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Standard Specification for Black Crosslinked Polyethylene (PEX) Line Pipe, Fittings and Joints Pipe For Oil and Gas Producing Applications¹

This standard is issued under the fixed designation F2905/F2905M; 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 Scope*

1.1 This specification covers outside diameter controlled, pressure rated, ~~black metric-sized and IPS-sized~~ inch-sized black or yellow crosslinked polyethylene (PEX) pipe, fittings and joints, pipe made in pipe dimension ratios ranging from 6 to 17. Included are requirements and test methods for material, workmanship, dimensions, burst pressure, hydrostatic sustained pressure, stabilizer functionality, bent-pipe hydrostatic pressure, degree of crosslinking, ~~and chemical resistance~~ chemical resistance, and minimum operating temperature. Requirements for pipe and fittings markings are also given. The ~~pipe, fittings and joints pipe~~ covered by this specification are intended for pressure or non-pressure oil and gas producing ~~applications to convey fluids applications~~, such as conveying oil, dry or wet gas, gas gathering, multiphase fluids, and non-potable oilfield water. This specification does not cover ~~pipe piping~~ for gas distribution applications.

1.2 This specification also includes requirements for joints made between PEX pipe and polyethylene electrofusion fittings (such as Specification **F1055**). Fittings to be used with PEX pipe manufactured to this Specification are in Specification **F2829**. Installation considerations are in .

1.3 The text of this specification references notes, footnotes, and appendixes, which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

1.4 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

NOTE 1—Metric sized (SI units) pipe should only be joined with corresponding metric sized fittings, and inch sized pipe should only be joined with corresponding inch sized fittings. Inch sized fittings should not be used for metric sized pipe, and metric sized fittings should not be used for IPS inch sized pipe.

1.5 *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 ~~health~~ 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

D618 Practice for Conditioning Plastics for Testing

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D1505 Test Method for Density of Plastics by the Density-Gradient Technique

D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1603 Test Method for Carbon Black Content in Olefin Plastics

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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.

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



- [D2122](#) Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- [D2290](#) Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe
- [D2565](#) Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications
- [D2765](#) Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
- [D2837](#) Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
- [D4218](#) Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique
- [F412](#) Terminology Relating to Plastic Piping Systems
- [F1055](#) Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
- [F1948](#) Specification for Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing
- [F2619](#) Specification for High-Density Polyethylene (PE) Line Pipe
- [F2657](#) Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
- [F2829](#) Specification for Metric- and Inch-Sized Crosslinked Polyethylene (PEX) Pipe Systems
- 2.2 *Federal Standard*:³
- [FED-STD-123](#) Marking for Shipment (Civil Agencies)
- 2.3 *Military Standard*:³
- [MIL-STD-129](#) Marking for Shipment and Storage
- 2.4 *ISO Standards*:⁴
- [ISO 1167](#) Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method ISO
- [ISO 13477](#) Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Small-scale steady-state test (S4 test)
- [ISO 14531-1](#) Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 1: Pipes
- [ISO 14531-2](#) Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 2: Fittings for heat-fusion jointing
- [ISO 14531-3](#) Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 3: Fittings for mechanical jointing (including PE-X/metal transitions)
- 2.5 *PPI Standards*:⁵
- [PPI TR-3](#) Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe
- [PPI TR-4](#) PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe
- [PPI TR-9](#) Recommended Design Factors and Design Coefficients for Thermoplastic Pressure Pipe

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology [F412](#), and abbreviations are in accordance with Terminology [D1600](#), unless otherwise specified. The abbreviation for crosslinked polyethylene is PEX. Plastic pipe denotes a particular diameter schedule of plastic pipe that is outside diameter controlled.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *crosslinked polyethylene, n*—molecular chains chemically connected through irradiation with high-energy electron beams, or chemical agents such as organic peroxides or silanes.

3.2.2 *multiphase fluid, n*—oil, gas, and water in any combination produced from one or more oil or gas wells, or recombined oil or gas well fluids that may have been separated in passing through surface facilities.

