**Summary of Substantive Changes**
**between the 2012 and the 2015 editions of**
# ASTM F1948 "Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing"

**Presented to the IAPMO Standards Review Committee on March 7, 2016**

**General:** The change to this standard may have an impact on currently listed products. The substantive changes are:

- Expanded the testing and performance requirements to include specifications for polyamide PA fittings as well as the transition fittings used to connect pipe made of differing thermoplastic materials (PE to PA) or of differing dimensions (see Sections 6 and 7).

Section 2, Referenced Documents: ASTM E515 and F2785 were added in the referenced documents as follows:
*2.1 ASTM Standards*
*E515 Practice for Leaks Using Bubble Emission Techniques*
*F2897 Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)*

Section 3.2, Definitions: Additional information was included for the definition of a stab-type fitting as follows:
*3.3.4 stab-type fitting, n—mechanical fitting used to make a mechanical joint in which a seal is achieved by radial compression of a gasket between; the outside diameter (OD) of the pipe and the inside diameter (ID) of the fitting; the inside diameter (ID) of the pipe with the insert stiffener; or both.*

Section 6, Qualification Requirements: Revised the testing and performance requirements to include specifications for polyamide piping as well as fittings designed for transition between different thermoplastic piping materials as follows:
*6.1 General—Unless otherwise specified, each nominal size of fitting shall be tested. Testing the fitting with the thickest wall pipe for which the fitting is designed qualifies that type of fitting for use with pipe of lesser wall thickness.*

*6.1.1 Mechanical joint qualification 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:*
*6.1.1.1 Connecting thermoplastic piping materials complying with ~~Specification D2513~~ applicable ASTM thermoplastic gas piping standards, as listed in Section 2, Referenced Documents, either same to same (for example, PE to PE) or transitioning (for example, PE to PA).*
*6.1.1.2 Transitioning between thermoplastic gas piping complying with applicable ASTM thermoplastic gas piping standards, in Section 2, Referenced Documents, and metal piping. It is not the intent of this standard to require the testing of all fitting configurations (that is, tee, ells, etc.) but each joint design in each size.*

*6.1.2 All mechanical fittings described in 3.3 shall have an internal pipe reinforcing tubular stiffener that extends at least under the seal and gripping device (where used). Exception: When the fitting is used to transition from plastic to metal, only the plastic end of the fitting is required to have a stiffener employed.*

*6.1.3 In the case of fittings designed to transition between different thermoplastic materials, between different wall thicknesses (SDRs), or different diameters of the same thermoplastic material, the pipe requiring the lowest force to elongate to yield shall fail before any joint fails. For example, when transitioning between PE and PA of the same wall thickness (same DR) and diameter, failure of the PE before the joint fails, qualifies the fitting in this transition scenario. Another example is a fitting used to transition between 1CTS PE and 1⁄2 CTS PE piping, of the same DR, qualifies if the 1⁄2 CTS tubing fails before the joint fails.*

*6.1.4 In the case of fittings designed to transition between metallic piping and thermoplastic piping, the fitting shall be qualified as Category 1 under this standard only if the joint between the fitting and the metallic piping has been tested to provide axial tensile restraint strength of 1.5 times the tensile strength at yield of the thermoplastic piping joined to the opposite end.*
*6.1.4.1 The metallic piping shall not pull out of the fitting when tested to the following pull-out forces and tested in accordance with 7.2.*
*(1) For PE 3770 psi*
*(2) For PA11 8700 psi*
*(3) For PA12 7614 psi*

*6.2 Performance Requirements:*
*6.2.1 Tensile Strength—~~The pipe joint shall accommodate the tensile loads~~ The fitting shall provide a thermoplastic pipe joint design capable of accommodating the following tensile loads, when tested in accordance with 7.2.*
*6.2.1.1 Category 1—~~The joint shall provide resistance to a force on the pipe joint~~ A fitting that, when properly installed and meeting the qualification requirements of 6.1.1, 6.1.2 and 6.1.3, shall provide for joints in thermoplastic piping that resist pull-out to a force on the thermoplastic pipe equal to or greater than that which will cause no less than 25 % elongation of the plastic pipe, or which causes the pipe to fail outside the joint area when tested in accordance with 7.2. Furthermore, a fitting designed to transition between metallic piping and thermoplastic piping that, when properly installed, shall meet the qualification requirements of 6.1.4 when tested in accordance with 7.2.*
*6.2.1.2 Category 2—~~Joint design that only provides~~ Fitting that, when properly installed, creates a joint that provides only a seal. A mechanical joint designed for this category excludes any provisions in the design of the joint to resist axial pullout forces; therefore, tensile tests are not required. 6.2.1.3 Category 3—~~Joint~~ Fittings of nominal pipe size 4 and larger in diameter ~~shall provide resistance to a force on the~~ that, when properly installed provides a pull-out resistance to a force on the thermoplastic pipe joint equal to or greater than the maximum thermal stress that would be produced by a temperature change of 100°F (55°C) (for formula, see Annex A1).*
*6.2.1.4 ~~Joint~~ Fitting restraint capabilities less than as defined in*
*6.2.2.1 and 6.2.2.3 shall constitute failure of the test.*
*6.2.2 Temperature Cycling Test—The mechanical joint shall provide a pressure seal after 10 cycles of the temperature cycling test when tested in accordance with 7.3.*

