Designation: F2165 – 19

An American National Standard

Standard Specification for Flexible Pre-Insulated Plastic Piping[1]

This standard is issued under the fixed designation F2165; 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 flexible, pre-insulated plastic piping systems commonly used to convey hot and cold fluids, including piping systems that are supplied complete with plastic carrier pipe, thermal insulation, and outer jacket manufactured as an integrated system, and are supplied in a coil or as a straight length. Both bonded and non-bonded insulation types are included. Included are requirements and test methods for material, workmanship, dimensions, and endseal testing. Requirements for markings are also given. The components covered by this specification are intended for use in, but not limited to, residential and commercial, hot- and cold-potable water distribution systems, reclaimed water, fire protection, municipal water service lines, radiant heating and cooling systems, hydronic distribution systems, snow and ice melting systems, geothermal ground loops, district heating, turf conditioning, compressed air distribution and building services pipe, provided that the carrier pipe or tubing covered herein complies with applicable code requirements.

1.2 Piping systems may include one or more carrier pipes within a common outer jacket.

1.3 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered part of this standard.

NOTE 1—Pre-insulated pipes covered by this specification are typically installed underground in buried applications.

1.4 *Units*—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 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 *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]

C168 Terminology Relating to Thermal Insulation

C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2239 Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

D3035 Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

F412 Terminology Relating to Plastic Piping Systems

F714 Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter

F876 Specification for Crosslinked Polyethylene (PEX) Tubing

F1281 Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe

F1282 Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe

F2389 Specification for Pressure-rated Polypropylene (PP) Piping Systems

F2769 Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems

F2788 Specification for Metric and Inch-sized Crosslinked

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.11 on Composite.

Current edition approved Jan. 1, 2019. Published January 2019. Originally approved in 2002. Last previous edition approved in 2013 as F2165– 13. DOI: 10.1520/F2165-19.

[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.

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

Polyethylene (PEX) Pipe
F3123 Specification for Metric Outside Diameter Polyethylene (PE) Plastic Pipe (DR-PN)
F3253 Specification for Crosslinked Polyethylene (PEX) Tubing with Oxygen Barrier for Hot- and Cold-Water Hydronic Distribution Systems

2.2 *NSF Standards:*[3]
NSF/ANSI 14 Plastics and Plumbing System Components
NSF/ANSI 61 Drinking Water System Components—Health Effects[3]

2.3 *DIN Standards:*[4]
DIN 8074 Polyethylene (PE) Pipes, PE 63, PE 80, PE-100, PE-HD—General Quality Requirements and Testing
DIN 8075 Polyethylene (PE) Pipes, PE 63, PE 80, PE-100, PE-HD—Dimensions
DIN 8077 Polypropylene (PP) pipes- PP-H, PP-B, PP-R, PP-RCT -Dimensions
DIN 8078 Polypropylene (PP) pipes- PP-H, PP-B, PP-R, PP-RCT - General quality requirements and testing
DIN 16892 Crosslinked Polyethylene Pipes—General Quality Requirements and Testing
DIN 16893 Crosslinked Polyethylene Pipes—Dimensions

2.4 *ISO Standard*[5]
ISO 15875 Plastic Piping Systems for Hot and Cold Water-Installations-Crosslinked Polyethlene (PE-X)
ISO 22391-2 Plastic Piping Systems for Hot and Cold Water Installations -- Polyethylene of Raised Temperature Resistance (PE-RT)

3. Terminology

3.1 Definitions are in accordance with Terminology F412 for plastic piping systems and C168 for thermal insulating materials; abbreviations are in accordance with Terminology D1600 unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bonded insulation system, n*—a product that is the result of applying thermal insulation to a carrier pipe where a bond forms between the insulation and the carrier pipe that exceeds the modulus of elasticity of the carrier pipe.

3.2.2 *carrier pipe, n*—the pipe(s) that are used to convey the medium.

3.2.3 *compression fittings, n*—types of fittings for pipe or tubing, such as insert-type fittings that utilize a reinforcing insert which is inserted into the pipe or tubing and a ring or clamp that compresses the pipe or tubing over the insert, and cold-expansion fittings that require the expansion of the pipe or tubing prior to insertion of the reinforcing insert that is inserted into the pipe or tubing and a ring or clamp which compresses the pipe or tubing over the insert.

3.2.4 *crosslinked polyethylene (PEX) plastic, n*—a polyethylene material which has undergone a change in molecular structure through processing whereby a majority of the polymer chains are chemically linked

3.2.5 *end seal, n*—a device that provides a seal between the outer jacket and carrier pipe, providing a moisture barrier for the insulation.

3.2.6 *flexible pre-insulated pipe system, n*—a factory manufactured pre-insulated pipe system consisting of carrier pipe(s), thermal insulating material, and protective jacket. This product is supplied in coils.

3.2.7 *jacket, n*—the outer covering of the flexible pre-insulated pipe system. The jacket provides mechanical and moisture protection for the insulation.

3.2.8 *non-bonded insulation system, n*—a product that is the result of applying thermal insulation to a carrier pipe without bonding the insulation to the carrier pipe, allowing the carrier pipe to move freely within the insulation.

3.2.9 *pipe joint, n*—a connection between two sections of piping material. The pipe joint shall include the connection of the carrier pipe, insulation of the bare section carrier pipe, and protective outer jacket.

3.2.10 *thermal insulation, n*—a general term used to describe any material that reduces heat transfer.

3.2.11 *ultraviolet (UV) stability, n*—the resistance to ultraviolet degradation of the jacket material.

4. Significance and Use

4.1 This specification establishes materials and performance requirements for flexible, pre-insulated plastic piping intended for hot and chilled fluid applications.

5. Materials

5.1 *Carrier Pipe(s):*

5.1.1 PEX carrier pipe shall conform to one or more of the following: Specifications F876, F2788, F3253; DIN 16892 and DIN 16893; ISO 15875.

5.1.2 PE carrier pipe shall conform to one or more of the following: Specifications D2239, D3035, F714, F3123; DIN 8075 and DIN 8074.

5.1.3 Composite carrier pipe shall conform to one or more of the following: Specifications F1281 or F1282.

5.1.4 PP carrier pipe shall conform to one or more of the following: Specification F2389; DIN 8077 or DIN 8078.

5.1.5 PE-RT carrier pipe shall conform to one or more of the following: Specification F2769; ISO 22391-2.

5.1.6 Other piping materials as specified by customer specifications.

5.2 *Thermal Insulation:*

5.2.1 Insulation shall have a maximum thermal conductivity of 0.30 BTU·in./h·ft^2·°F (0.04 W/(m·K) when measured in accordance with Test Method C177.

5.2.2 All seams of the non-bonded insulation sheets shall be permanently joined.

5.2.3 Non-bonded insulation shall be visually inspected for voids and other defects prior to the application of the jacket. Any voids or variance in thickness greater than 0.1 in. shall be reason for rejection. Manufacturer shall repair or replace

[3] Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, http://www.nsf.org.

[4] Available from Beuth Verlag GmbH (DIN-- DIN Deutsches Institut fur Normung e.V.), Burggrafenstrasse 6, 10787, Berlin, Germany, http://www.en.din.de.

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