3.2.3 *oilfield water, n*—fresh or salt water transported by pipeline, regardless of purity or quality, from wells or surface locations for the purpose of providing water injection to underground reservoirs; or disposing of waste water from hydrocarbon or gas production, processing, or storage facilities.

3.2.4 *PEX pipe material designation code*—The PEX pipe material designation code shall consist of the abbreviation for crosslinked polyethylene (PEX) followed by four Arabic digits as shown in [Table 1](#), and as defined in Terminology [F412](#) for PEX pipe materials.

3.2.5 *production run, n*—the continuous extrusion of pipe of a specific diameter, wall thickness and material compound.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

⁴ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, <http://www.iso.org>.

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

TABLE 1 PEX Pipe Material Designation Codes

PEX Pipe Material Designation Code	73°F [23°C] HDB, Psi [MPa]	200°F [93°C] HDB, Psi [MPa]
PEX 0006	1250 [8.62]	630 [4.34]
PEX 0008	1600 [11.03]	630 [4.34]
PEX 0009	1800 [12.41]	630 [4.34]

3.2.6 *sample, n*—pipe or an element of pipe that represents a quantity of pipe and provides a specimen or specimens for testing.

3.2.7 *specimen, n*—pipe or an element of pipe that is subjected to test.

4. Pipe Classification

4.1 *General*—This standard covers black PEX pipe that is pressure rated based on HDB at 73°F [23°C] and 200°F [93°C]. Pressure ratings for temperatures between 73°F [23°C] and 200°F [93°C] are determined by temperature interpolation in accordance with PPI TR-3.

4.2 *Classification*—PEX pipes are classified by their PEX pipe material designation codes as shown in [Table 1](#).

5. Materials

5.1 *General*—PEX pipes, meeting the requirements of this specification, are defined by means of (1) degree of crosslinking per 6.7, and (2) long-term strength tests per Test Method [D2837](#) to determine HDB per [Table 1](#). The HDB is a property of the PEX compound, which is used to make the PEX pipe.

5.2 *Basic Materials*—PEX pipe and fittings shall be made from PE compounds, which have been crosslinked by peroxides, azo compounds, or silane compounds in extrusion, or by electron beam after extrusion, such that the pipe meets the performance requirements of Section 6. The materials, procedure for mixing, and the process for crosslinking shall result in a product with Hydrostatic Design Basis ratings equal to or better than those shown in [Table 1](#), when determined in accordance with procedures no less restrictive than those of Test Method [D2837](#), and the PEX material shall have a Plastics Pipe Institute (PPI) long-term hydrostatic design stress and hydrostatic design basis rating. See [Appendix X1](#) for additional information on PPI hydrostatic stress ratings.

5.3 *PEX Pipe Material Designation Code*—The PEX material meeting the requirements of this specification shall be designated PEX 0006, PEX 0008 or PEX 0009.

5.4 *Density*—When determined in accordance with 7.5, the PEX base resin, without carbon black, shall have a minimum average density of 0.926 g/cm³.

5.5 Color:

5.5.1 PE compounds used to make black PEX pipe shall contain well dispersed carbon black as a colorant.

5.5.2 PE compounds used to make yellow PEX pipe shall contain a yellow pigment as a colorant.

5.6 *Carbon Black—UV Protection*: PE compounds used to make PEX pipe shall contain 2.0 to 3.0 percent well dispersed carbon black as measured in the PEX pipe by Test Method [D1603](#) or Test Method [D4218](#).

5.6.1 Black pipe with or without yellow stripes shall be stabilized and protected against deterioration from unprotected UV exposure for not less than 10 years. Yellow pipe shall be stabilized and protected against deterioration from unprotected UV exposure for not less than 3 years.

