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An American National Standard

Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems[1]

This standard is issued under the fixed designation F1973; 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 requirements and test methods for the qualification of factory assembled anodeless risers and transition fittings, for use in polyethylene (PE), in sizes through NPS 16, and Polyamide 11 (PA11) and Polyamide 12 (PA12), in sizes through NPS 6, gas distribution systems.

1.2 The test methods described are not intended to be routine quality control tests.

1.3 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.

1.4 Throughout this specification footnotes are provided for informational purposes and shall not be considered as requirements of this specification.

1.5 *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]

A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A513 Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

D638 Test Method for Tensile Properties of Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2513 Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings

E515 Practice for Leaks Using Bubble Emission Techniques

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

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

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

2.2 *Federal Standard:*[3]

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

2.3 *ANSI Standards:*

ANSI B 31.8 Gas Transmission and Distribution Piping Systems[4]

ANSI/ASME B1.20.1 Pipe Threads, General Purpose (inch)[4]

ANSI B 16.5 Steel Pipe Flanges, Flanged Fittings[4]

2.4 *ASME Standard:*[5]

ASME Boiler and Pressure Vessel Code

2.5 *API Standard:*[6]

API 1104 Standard for Welding Pipelines and Related Facilities

2.6 *UL Standard:*[7]

UL 360 Flexible Metal Hose

[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] 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 DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[5] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

[6] Available from American Petroleum Institute (API), 200 Massachusetts Ave. NW, Suite 1100, Washington, DC 20001, http://www.api.org.

[7] Available from Underwriters Laboratories (UL), UL Headquarters, 333 Pfingsten Road, Northbrook, IL, 60062, http://www.ul.com.

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

2.7 *PPI Standard:*[8]

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

3. Terminology

3.1 The gas industry terminology used in this specification is in accordance with ANSI B31.8 or the United States CFR 49 Part 192, unless otherwise indicated.

3.1.1 The term "pipe" used herein refers to both "pipe" and "tubing" unless specifically stated otherwise.

3.1.2 The term "gas" used herein refers to any fuel gas unless specifically stated otherwise.

3.2 *Definitions*—Definitions are in accordance with Definitions F412 unless otherwise specified. Abbreviations are in accordance with Abbreviations D1600 unless otherwise specified.

3.3 *Definitions:*

3.3.1 *anodeless flex riser casing*—a flexible, plastic coated, metallic, non-gas carrying, protective outer sleeve portion of an anodeless riser which is sometimes selected as an alternate to rigid riser casings.

3.3.2 *anodeless riser*—a type of transition fitting which is designed to transport gas from an underground polyethylene or polyamide 11 or polyamide 12 service line to above-ground steel piping. In an anodeless riser, the polyethylene or polyamide 11 or polyamide 12 pipe is always the gas carrier, at least, in the below ground section.

3.3.3 *anodeless riser, flex design*—an anodeless riser where the rise leg is a transition fitting which is fabricated to an anodeless flex riser casing which is field bent to form the base leg.

3.3.3.1 *Discussion*—Anodeless flex risers usually require a riser bracket attached to a rigid supporting member to avoid meter set loads from being transmitted to the thermoplastic service line.

3.3.4 *anodeless riser nipple*—the metallic, aboveground, gas carrying pipe or fitting portion of an anodeless riser.

3.3.5 *anodeless riser rigid riser casing*—the metallic, non-gas carrying protective outer sleeve portion of an anodeless riser.

3.3.6 *anodeless riser, rigid, straight and prebent*—an anodeless riser which is produced straight or factory prebent, usually 90°, thus defining rise leg and base leg dimensions.

3.3.7 *base leg*—the steel horizontal portion of an anodeless riser measured from the centerline of vertical.

3.3.8 *Category 1*—a transition joint which provides for pressure tightness and resistance to end loads sufficient to cause no less than 25 % elongation of the PE, PA11 or PA12 piping as described in this standard.

