



# Standard Specification for Polyamide 11 (PA 11) and Polyamide 12 (PA12) Mechanical Fittings for Use on Outside Diameter Controlled Polyamide 11 and Polyamide 12 Pipe and Tubing<sup>1</sup>

This standard is issued under the fixed designation F2145; 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.

## 1. Scope\*

1.1 This specification describes requirements and test methods for the qualification of Polyamide 11 (PA 11) bodied mechanical fittings for use with outside diameter controlled Polyamide 11 (PA 11), nominal 2 pipe size (IPS), and smaller complying with Specification [D2513](#). Additionally, the requirements and test methods for the qualification of Polyamide 12 (PA12) bodied mechanical fittings for use with outside diameter controlled Polyamide 11 (PA11) nominal 2 in pipe size (IPS) and smaller complying with Specification [D2513](#) and outside diameter controlled Polyamide 12 (PA12) nominal 2 in pipe size (IPS) and smaller complying with Specification [F2785](#). In addition, it specifies general requirements of the material from which these fittings are made.

1.2 The test methods described in this specification are not intended to be used as routine quality tests.

1.3 This specification covers the types of mechanical fittings covered in [3.2.1](#).

1.4 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.

1.5 The following safety hazards caveat pertains only to the test methods portion, Section [7](#), 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.*

1.6 The text of this specification 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 this specification.

*1.7 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>

NOTE 1—For over 40 years [D2513](#) was the singular US CFR Title 49 Part 192 referenced Standard Specification codifying the installation and use of thermoplastic gas piping in jurisdictional installations. Initially all materials (PE, PVC, ABS, CAB) were contained within the body of the standard [D2513](#). In later years [D2513](#) was completely reformatted to make it more user friendly by moving material-specific requirements from the standard's body to mandatory annexes. The next major change occurred late in 2009 at which time all thermoplastic materials, except polyethylene, were removed from [D2513](#) changing its Title and Scope from a thermoplastic gas piping standard to a polyethylene-only gas piping standard. This recent change required that new standards be developed for those materials that were removed from [D2513](#) including PA11. This causes problems for PA11 piping because it has been referenced and permitted for jurisdictional use and installation under US CFR Title 49 Part 192 as complying with [D2513](#) and [D2513](#) no longer has the A5 polyamide annex and Part 192 still references [D2513-99](#) which makes for potential confusion. This puts PA11 gas piping standards into somewhat of a limbo since [D2513](#) is now a PE-only specification is referenced in all of these standards. Therefore until Part 192 is revised to reference the new PA11 specification, [F2945](#), PA11 has to fall back to citing the US Code referenced 1999 edition of [D2513](#) in related standard such as this one. Until CFR Title 49 Part 192 references the newly developed thermoplastic gas piping standards for those materials removed from [D2513](#), there will be dual references, both [D2513-99](#) and [F2945](#) for PA11, as seen in this standard. At which time Part 192 references [F2945](#), the PA11 gas piping standard, all references to [D2513](#) and this note will be removed from these standards.

- [D638 Test Method for Tensile Properties of Plastics](#)
- [D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure](#)
- [D1600 Terminology for Abbreviated Terms Relating to 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 [F17.60](#) 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.

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

**D2513** Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

**D2837** Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

**F412** Terminology Relating to Plastic Piping Systems

**F1588** Test Method for Constant Tensile Load Joint Test (CTLJT)

**F2785** Specification for Polyamide 12 Gas Pressure Pipe, Tubing, and Fittings

**F2945** Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings

## 2.2 ASME Standard:

**ASME B31.8** Gas Transmission and Distribution Piping Systems<sup>3</sup>

## 2.3 Federal Standard:

**CFR, Title 49, Part 192** Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards<sup>4</sup>

## 2.4 Plastic Pipe Institute Standard:

**PPI TR-4** PPI Listing of Hydrostatic Design Bases (HDB), Pressure Design Bases (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe<sup>5</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 Definitions of the terms used in this specification are in accordance with Terminology **F412** unless otherwise specified. Abbreviations are in accordance with Terminology **D1600** unless otherwise specified.

