



Standard Specification for Plastic Insert Fittings For SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing¹

This standard is issued under the fixed designation F2735; 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 establishes requirements for sulfone plastic insert fittings and copper crimp rings for three sizes ($\frac{1}{2}$, $\frac{3}{4}$, and 1) of cross-linked polyethylene (PEX) and polyethylene of raised temperature (PE-RT) plastic tubing. These fittings are intended for use in 100 psi (690 kPa) cold- and hot-water distribution systems operating at temperatures up to and including 180°F (82°C). Included are the requirements for material, molded part properties, performance, workmanship, dimensions, and markings to be used on the fittings and rings.

1.2 *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.

1.3 The following is an index of the appendix in this specification.

GO/NO-GO Crimp Gauges

Appendix X1

1.4 The following precautionary caveat pertains only to the test method portions, Sections 11 and 12, 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

F1600 Terminology for Abbreviated Terms Relating to Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D6394 Specification for Sulfone Plastics (SP)

F412 Terminology Relating to Plastic Piping Systems

F876 Specification for Crosslinked Polyethylene (PEX) Tubing

F877 Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems

F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings

F1807 Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing

F2623 Specification for Polyethylene of Raised Temperature (PE-RT) SDR 9 Tubing

2.2 *ASME Standard*:³

B1.20.1 Pipe Threads General Purpose Inch

2.3 *NSF International Standard*:⁴

NSF/ANSI Standard No. 14 for Plastic Piping Components and Related Materials

NSF/ANSI Standard No. 61 for Drinking Water System Components-Health Effects

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology **F412** and abbreviations are in accordance with Terminology **D1600**, unless otherwise indicated.

4. Classification

4.1 This specification governs one class of fittings and copper crimp rings suitable for use with nominal size $\frac{1}{2}$, $\frac{3}{4}$, and 1 size PEX tubing that meets the requirements of Specifications **F876** and polyethylene of raised temperature (PE-RT) tubing that meets the requirements of Specification **F2623**.

5. Ordering Information

5.1 *Material*—Material—Fittings shall be molded from sulfone plastic (SP) as specified in Specification **D6394**. The

¹ This test method is under the jurisdiction of ASTM Committee **F17** on Plastic Piping Systems and is the direct responsibility of Subcommittee **F17.10** on Fittings.

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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 American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.

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

material shall be polyphenylsulfone (group 03, class 1, grade 1 or 2) or unreinforced polyphenylsulfone/polysulfone blends (group 04, Class 2, grade 1) or reworked plastic in accordance with 5.1.1. Colored products can exceed the maximum specific gravity listed provided that they comply with all other properties listed in Specification D6394 Table SP.

5.1.1 Since fittings specified by this standard will be used in hot-and-cold water plumbing systems, a material used to manufacture fittings in accordance with this specification must demonstrate qualities consistent with that application in addition to the performance requirements of this specification. Those qualifying characteristics include, but are not limited to, an established hydrostatic design basis (HDB) or stress design basis (SDB) in accordance with PPI TR-3 or similar rating and a demonstration of resistance to the long-term effects of those chemicals normally found in potable water at the maximum temperature stated in this specification.

5.1.2 *Rework Material*—Clean rework material of the same commercial designation, generated from the manufacturer's own production may be used by the same manufacturer, provided the fittings meet all of the requirements of this specification. Reworked material shall not be introduced at a ratio exceeding 25 %.

5.2 *Potable Water Requirements*—Products intended for the transport of potable water shall be evaluated, tested and certified for conformance with NSF/ANSI Standard No. 61 or the health effects portion of NSF/ANSI Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

5.3 *Crimp Rings*—Crimp rings shall be manufactured and marked in accordance with the requirements of Specification F1807.

6. Molded Part Properties

6.1 *Insert Crush*—The fitting insert shall not crack, split, or shatter when tested in accordance with 12.1.

6.2 *Splay*—The molded part shall be free of visible splay excepting some slight blushing at the gate location.

7. Performance Requirements

7.1 *General*—All performance tests shall be performed on assemblies of fittings, crimp rings, and PEX tubing. Fittings and crimp rings shall meet the material and dimensional requirements of this standard. PEX tubing shall meet the requirements of Specification F876. Assembly of test specimens shall be in accordance with Section 10. Use separate sets of assemblies for each performance test requirement.

7.2 The following sections of Specification F877 constitute a part of this specification:

- 7.2.1 Hydrostatic Burst,
- 7.2.2 Hydrostatic Sustained Pressure Strength,
- 7.2.3 Thermocycling,
- 7.2.4 Excessive Temperature-Pressure Capability, and
- 7.2.5 Test Methods.

7.3 In addition, when a section with a title identical to that referenced in 7.2 appears in this specification, it contains additional requirements that supplement those appearing in Specification F877.