*6.2.3 Constant Tensile Load Test (CTLIT)—~~The joint shall not fail by leakage or pullout when loaded to an axial tensile stress of 1320 psi (9101 kPa) and tested~~ Pull out of the pipe or leakage before, during or after testing in accordance with 7.4, shall constitute failure of the test.*

*6.3 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 7.5. The fitting or joint meets this requirement when tested in accordance with any one of the three conditions (A, B, or C) ~~listed in 7.5~~ for PE (polyethylene) piping, or any of the two conditions (D or E) for PA (polyamide) piping, as listed in Table 1 Elevated Temperature Sustained Pressure Test Conditions. To qualify fittings designed and used for transitioning between different thermoplastic piping materials, the hoop stress condition of the material with the lowest HDB shall be used.*

Section 7, Test Methods: Revised the test methods to include polyamide piping and transition fittings as follows:

*7.4 Constant Tensile Load Joint Test:*

*7.4.1 ~~One specimen of each nominal pipe size shall be tested~~ The testing shall be carried out in accordance with Test Method F1588 ~~for a minimum of 1000 h at an internal pressure between 4 psig (27.6 kPa) and the pipe MAOP.~~*

*7.4.1.1 Prepare fitting/piping assemblies in accordance with manufacturer installation instructions making one sample of each piping/combination of piping joints to be categorized. 7.4.1.2 Pressurize specimen at a pressure between 4 psig (27.6 kPa) and the lowest design pressure of the pipe combination being tested. Record and monitor pressure. When qualifying fittings designed and used to transition between different materials (for example, metal, PA or PE), fiber stress of the lowest tensile strength material shall be used.*

*7.4.2 The fiber stress shall be as follows:*

*7.4.2.1 1320 psi for PE piping.*

*7.4.2.2 2060 psi for polyamide 11 (PA11) 32312 piping.*

*7.4.2.3 2600 psi for polyamide 11 (PA11) 32312 and 32316 and polyamide 12 (PA12) 42316 piping.*

*7.4.3 The duration of the test shall be 1000 h.*

*7.4.4 The samples shall be leak tested at 7 6 3 psig and a minimum of 1.5 × the lowest design pressure of the pipe combinations being tested, prior to and at the end of the 1000h test (while still under tensile load and immediately following the CTLJT). No leakage shall be permitted prior, during or after the CTLJT testing when tested in accordance with the Liquid Application Technique in 7.6.*

*7.4.5 Failure of the specimen shall constitute failure of the test.*

*7.6 Leak Testing:*

*7.6.1 Pressurize the sample using air or other inert gas.*

*NOTE 5—SAFETY – In large diameter samples it is prudent to first fill the specimen with a coarse granular solid to reduce the pressurized volume of the sample. Plastic granules are frequently used for this purpose.*

*7.6.2 Ensure that all end caps and test fittings are bubble tight.*

*7.6.3 Detect leakage of the transition joint in accordance with Test Method E515 9.1, 9.2, and 9.3 Liquid Application Technique. Conduct leak testing for 2 min.*

Section 8, Product Instructions: Added the requirement to include piping material combinations for which the fitting is qualified as follows:
*8.2 The installation instructions shall state what piping material(s)/combinations for which the mechanical fitting has been qualified.*

Table 1, Elevated Temperature Sustained Pressure Test Conditions: Added new Rows D and E for test temperatures and minimum times for Polyamide and, revised the heating of the fourth column (i.e. changed from Pipe Hoop Stress to PE Hoop Stress) and added a new fifth column (i.e. PA, Hoop Stress).

Section X2, Transition: This normative section was removed.