Designation: F 1807 – 99

An American National Standard

Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing[1]

This standard is issued under the fixed designation F 1807; 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 metal insert fittings and copper crimp rings for four sizes of cross-linked polyethylene (PEX) plastic tubing. These fittings are intended for use in 100 psi (689.5 kPa) cold- and hot-water distribution systems operating at temperatures up to and including 180°F (82°C). Included are the requirements for materials, workmanship, dimensions, burst pressure, sustained pressure, excessive temperature and pressure, temperature cycling tests, and markings to be used on the fittings and rings.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI values stated in parentheses are provided for information purposes.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 10, 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:*

B 16 Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines[2]

B 62 Specification for Composition Bronze or Ounce Metal Castings[2]

B 75 Specification for Seamless Copper Tube[2]

B 88 Specification for Seamless Copper Water Tube[2]

B 140/B140M Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar, and Shapes[2]

B 283 Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)[2]

B 584 Specification for Copper Alloy Sand Castings for General Applications[2]

D 618 Practice for Conditioning Plastics for Testing[3]

D 1598 Test Method for Time-To-Failure of Plastic Pipe Under Constant Internal Pressure[4]

D 1599 Test Method for Short-Time, Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings[4]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[3]

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings[4]

E 18 Test Methods for Rockwell Hardness and Superficial Hardness of Metallic Materials[5]

F 412 Terminology Relating to Plastic Piping Systems[4]

F 876 Specification for Cross-linked Polyethylene (PEX) Tubing[4]

F 877 Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems[4]

2.2 *ASME Standards:*[6]

B1.20.1 Pipe Threads General Purpose (Inch)

B16.18 Cast Copper Alloy Solder Joint Pressure Fittings

B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

2.3 *Manufacturer's Standardization Society Standard:*[7]

SP-104 Wrought Copper Solder Joint Pressure Fittings

2.4 *NSF International Standard:*[8]

Standard No. 14 for Plastic Piping Components and Related Materials

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

3. Terminology

3.1 Definitions are in accordance with Terminology F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

[1] This standard is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.26 on Olefin Based Pipe.

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[2] *Annual Book of ASTM Standards*, Vol 02.01.

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 08.04.

[5] *Annual Book of ASTM Standards*, Vol 03.01.

[6] Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

[7] Available from Manufacturer's Standardization Society of the Valve and Fittings Industry, 5203 Leesburg Pike, Suite 502, Falls Church, VA 22041.

[8] Available from the National Sanitation Foundation International, P.O. Box 1468, Ann Arbor, MI 48106.

4. Classification

4.1 This specification covers one class of fittings and copper crimp rings suitable for use with four sizes of PEX tubing that meet the requirements of Specifications F 876 or F 877.

5. Materials and Manufacture

5.1 *Fittings*—The fittings shall be made from one of the following metals:

5.1.1 *Wrought Copper*—Wrought copper fittings shall be made from material meeting the requirements of Specification B 75or B 88 for one of the following coppers: copper UNS C10200, C10300, C10800, or C12200.

5.1.2 *Cast Copper Alloys*—Cast copper alloy fittings shall be made from material meeting the requirements of Specification B 584, copper alloy UNS C84400, C83800 or C89844 or Specification B 62 copper alloy UNS C83600.

5.1.3 *Machined Brass*—Machined brass fittings shall be made from material meeting the requirements of Specification B 140 copper alloy UNS C31400 or Specification B 16 copper alloy UNS C36000.

5.1.4 *Forged Brass*—Forged brass fittings shall be made from material meeting the requirements of Specification B 283 copper alloy UNS C37700.

5.2 *Crimp Rings*—Crimp rings shall be made from copper UNS C10200, or C12200. The crimp rings shall have a minimum allowable hardness of 35 and a maximum allowable hardness of 45 on the Rockwell 15T scale when measured according to Test Methods E 18.

6. Performance Requirements

6.1 *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 specification. PEX tubing shall meet the requirements of Specification F 876 or F 877. Assembly of test specimens shall be in accordance with 9.1.1. Each assembly shall contain at least two (2) joints. Use separate sets of assemblies for each performance test requirement.

6.2 *Hydrostatic Burst*—Assemblies shall meet the minimum hydrostatic burst requirements shown in Table 1 when tested in accordance with 10.5.

6.3 *Hydrostatic Sustained Pressure Strength*—Assemblies shall meet the hydrostatic sustained pressure requirements shown in Table 2 when tested in accordance with 10.6.