8. Dimensions

8.1 *Dimensions and Tolerances*—The dimensions and tolerances of fittings shall be as shown in Fig. 1, when measured in accordance with 11.1

8.1.1 *Alignment*—The maximum angular variation of any opening shall not exceed 1° off the true centerline axis.

8.1.2 *Tapered Threads*—Fitting threads shall be American National Standard Taper Pipe Thread Form conforming to Specification F1498.

8.1.3 *Straight Threads*—Straight pipe threads, intended for the making of a gasketed seal with taper pipe threads, shall be American National Straight Pipe Thread for Fixtures (free-fitting mechanical joints), NPSM, and conform to ASME B 1.20.1.

9. Workmanship, Finish, and Appearance

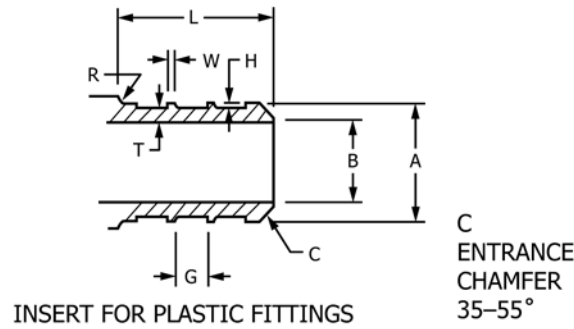
9.1 The sealing surfaces of the insert shall be smooth and free of foreign material. The fitting walls shall be free of cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the unaided eye and that affect the wall integrity.

9.2 Except for the insert, the molded part shall be free of flash in excess of 0.005 in. (0.13 mm). Flash, mismatch, and witness mark requirements for the insert shall be in accordance with Fig. 1.

10. Assembly

10.1 *Crimp Joints*—Insert fittings shall be joined to PEX tubing by the compression of a copper crimp ring around the outer circumference of the tubing forcing the tubing material into annular spaces formed by ribs on the fitting. Insert fittings and crimp rings shall meet the dimensional and material requirements of this standard. PEX tubing shall meet the requirements of Specifications F876. The dimensions and out-of-roundness of the crimp ring after it has been crimped shall be in accordance with Table 1.

10.1.1 *Crimping Procedure*—To affix the insert fitting to the tubing with the crimp ring, the crimping procedure shall be as follows: slide the crimp ring onto the tubing, insert the ribbed end of the fitting into the end of the tubing until the tubing contacts the shoulder of the fitting or tube stop. The crimp ring shall then be positioned on the tubing so the edge of the crimp ring contacts the shoulder of the fitting or tube stop. The jaws of the crimping tool shall be centered over the crimp ring and the tool shall be held so that the crimping jaws are approximately perpendicular to the axis of the barb. The jaws of the crimping tool shall be closed around the crimp ring, compressing the crimp ring onto the tubing. The crimp ring shall not be crimped more than once. Each crimp shall be checked to determine conformance to the after crimped dimensional requirements of Table 1.



	A	B ^A	L ^B	H		W	G	T	R	Maximum Flash and Mismatch
Size (in.)	Outside Diameter	Minimum ID	Insert Length	Minimum Rib Height	Number of Ribs ^C	Rib Width Type	Gap Width Type	Minimum Wall ^D	Minimum Radius	Total on Crest Diameter ^{EF}
1/2	0.471 ± .004	0.315	0.480 ± .004	0.011	2	0.02- 0.04	0.114±.004	0.059	0.03	0.005
3/4	0.667 ± .004	0.490	0.480 ± .004	0.011	2	0.02- 0.04	0.114±.004	0.067	0.03	0.005
1	0.856 ± .004	0.645	0.480 ± .004	0.011	2	0.02- 0.04	0.114±.004	0.084	0.03	0.005

^AThe minimum ID shall be maintained through the insert length and into the fitting, intersecting and minimum ID of the other fitting.

^BFitting shall be designed with sufficient overall dimensions to allow proper use of crimp tool without interference with previously completed crimps on the same fitting.

^CLead chamfer area is not considered rib.

^DApplies to entire fitting and not just insert area.

^EThe maximum flash and mismatch at the root diameter between the ribs may not exceed 30% of rib height

^FThe total flash and mismatch is assumed to be the difference between the dimensions X and Y (See Fig. 2 a.) These dimensions may be measured with appropriate callipers or micrometres. See Fig. 2b for a graphic definition of flash and mismatch created by imperfection in die half interfaces.

FIG. 1 Fitting Insert Dimensions and Tolerances



a—Flash and Mismatch Created by Imperfection in Die Half Interfaces

b—Total Flash and Mismatch

FIG. 2 Fitting Insert Dimensions and Tolerances

TABLE 1 Crimp Ring Dimensions After Crimping on Tube/Fitting Assembly

Nominal Tube Size Insert End	Final Crimped Outside Diameter ^{A,B}	
	Minimum, in. (mm)	Maximum, in. (mm)
1/2	0.700 (17.8)	0.715 (18.2)
3/4	0.945 (24.0)	0.960 (24.4)
1	1.175 (29.8)	1.190 (30.2)

^AFor all diameters except for the area of scoring caused by the crimping tool.

