for which the manufacturer recommends use of his fitting. Any revisions to the electrofusion joint design or processing by the manufacturer after the initial testing requires retesting to ensure these requirements can still be met. Fittings intended for use in the distribution of natural gas or liquid petroleum gas shall also meet the requirements of Specification **D2513**.

5.1.1 It is not required that each configuration of a fitting be tested to meet all of these qualifications (that is, 2 in. main saddle joint with multiple outlet configurations offered) as long as the electrofusion joint design is not altered in the configuration differences.

NOTE 1—It is permissible when accomplishing these tests, to do so on the highest and lowest dimension ratio of the same pipe material. If in those tests all performance requirements are met, all dimension ratios between those tested may be considered as having met the requirements. These tests do not have to cover the full range of dimension ratios available, only the dimension ratio range on which the manufacturer recommends his fitting be used.

### 5.2 Pressure Requirements:

5.2.1 *Minimum Hydraulic Burst Pressure*—The minimum hydraulic burst pressure of the test specimen shall not be less than that required to produce 3900 psi (26.9 MPa) fiber stress in the pipe being used in the test when tested in accordance with **9.1**. The test equipment, procedures, and failures definitions shall be as specified in Test Method **D1599**.

5.2.2 *Sustained Pressure*—The fitting and fused joint shall not fail when tested in accordance with **9.2**.

5.3 *Tensile Strength Requirements (Coupling Type Joints Only)*—The fitting or the pipe to fitting joint made on pipe shall not fail when tested in accordance with **9.3**. Specimens shall be subjected to a tensile stress that causes the pipe to yield or causes the pipe to break outside the joint area. Tensile tests must be made on specimens as joined, not on straps cut from the specimen. Yielding must be measured only in the pipe, independent of the fitting or joint.

5.4 *Impact Resistance (Saddle Type Joints Only)*—The joint made on the specimen shall not fail when impacted with a force sufficient to break the body or other portion of the specimen. Tests of 500 ft-lb or higher impact with no failures noted shall be considered as a "pass" impact test. The device for testing and the methods shall be as defined in Practice **F905**.

5.5 *Joint Integrity Tests—(Couplings and Saddle Type Joints)*—The joint made on the specimen shall meet the requirements in **9.4** and **9.5** of this specification, when tested in accordance with **9.4**.

## 6. Dimensions, Mass, and Permissible Variations

6.1 Dimension and tolerances of electrofusion fittings must be such that heat fusion is possible to outside diameter (OD) controlled PA-11 pipes such as those listed in Specifications

**D2513**, such that the joints will satisfy the performance requirements in Section **5**. ( See Test Method **D2122**.)

6.2 Because of the varying designs for electrofusion fittings, the actual spread of dimensions may be quite different from manufacturer to manufacturer. A table of dimensions and tolerances encompassing these differences would be meaningless and without value and, therefore, is omitted from this specification.

6.3 The manufacturer shall furnish to the user the electrical resistance, critical dimensions, and tolerances of his fittings. This information must include at least the following dimensions and tolerances:

- 6.3.1 Coupling inside diameter,
- 6.3.2 Temperature joining limits, and
- 6.3.3 Operating pressure of the fitting.

NOTE 2—There are other items that fall beyond the scope of this specification which would be of interest to the user for proper application of the fittings and is recommended as additional information to be furnished. A few of these are: (1) maximum pipe out of round allowed at joint area; (2) minimum/maximum pipe SDR capability of the fitting, and (3) for saddles intended for use on a live main, the maximum allowable line pressure when making the joint.

## 7. Workmanship, Finish, and Appearance

7.1 The manufacture of these fittings shall be in accordance with good commercial practice so as to produce fittings meeting the requirements of this specification.

7.2 The fittings shall be homogeneous throughout, except where a heating coil or electrical connectors are incorporated, and free of cracks, holes, foreign inclusions, or injurious defects such as gouges, dents, cuts, etc. The fittings shall be as uniform as commercially practicable in opacity, density, and other physical properties. Any heating coils, connecting cables, connectors, and related electrical power source shall be designed to prevent electrical shock to the user.

## 8. Specimen Preparation

### 8.1 Conditioning:

8.1.1 Unless otherwise specified, condition the specimens (pipe and fittings) prior to joining at the minimum pipe temperature allowable for fusion as recommended by the manufacturer, for not less than 16 h and make the fusion joint at that temperature for those tests where conditioning is required.

8.1.2 Unless otherwise specified, condition the specimens (pipe and fittings) prior to joining at the maximum pipe temperature allowable for fusion as recommended by the manufacturer, for not less than 16 h and make the fusion joint at that temperature for those tests where conditioning is required.

8.2 *Test Conditions*—Conduct the tests at the Standard Laboratory Temperature of  $23 \pm 2^\circ\text{C}$  ( $73.4 \pm 3.6^\circ\text{F}$ ) unless otherwise specified.

### 8.3 Preparation of Specimens for Testing:

8.3.1 Prepare test specimens so that the minimum length of unreinforced pipe on one side of any fitting is equal to three times the diameter of the pipe, but in no case less than 12 in. (304 mm). It is permissible to test multiple fittings together