5.6.2 If the carbon black content is less than 2.0%, the pipe shall be tested in accordance with Test Method [F2657](#), Practice [D2565](#) or ISO 14531-1 Annex C. After PEX pipe has been weathered, it shall meet the thermal stability, 95 °C hydrostatic strength (for stress values, use 536 psi (3.7 MPa) for PEX 0006, 681 psi (4.7 MPa) for PEX 0008, or 768 psi (5.3 MPa) for PEX 0009), and elongation at break requirements of ISO 14531-1 Table 8.

5.6.3 If the carbon black content is greater than 2.0% and less than 3.0% as measured by Test Method [D1603](#) or Test Method [D4218](#), the UV exposure time requirement of 5.6.2 is not applicable. This is consistent with ISO 14531-1 Table 8. The carbon black shall be well dispersed, and have the correct type (furnace) and particle size (40 nm or less), such as N550.

5.7 *Rework Material*—PEX rework shall not be used in the manufacture of PEX pipes and fittings made in accordance to this specification.

6. Requirements

6.1 *Workmanship*—The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.2 *Out-of Roundness*—The maximum out-of roundness requirements shown in [Table 2](#) and [Table 3](#) for pipe apply to the average measured diameter in accordance with [7.4.1](#).

6.3 *Dimensions and Tolerances:*

6.3.1 *Outside Diameters*—The outside diameters and tolerances shall be as shown in [Table 2](#) or [Table 3](#), when measured in accordance with [7.4](#) and [7.4.1](#).

6.3.2 *Wall Thickness*—The wall thickness and tolerances shall be as shown in [Table 4](#) or [Table 5](#), when measured in accordance with [7.4](#) and [7.4.2](#).

6.4 *Sustained Pressure 73°F [23°C]—73 °F [23 °C]*—The PEX pipe shall not fail in less than 1000 h when tested in accordance with [7.6](#). For PEX 0006 the stress shall be 1320 psi [9.1 MPa], for PEX 0008 the stress shall be 1650 psi [11.3 MPa], and for PEX 0009 the stress shall be 2050 psi [14.1 MPa]. Piping intended for use at temperatures of $\pm 100^{\circ}\text{F}$ [$\pm 38^{\circ}\text{C}$] $\pm 100^{\circ}\text{F}$ [$\pm 38^{\circ}\text{C}$] and higher shall be tested at both 73°F [23°C] 73°F [23°C] and the maximum design temperature. The test fiber stress shall be 90 % of the HDB.

6.5 *Minimum Hydrostatic Burst Pressure (Quick Burst)*—The pipe shall fail in a ductile manner when tested in accordance with [7.7](#). For pipe sizes above 4 in. [110 mm] nominal diameter, the testing lab shall be allowed to replace the quick burst test by the apparent ring tensile strength test in [6.6](#).

6.6 *Apparent Tensile Strength at Yield*—When tested in accordance to [7.8](#), the PEX pipe shall demonstrate a minimum of 3000 psi [20.7 MPa] for PEX 0006, 3700 psi [25.5 MPa] for PEX 0008, and 4600 psi [31.7 MPa] for PEX 0009.

6.7 *Degree of Crosslinking—Crosslinking:* When tested in accordance with [7.9](#), the degree of crosslinking for PEX pipe material shall be within the range from 65 to 89% inclusive. Depending on the process used, the following minimum percentage crosslinking values shall be achieved: 73% by peroxides, 65% by electron beam, or 65% by silane compounds.

6.7.1 When tested in accordance with [7.9](#), the degree of crosslinking for PEX pipe material shall be within the range from 65 to 89% inclusive. Depending on the process used, the following minimum percentage crosslinking values shall be achieved: 70 % by peroxides, 65 % by electron beam, or 65 % by silane compounds. PEX pipe shall meet these minimum crosslink requirements before the manufacturer can release this pipe for installation by the user.