3.1.2 The Gas Industry Terminology is in accordance with ASME B31.8 or CFR, Title 49, Part 192 unless otherwise specified.

3.1.3 The term “pipe” refers to both “pipe” and “tubing”. The term “fitting” refers to a mechanical connecting device as described in 3.1.5 and 3.1.7.

3.1.4 *joint, n*—the location at which two pieces of pipe and a fitting are connected together. For example, an installed coupling has two joints.

3.1.5 *joint, mechanical, n*—a connection between piping components and employing physical force to develop a seal or produce alignment.

3.1.6 *long-term-strength (LTS), n*—the estimated tensile stress that when applied continuously will cause failure at 100 000 h. This is the intercept of the stress regression line with the 100 000 h coordinate.

3.1.7 *mechanical fitting, n*—fitting for making a mechanical joint to provide for pressure integrity, leak tightness, and resistance to end loads.

3.1.7.1 *category 1 mechanical fitting, n*— fitting for assembling pipes, which includes a compression zone to provide for pressure integrity, leak tightness, and resistance to end loads sufficient to cause no less than 25 % elongation of the PA 11 or PA 12 piping as described in this specification.

3.1.8 *MAOP, n*—The Maximum Allowable Operating Pressure of the fuel gas piping system in psig as determined in accordance with CFR, Title 49, Part 192 and as represented in the following:

$$MAOP = P = 2 \times S / (DR - 1) \times f_D \quad (1)$$

where:

$S$  = the PA 11 or PA 12 material’s HDB as published in PPI TR-4,

$DR$  = the pipe’s dimension ratio determined by dividing the pipe’s specified nominal outside diameter by the pipe’s specified wall thickness; and,

$f_D$  = the design factor for thermoplastic fuel gas piping as set by the authority having jurisdiction. In the United States, the design factor is cited in CFR, Title 49, Part 192.121.

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

#### 3.2.1 Types of Mechanical Fittings:

3.2.2 *in-line fitting, n*—mechanical fitting used to make a mechanical joint where the bore axis of compression and sealing zones of the fitting is essentially the same as the connected pipe, for example, couplings, ells, and tees.

3.2.3 *mechanical saddle fitting, n*—mechanical fitting used to make a mechanical joint that allows a lateral connection to an exiting main in which a portion of the fitting is contoured to match the O.D. of the pipe to which it is attached. Herein referred to as the *saddle fitting mating pipe* or *main pipe size*.

## 4. Materials and Manufacture Requirements

4.1 Polyamide 11 (PA 11) and Polyamide 12 (PA12) pressure containing materials subject to continuous stress, either hoop or axial, shall meet the requirements of Specification **D2513–99**, Annex A5, Specification **F2945** for Polyamide 11 and Specification **F2785** for PA12, have an ASTM material specification, and the materials long-term strength, such as the long-term hydrostatic strength, determined in accordance with Test Method **D2837**, excepting that failure data can be obtained from specimens such as the following: tensile bars, plane strain, or actual fitting samples.

4.2 The physical properties of the PA 11 and PA 12 material used to produce the fitting shall be available from the fitting manufacturer upon request.

4.3 Specifications outlining all the physical properties and effects of environmental conditions for the PA 11 and PA 12 material used to produce the fitting shall be available from the fitting manufacturer upon request.

NOTE 2—Materials in long term contact with natural gas of line quality and LP gas vapor should be demonstrated not to adversely affect the performance of the fitting.

NOTE 3—Materials should have demonstrated resistance to environmental stress cracking when exposed, under stress to chemical compounds encountered in, or external gas piping systems, and a demonstrated resistance to bacteriological decomposition. Such compounds include ice

<sup>3</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>4</sup> Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

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