



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 Tubing¹

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1. Scope*

1.1 This specification describes requirements and test methods for the qualification of Polyamide 11 (PA 11) and Polyamide 12 (PA 12) bodied mechanical fittings for use with outside diameter controlled PA 11, nominal 2 pipe size (IPS), and smaller complying with Specification F2945, and PA 12, nominal 2 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.*

¹ 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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2. Referenced Documents

2.1 ASTM Standards:²

- 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
- 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 Systems³

2.3 Federal Standard:

- CFR, Title 49, Part 192 Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards⁴

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 Pipe⁵

3. Terminology

3.1 Definitions:

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

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

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

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

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 **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 1—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 2—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 thawing chemicals, fertilizers, insecticides, herbicides, leak detection fluids, acids, bases, and, antifreeze solutions used to thaw frozen lines. The effects of liquid environments such as antifreeze agents, odorants, and hydrocarbons are known to be deleterious to some plastics, particularly under service conditions.

5. Dimensions

5.1 The dimensions and tolerance shall be determined by the manufacturer.

6. Qualification Requirements

6.1 *General*—Unless otherwise specified, each nominal size of fitting shall be tested. Testing of the thickest wall pipe that the fitting is designed to be used with qualifies it with use of lesser wall thickness.

6.1.1 Mechanical joint qualifications shall be performed on assembled joints using the fitting manufacturers joining procedure. All mechanical fitting offered by the manufacturer shall be capable of meeting the requirements of this standard when connecting Polyamide 11 complying with Specification **F2945** or Polyamide 12 gas piping complying with Specification **F2785**. To verify the structural integrity of the fitting body, representative samples shall be subjected to the requirements of **6.2.1**. It is not the intent of the specification to require testing of all fitting configurations, that is, tees, ells, etc., but each mechanical joint design in each size.

6.1.2 All mechanical fitting described in **3.2.1** shall have an internal pipe reinforcing tubular insert stiffener that extends at least under the seal and gripping device, where used. The saddle portion of saddle-type fittings do not require an internal tubular stiffener due to the nature of the connection.

6.2 Performance Requirements:

6.2.1 *Elevated Temperature Sustained Pressure*—The fitting joint or pipe in the area affected by the fitting shall not fail as defined in Test Method **D1598**, when tested in accordance with