6.7.2 In addition, for pipe with a wall thickness greater than 0.5 in. (12.7 mm), the degree of crosslinking shall be measured at four points separated by 90 degrees in the middle of the wall. For one of these points, measure at three points along the wall thickness – see [Fig. 1](#) below. Collect shaving samples, about 0.004 in (0.10 mm) thick, by drilling a hole in the axial pipe direction with a 1/8 in. (3 mm) drill to collect a 0.007 – 0.014 ounce (0.2 – 0.4 gram) sample size.

6.7.3 The degree of crosslinking over the entire wall thickness of all thick-wall pipe tested per [6.7.2](#) shall meet the minimum requirements specified in [6.7.1](#). The degree of crosslinking shall not vary outside the limits specified in [6.7.1](#) at any time at any part of the pipe.

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<https://standards.iteh.ai/catalog/standards/sist/f6dfe4-fdaf-4983-b11d-9d9a074550ad/astm-f2905-f2905m-19>

TABLE 2 Metric-sized Outside Diameters and Tolerances for PEX Pipe

Pipe Size	Average Outside Diameter	Tolerances for Average Diameter	Out-of-Roundness
mm	mm	mm	mm
16	16.15	±0.15	1.2
20	20.15	±0.15	1.2
25	25.15	±0.15	1.2
32	32.15	±0.15	1.3
40	40.20	±0.20	1.4
50	50.20	±0.20	1.4
63	63.20	±0.20	1.5
75	75.25	±0.25	1.6
90	90.30	±0.30	1.8
110	110.35	±0.35	2.2
125	125.40	±0.40	2.5
140	140.45	±0.45	2.8
160	160.50	±0.50	3.2
180	180.55	±0.55	3.6
200	200.60	±0.60	4.0
225	225.70	±0.70	4.5
250	250.75	±0.75	5.0
280	280.85	±0.85	9.8
315	315.95	±0.95	11.1
355	356.10	±1.10	12.5
400	410.20	±1.20	14.0
450	451.35	±1.35	15.6
500	501.50	±1.50	17.5
560	561.70	±1.70	19.6
630	631.90	±1.90	22.1



TABLE 3 Inch-sized Outside Diameters and Tolerances for PEX Pipe

Pipe Size in.	Outside Diameter in.	Tolerances or Outside Diameter \pm in.
3	3.500	.016
4	4.500	.020
5	5.563	.025
6	6.625	.030
8	8.625	.039
10	10.750	.048
12	12.750	.057
14	14.000	.063
16	16.000	.072
18	18.000	.081
20	20.000	.090
22	22.000	.099
24	24.000	.108
26	26.000	.117
28	28.000	.126
30	30.000	.135
32	32.000	.144
34	34.000	.153
36	36.000	.162
42	42.000	.189
48	48.000	.216
54	54.000	.243

6.8 *Stabilizer Functionality*—Stabilizer Functionality shall be tested in accordance with 7.10. The test need only be performed for the original validation of pipe made from a particular compound.

6.9 *Bent Pipe Hydrostatic Sustained Pressure Strength*:—

6.9.1 *General*—PEX pipe sizes and DR's deemed suitable for bending by the pipe manufacturer shall meet the requirements in 6.10.26.9.2.

6.9.2 Cold-bent pipe, with a radius of six (6) times the outside diameter and consisting of a continuous bend length inducing not less than 90° angle, shall meet the minimum hydrostatic sustained pressure strength requirements in 6.4 when tested in accordance with 7.6.

6.10 All tests shall be repeated if there is a change in the crosslinking agent, antioxidant package or the base PE resin for the PEX compound.

6.11 *Minimum Operating Temperature*:

6.11.1 Pipe shall have a minimum operating temperature established by testing in accordance with 6.11.2. Squeeze-off tests are then conducted on the pipe at this minimum operating temperature in accordance with 6.12.

6.11.1.1 These tests need only be performed for the original pipe made from a particular compound. Re-testing is required for a compound change that also requires re-testing of the new formulation. Changes in compound formulations are defined in PPI TR-3.

