



Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing¹

This standard is issued under the fixed designation F1924; 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 describes requirements and test methods for the qualification of plastic bodied mechanical fittings for use with outside diameter controlled polyethylene (PE) gas distribution pipe, nominal 2 pipe size (IPS) and smaller complying with Specification **D2513**. 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 control tests.

1.3 This specification covers the types of mechanical fittings described in **3.2**.

1.4 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.

1.5 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.

1.6 The following safety hazards caveat pertains only to the test method 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: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

D2513 Specification for Polyethylene (PE) 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)

F2897 Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)

2.2 ASME Standard:

ASME B31.8 Gas Transmission and Distribution Piping Systems³

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. Current edition approved April 1, 2012/Aug. 1, 2019. Published May 2012/August 2019. Originally approved in 1998. Last previous edition approved in 2011/2012 as **F1924-05(2011)-F1924-12**. DOI: 10.1520/F1924-12.10.1520/F1924-19.

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 Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

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

2.3 *Federal Standard:*
CFR, Title 49, Part 192 Pipeline Safety Regulations⁴

2.4 *Plastics Pipe Institute Standard:*
PPI TR-4 Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds⁵

3. Terminology

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

3.1.1 The Gas Industry terminology used in this specification is in accordance with ASME B31.8 or CFR, Title 49, Part 192 unless otherwise indicated.

3.1.2 The term “pipe” used herein refers to both “pipe” and “tubing” unless specifically stated otherwise. The term “fitting” refers to a mechanical connecting device as described in **3.1.4** and **3.1.6**.

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

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

3.1.5 *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.

3.1.6 *mechanical fitting, n*—fitting for making a mechanical joint to provide for pressure integrity, leak tightness, and depending on category, as defined in this specification, resistance to end loads.

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

3.1.6.2 *category 2 mechanical fitting, n*—fitting for assembling pipes, which includes a compression zone(s) to provide for pressure integrity and leak tightness only. Category 2 fittings do not provide for resistance to end loads.

3.1.7 *MAOP, n*—the Maximum Allowable Operating Pressure of the fuel gas piping system, in psig, as determined in accordance with CFR, Title 49, Part 192.121 and as represented in the following:

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

where:

S = the PE material’s HDB as published in PPI TR-4.

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

f_D = the design (derating) 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 *Types of Mechanical Fittings:*

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

3.2.2 *mechanical saddle fitting, n*—mechanical fitting used to make a mechanical joint that allows a lateral connection to an existing 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*.

4. Materials and Manufacture Requirements

4.1 Plastic pressure containing materials subject to continuous stress, either hoop or axial, shall 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. A material listing in PPI TR-4 document is evidence of compliance with this paragraph for third party certifying and listing agencies.

4.2 The physical properties of each 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 materials of manufacture shall be available from the fitting manufacturer upon request.

⁴ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil/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>.

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 a demonstrated resistance to environmental stress cracking when exposed, under stress, to chemical compounds encountered in, or external to gas piping systems, and a demonstrated resistance to bacteriological decomposition. Such compounds include, but are not limited to, 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 when under service conditions.

5. Dimensions

5.1 The dimensions and tolerances 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 the use of that fitting with pipe of lesser wall thickness.

6.1.1 Mechanical joint qualifications shall be performed on assembled joints using the fitting manufacturer's joining procedure. All mechanical fittings offered by the manufacturer shall be capable of meeting the requirements of this standard when connecting polyethylene gas piping complying with Specification D2513. 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 this 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 fittings described in 3.2 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 7.2. The fitting or joint meets this requirement when tested in accordance with any one of the three conditions (A, B, or C) listed in 7.2.

6.2.2 *Tensile Strength*—The pipe joint shall accommodate the tensile loadings when tested in accordance with 7.3.

6.2.2.1 *In-Line Fittings, Category 1*—The joint shall provide resistance to a force on the pipe joint equal to or greater than that which will cause no less than 25 % elongation of pipe, or the pipe fails outside the joint area when tested in accordance with 7.3.

6.2.2.2 *In-Line Fittings, Category 2*—A joint design that provides a seal only. A mechanical joint designed for this category excludes any provisions in the design of the joint to resist any axial pullout forces; therefore, tensile tests are not required.

6.2.2.3 *Mechanical Saddle Fittings*—The joint between the saddle and mating pipe shall not fail by rotation or leakage when tested in accordance with 7.6.

6.2.2.4 Joint restraint capabilities less than as defined above shall constitute failure of the test.

6.2.3 *Temperature Cycling Test*—The mechanical joint shall provide a pressure seal after 10 cycles of the temperature cycling test when tested in accordance with 7.4.

6.2.4 *Constant Tensile Load Joint Test*—The joint shall not fail by leakage or pullout when loaded to an axial tensile stress of 1320 psi (9.1 MPa) and tested in accordance with 7.5.

7. Test Methods

7.1 *General*—The test methods in this specification cover mechanical joint designs. Test methods that are applicable from other specifications will be referenced in the section pertaining to that particular test.

7.1.1 *Conditioning*—Unless otherwise specified, condition the specimens (pipe and fittings) prior to joining at 73.473 ± 3.6 F-4 °F (23 ± 2 °C) for not less than 16 h.

7.1.2 *Test Conditions*—Conduct the tests at the standard laboratory temperature of 73.473 ± 3.6 F-4 °F (23 ± 2 °C) unless otherwise specified.

7.1.3 *Test Specimens*—Test joints shall be prepared with the appropriate size PE pipe, complying with the dimensional requirements of Specification D2513, in accordance with the manufacturer's joining procedures.

7.2 Elevated Temperature Sustained Pressure Test:

7.2.1 The apparatus and report shall be as specified in Test Method D1598. Test six joints assembled in accordance with 6.1.1.

7.2.2 The assembled joints shall be tested in accordance with Test Method D1598 with the exception that it is not required that 12 in. or five times the nominal outside diameter of the pipe used in conducting the test be placed on each side of the fitting being tested. The test shall be conducted at one of the time/temperature/hoop stress combinations shown in Table 1 with the test pressure calculated using Eq 2. If ductile failure occurs in the pipe at 176°F (80°C)/670 psi (4.6 MPa) hoop stress, retest at 176°F (80°C)/580 psi (4.0 MPa) hoop stress.

$$P = \frac{2S}{DR - 1} \quad (2)$$