3.3.9 *Category 3*—a transition joint which provides for pressure tightness and resistance to end loads greater than the maximum thermal stress that would be produced by a temperature change of 100 °F (55 °C).

3.3.10 *grade level marking*—a marking, tape or label applied to the riser to identify the point at which the transition from PE, PA11 or PA12 gas carrier to metallic gas carrier occurs. This marking assists the installer in determining the grade level of the installation.

3.3.11 *insert stiffener*—a rigid, non-split, solid wall tube which is inserted into PE, PA11 or PA12 piping to support compression loads in the area of the transition joint.

3.3.12 *joint*—the location at which two or more pieces of pipe or a pipe and a fitting are connected.

3.3.13 *MAOP*—the maximum allowable operating pressure of the fuel gas piping system, in psig, as determined in accordance with US DOT CFR, Title 49, Part 192.121 and as represented in the following:

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

where:

S = The Thermoplastic materials' HDB as published in the Plastics Pipe Institute PPI TR 4 publication,

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.

3.3.14 *rise leg*—the vertical portion of an anodeless riser measured from the centerline of horizontal.

3.3.15 *service line*—a fuel gas distribution line which transports gas from a common source of supply (gas main) to the customer piping.

3.3.16 *spigot*—a rigid profiled solid wall metallic tube, inserted into the PE, PA11 or PA12 piping serving as the stiffener in the area of transition.

3.3.17 *transition fitting*—a fitting that makes a transition joint between two different types of piping materials. As used in this Standard, it is the transition between the PE, PA11 or PA12 and the metallic pipes.

3.3.18 *transition joint*—the joint at which two different piping materials (the PE, PA11 or PA12 and metal piping) are connected.

4. Materials and Manufacture

NOTE 1—Materials used in components of the fitting that will be in long term contact with gas should be demonstrated by testing or history of successful usage not to be adversely affected.

4.1 *General:*

4.1.1 All materials of the fitting shall meet the performance requirements of this specification. Specific materials referenced in this section are common materials used in these types of products. Alternate materials proven to provide equal or better performance are acceptable.

4.1.2 As per the recommendations of the respective resin manufacturers, no cross fusion between PA11 pipe and fittings and PA12 pipe and fittings is permitted. Alternatively, no cross

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

fusion between PE pipe and fittings and either PA11 or PA12 pipe and fittings is permitted.

4.2 *Casings and Nipples:*

4.2.1 Rigid riser casings shall be constructed of Specification A53/A53M, Specification A513 or equivalent metallic materials with a minimum nominal 0.065 in. (1.65 mm) wall thickness within the allowable tolerance ranges of the applicable metallic piping specification.

4.2.2 Flex riser casings shall be constructed of plastic coated flexible metallic tubing providing a crush strength of not less than 1000 lbs. When tested in accordance with UL 360, section 9.1. The flex shall also be capable of withstanding a tensile pull of 300 lbs force without breaking or unwinding.

4.2.3 Riser nipples shall be constructed of Specification A53/A53M, or equivalent, steel pipe with a minimum of schedule 40 wall thickness.

4.2.4 All burrs on metal components, which could damage the PE, PA11 or PA12 piping, shall be removed prior to insertion of the PE, PA11 or PA12 piping so as to prevent any damage to the PE, PA11 or PA12 gas piping. Alternately, all such burrs shall be suitably covered with a protective device such as an ID plastic sleeve, to preclude any damage to the PE, PA11 or PA12 gas piping.

4.3 *Polyethylene Pipe (PE), Polyamide 11 (PA11) and Polyamide 12 (PA12) Pipe:*

4.3.1 Polyethylene and pipe shall comply with the requirements of Specification D2513.

4.3.2 Polyamide 11 pipe shall comply with the requirements of Specification F2945.

4.3.3 Polyamide 12 pipe shall comply with the requirements of Specification F2785.

4.4 *Elastomers:*

4.4.1 Gas sealing elastomeric components shall be of materials compatible with all components of the fitting and the materials of the pipes being joined, and shall be resistant to fuel gases.