6.11.2 The minimum operating temperature shall be greater than the Small-Scale-SteadyState RCP critical temperature when determined in accordance with ISO 13477 at a constant hoop stress of 928 psi (6.4 MPa) for PEX 0006, or 1160 psi (8.0 MPa) for PEX 0008.

6.12 *Squeeze-Off*—The squeeze-off testing discussed below is only for pipe sizes, wall thicknesses, squeeze procedures, and conditions deemed suitable for squeeze-off in service by the pipe manufacturer. The PEX pipe shall be conditioned to assure it is at the established minimum operating temperature, then squeezed-off at this temperature in accordance with ISO 14531-1 Annex D. Samples of pipe that have been subjected to squeeze-off shall then not fail when tested at 200 °F (93 °C) for 1000 h in accordance with Test Method D1598 at a hoop stress of 536 psi (3.7 MPa) for PEX 0006, or 681 psi (4.7 MPa) for PEX 0008.

6.13 *Fittings and Polyethylene Electrofusion Joints*:

6.10.1 Fittings intended for use with PEX pipe at temperatures up to 200°F [93°C] shall meet the dimensional, design and performance requirements for the corresponding fitting product standard, such as Specification F1055, ISO 14531-2, or ISO 14531-3. Fittings shall be compatible with PEX pipe made to this specification. The fittings manufacturer shall recommend their fittings for use with PEX pipe in the intended application. PEX pipe shall only be joined using qualified joining procedures.

6.13.1 *Qualification of Electrofusion Joints*—PE electrofusion fittings shall only be used for temperatures up to 140°F [60°C]. PEX electrofusion fittings shall be used for temperatures above 140°F [60°C] up to 200°F [93°C]. All electrofusion joints made between PEX pipe and electrofusion fittings shall meet the joint performance requirements as specified in the applicable fittings. For PEX pipe that is deemed suitable by the pipe manufacturer for joining to polyethylene (PE) electrofusion fittings, the pipe

TABLE 4 Metric-sized Wall Thickness and Tolerances for PEX Plastic Pipe Minimum Wall Thickness (t), mm (tolerance is plus 12%)

Pipe Size [mm]	DR 6	DR 7.4	DR 9	DR 11	DR 13.6	DR 16.2	DR 17	DR 21
16	3.0	2.3	2.0	...	...	...	...	...
20	3.4	3.0	2.3	2.0	...	...	...	...
25	5.4	3.5	3.0	2.3	2.0	...	...	...
32	5.4	4.4	3.6	3.0	2.4	2.0	2.0	2.3
40	6.7	5.5	4.5	3.7	3.0	2.5	2.4	2.8
50	8.3	6.9	5.6	4.6	3.7	3.1	3.0	3.4
63	10.5	8.6	7.1	5.8	4.7	3.9	3.8	4.3
75	12.5	10.3	8.4	6.8	5.6	4.6	4.5	5.1
90	15.0	12.3	10.1	8.2	6.7	5.6	5.4	6.1
110	18.3	15.1	12.3	10.0	8.1	7.7	6.6	7.4
125	20.8	17.1	14.0	11.4	9.2	7.7	7.4	8.3
140	23.3	19.2	15.7	12.7	10.3	8.7	8.3	9.3
160	26.6	21.9	17.9	14.6	11.8	9.9	9.5	10.6
180	29.9	24.6	20.1	16.4	13.3	11.1	10.7	11.9
200	33.2	27.4	22.4	18.2	14.7	12.4	11.9	13.2
225	37.4	30.8	25.2	20.5	16.6	13.9	13.4	14.9
250	41.5	34.2	27.9	22.7	18.4	15.5	14.8	16.4
280	46.5	38.3	31.3	25.4	20.6	17.3	16.6	18.4
315	52.3	43.1	35.2	28.6	23.2	19.5	18.7	20.7
355	59.0	48.5	39.7	32.2	26.1	21.9	21.1	23.4
400	...	54.7	44.7	36.3	29.4	24.7	26.2	23.7
450	...	61.5	50.3	40.9	33.1	27.8	26.7	29.5
500	...	...	55.8	45.4	36.8	30.9	29.7	32.8
560	...	...	62.5	50.8	41.2	34.6	33.2	36.7
630	...	...	70.3	57.2	46.3	38.9	37.4	41.3
710	...	...	79.3	64.5	52.2	43.9	42.1	46.5
800	...	...	89.3	72.6	58.8	49.4	47.4	52.3
900	...	...	...	81.7	66.2	56.6	53.3	58.8
1000	...	...	...	90.2	72.5	61.8	59.3	65.4