^BThe maximum out of roundness as measured by the difference between the minimum crimped outside diameter and the maximum crimped outside diameter shall not exceed 0.006 in. 90.150 mm).

11. Test Methods

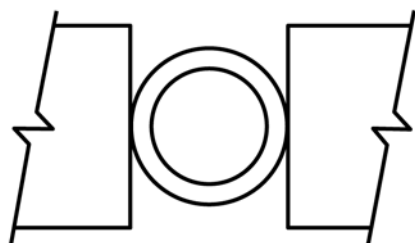
11.1 *Dimensions*—Any randomly selected fitting or fittings and crimp ring or crimp rings shall be used to determine

dimensions. Measurements shall be made in accordance with Test Method D2122. Determine the diameters by making measurements at four locations spaced at approximately 45° apart around the circumference.

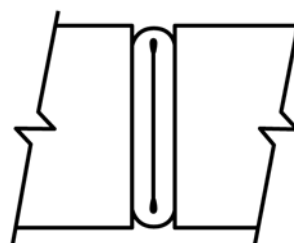
12. Molded Part Properties Test Methods

12.1 *Insert Crush Test*—Under ambient conditions, test six fittings of each size in accordance with 12.1.1.

12.1.1 *Procedure*—Using a bench vise or other suitable compression device, place the insert of the fitting between the jaws of the vise. Close the jaws of the vise deforming the insert until the opposing inside walls of the insert touch. The insert shall not crack, split, or shatter, see Fig. 3. Separation of the



1— Place the insert in a vise or other suitable device



2 — Close the vice jaws until the inside walls touch.

FIG. 3 Insert Crush Test

insert from the fitting body at the shoulder shall not be considered a failure, see Fig. 4.

13. Retest

13.1 If any failure occurs, a retest shall be conducted only if agreed upon between the purchaser and the seller. Failure in the retest is cause for rejection of the shipment.

14. Quality Assurance

14.1 When the product or product packing is marked with the ASTM designation F2735, the manufacturer affirms that the

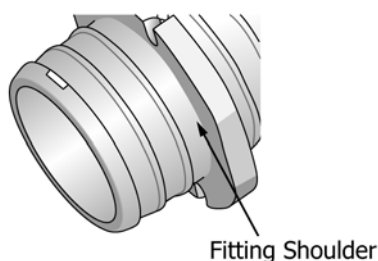


FIG. 4 Location of Fitting Shoulder

product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

15. Product Marking

15.1 *Quality of Marking*—The marking shall be applied to the fittings in such a manner that it remains legible after installation and inspection.

15.2 Content of Marking:

15.2.1 Marking on fittings shall include manufacturer's name or trademark, or some other identifying mark, material designation, and ASTM F 2735.

15.2.1.1 Where recessed marking is used on fittings, care shall be taken to see that in no case shall the marking cause cracks or reduce the wall thickness below the minimum specified.

15.2.2 Marking on packaging shall include manufacturer's name, fitting size, and ASTM F2735.

16. Keywords

16.1 cold- and hot-water distribution; copper crimp rings; cross-linked polyethylene; plastic insert fittings; PEX; PE-RT

APPENDIX

(Nonmandatory Information)

X1. GO/NO-GO CRIMP GAUGE

X1.1 This appendix provides dimensions for gages to check the after-crimped dimensions of the three sizes of crimp connections governed by this standard. This information has been taken from gages in current production at the time of the writing of this standard. Gages shown here provide only a reference for the maximum and minimum diameters of the crimped ring and do not provide a check for the out-of-round dimension. Additionally, calipers or micrometers may also be used.

X1.2 Crimp gages manufactured according to the dimensions shown in Fig. X1.1 will ensure that crimps checked with these gages will not be larger or smaller than those allowed by this standard.

X1.3 Use of the Crimp GO/NO-GO Gage—Slide the correct size GO section of the gage over the crimped ring in at least two places and attempt to slide the NO-GO section of the gage over the crimped ring in at least two places (see Note X1.1). The GO section of the gage should slide over the crimped ring easily and the NO-GO section should not slide over the crimped ring. If the GO section does not slide over the ring, or the NO-GO section slides over the ring, the crimped joint must be replaced. Additionally, the crimp tool may need adjustment, follow the recommendations of the tool manufacturer.

NOTE X1.1—Most of the commercially available crimp tools will produce a scoring mark on the ring where the jaws of the tool overlap. Gaging the crimped ring on this scoring mark will generally give a false reading. Gage the crimped ring away from the scoring mark for best accuracy.



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