4.5 Specifications outlining the physical and chemical properties of all fitting materials shall be available from the fitting manufacturer upon request.

5. Dimensions, Mass, and Permissible Variations

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

6. Design Qualification Requirements

6.1 *General:*

6.1.1 After initial testing, any revision to design adversely affecting performance requires retesting.

6.2 *Bend Radius Requirements:*

6.2.1 The bend radius of anodeless risers shall not be less than 8× the diameter of the PE, PA11 or PA12 piping.

NOTE 2—If a bend radius of less than 8× the nominal PE, PA11 or PA12 pipe diameter is used the PE, PA11 or PA12 pipe manufacturer should be contacted to assure that their piping can accept a bend radius less than 8×.

6.3 *Thread Requirements:*

6.3.1 All gas carrying steel pipe threads shall comply with ANSI/ASME B1.20.1

6.3.2 The polyethylene or polyamide 11 or polyamide 12 piping shall not be threaded.

6.4 *Flange Requirements:*

6.4.1 All steel flanges shall comply with ANSI B 16.5.

6.5 *Welding Requirements:*

6.5.1 All gas pressure containing factory welding shall comply with the requirements of the United States Code of Federal Regulations, Title 49, Part 192, Subpart D or in accordance with ASME Boiler and Pressure Vessel Code, Section IX or API 1104.

6.6 *Temperature Cycling:*

6.6.1 The joint shall be leak-free after ten temperature cycle tests as tested at a minimum of 1.5 × MAOP and 7 ± 3 psig in accordance with 7.4.

6.7 *Tensile Pull Test Requirements :*

6.7.1 Transition joints in transition fittings and anodeless risers in PE, PA11 or PA12 sizes below NPS 4 shall be proven to be of full restraint/full seal Category 1 design. The joint qualifies under this requirement if the pipe is pulled to a minimum of 25 % elongation, as indicated by when the length of the unrestrained PE, PA11 or PA12 piping has been elongated to 125 % of its original length, when tested in accordance with 7.3, and is bubble tight in accordance with 6.7.3. No leakage or pullout is permitted.

6.7.2 In PE, PA11 or PA12 sizes NPS 4 and larger the joint shall be qualified to be of either Category 1 design as in 6.7.1, or of Category 3 design by pull testing to tensile stress equal to or greater than the maximum tensile stress that would be produced by a temperature change of 100 °F (38 °C) when tested in accordance with 7.3. No leakage or pullout is permitted in accordance with 6.7.3. Failure of one sample constitutes failure of this test.

NOTE 3—Sample calculations are shown in Specifications D2513 or F2785section X2.4, Thermal Stress.

6.7.3 The samples shall be leak tested at 7 ± 3 psig and a minimum of 1.5 × MAOP, prior to, and at the end of the test while still under tensile load and immediately following the tensile test. No leakage shall be permitted when tested in accordance with 7.2.

6.7.4 Each nominal size transition design, in PE, PA11 or PA12 shall be tested, except testing of the heaviest wall (lowest SDR) polyethylene or polyamide 11 and polyamide 12 piping shall qualify all thinner wall polyethylene or polyamide 11 or polyamide 12 pipe joints of the same outside diameter.

6.7.5 The polyethylene, polyamide 11 or polyamide 12 pipe, in the transition compression zone(s), shall be fully supported by an inserted stiffener or spigot which, by design, has no sharp O.D. burrs capable of damaging the polyethylene, polyamide 11 and polyamide 12 pipe during assembly.

6.8 *Leak Test:*

6.8.1 The transition joint shall be leak free when leak tested at 7 ± 3 psig and at a minimum of 1.5× the MAOP at both 73.4 ± 3.6 °F (23 ± 2 °C) and –20 ± 3.6 °F (–29 ± 2 °C) in accordance with 7.2.