TABLE 5 Inch-Sized Wall Thickness and Tolerances for PEX Plastic Pipe

Pipe Size (in)	DR 7.3	DR 8.3	DR 9	DR 11	DR 13.5	DR 15.5	DR 17	DR 21
3	0.479	0.422	0.389	0.318	0.259	0.226	0.206	0.167
4	0.616	0.542	0.500	0.409	0.333	0.290	0.265	0.214
5	0.762	0.670	0.618	0.506	0.412	0.359	0.327	0.265
6	0.908	0.798	0.736	0.602	0.491	0.427	0.390	0.315
8	1.182	1.039	0.958	0.784	0.639	0.556	0.507	0.411
10	1.473	1.295	1.194	0.977	0.796	0.694	0.632	0.512
12	1.747	1.536	1.417	1.159	0.944	0.823	0.750	0.607
14	1.918	1.687	1.556	1.273	1.037	0.903	0.824	0.667
16	2.192	1.928	1.778	1.455	1.185	1.032	0.941	0.762
18	2.466	2.169	2.000	1.636	1.333	1.161	1.059	0.857
20	...	2.409	2.222	1.818	1.481	1.290	1.176	0.952
22	...	...	2.444	2.000	1.630	1.419	1.294	1.048
24	...	...	2.667	2.182	1.778	1.548	1.412	1.143
26	...	...	...	2.364	1.926	1.677	1.529	1.238
28	...	...	...	2.545	2.074	1.806	1.647	1.333
30	...	...	...	2.727	2.222	1.935	1.765	1.429
32	...	...	...	2.909	2.370	2.065	1.882	1.524
34	...	...	...	3.091	2.519	2.194	2.000	1.619
36	...	...	...	3.273	2.667	2.323	2.118	1.714
42	...	...	...	...	...	2.710	2.471	2.000
48	...	...	...	...	...	3.097	2.824	2.286
54	...	...	...	...	...	...	3.176	2.571

manufacturer shall qualify the PEX pipe by testing joints made with PE electrofusion fittings and PEX pipe meeting this standard, and assuring that these joints meet the performance requirements of the PE electrofusion fitting standard, such as Specification F1055 or ISO 14531-2.

NOTE 2—The following performance requirements are described in these ASTM and ISO standards for electrofusion fittings — 68°F [20°C] or 73°F [23°C] hydrostatic strength, 176°F [80°C] hydrostatic strength, short-term internal pressure resistance, resistance to tensile loads, cohesive resistance for electrofusion saddle and socket fittings at both the minimum and maximum recommended temperatures, impact resistance for saddle fittings. 6.10.3 All mechanical fitting joints made between PEX pipe and mechanical fittings shall meet the joint performance requirements as specified in the applicable fitting standard, such as Specification F1948 or ISO 14531-3.

NOTE 3—The following performance requirements are described for mechanical fittings — 68°F [20°C] hydrostatic strength, elevated temperature hydrostatic strength, short-term internal pressure resistance, resistance to tensile loads, impact resistance for saddle fittings, leak tightness under internal pressure, leak tightness under internal pressure when subjected to bending, external pressure test, and resistance to pull-out under constant longitudinal force.