6.4 *Thermocycling*—Assemblies shall not leak or separate when thermocycled 1000 cycles between the temperatures of 60°F (16°C) and 180°F (82°C) when tested in accordance with 10.7.

TABLE 1 Minimum Hydrostatic Burst Strength Requirements for Fitting, Crimp Ring and PEX Tubing Assemblies

Nominal Tubing Size		Minimum Burst Pressures at Different Temperatures			
in.	mm	psi[A] at 73.4°F	(kPa) at (23°C)	psi[A] at 180°F	(kPa) at (82.2°C)
⅜	10	620	(4275)	275	(1896)
½	13	480	(3309)	215	(1482)
¾ and larger	16 and larger	475	(3275)	210	(1448)

[A] The fiber stress to derive this test pressure is:
at 73.4°F (23.0°C) 1900 psi (13.10 MPa),
at 180°F (82.2°C) 850 psi (5.86 MPa).

TABLE 2 Minimum Hydrostatic Sustained Pressure Requirements for Fitting, Crimp Ring and PEX Tubing Assemblies[A,B]

Nominal Tubing Size		Pressure Required for Test, psi (kPa)[A]	
in.	mm	180°F	(82.2°C)
⅜	10	250	(1724)
½	13	195	(1344)
¾ and larger	16 and larger	190	(1310)

[A] The fiber stress to derive this test pressure is: 770 psi (5.31 MPa) at 180°F (82.2°C).

[B] Test duration is 1000 h.

6.5 *Excessive Temperature-Pressure Capability*:

6.5.1 *General*—Assemblies shall have adequate strength to accommodate short-term conditions, 30 days of 210°F (99°C) and 150 psi (1034 kPa).

6.5.2 *Excessive Temperature Hydrostatic Sustained Pressure*—Assemblies shall meet sustained pressure requirements shown in Table 3 when tested in accordance with 10.8.

7. Dimensions

7.1 *Dimensions and Tolerances*—The dimensions and tolerances of fittings and crimp rings shall be as shown in Fig. 1, Fig. 2, Fig. 3, and Fig. 4 when measured in accordance with 10.4.

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

7.1.2 *Fittings with Solder Joint Ends*— Solder joint ends shall be in accordance with ASME B16.22, ASME B16.18, or MSS SP-104.

7.1.3 *Tapered Threaded Ends*—Fitting threads shall be right-hand conforming to ASME B1.20.1. They shall be taper threads (NPT).

8. Workmanship, Finish, and Appearance

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

9. Assembly

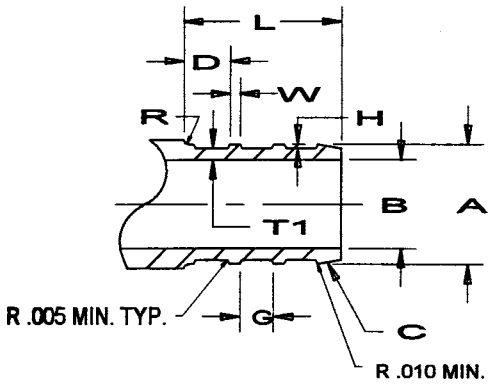
9.1 *Crimp Joints*—Insert fittings shall be joined to PEX tubing by the compression of a copper crimp ring around the outer circumference of the tubing, forcing the tubing material into annular spaces formed by ribs on the fitting. Insert fittings and crimp rings shall meet the dimensional and material requirements of this standard. PEX tubing shall meet the requirements of Specifications F 876 or F 877. The dimensions and out-of-roundness of the crimp ring, after it has been crimped, shall be in accordance with Table 4.

9.1.1 *Crimping Procedure*—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

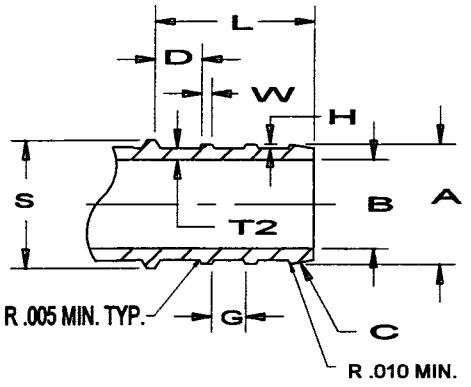
TABLE 3 Excessive Temperature and Pressure Requirements for Fitting, Crimp Ring and PEX Tubing Assemblies

Test Duration, h	Hydrostatic Test Pressure Air Bath,[A] psi (kPa)	Air Bath Temperature° F (°C)
720	150 (1034)	210 (99)

[A] The fiber stress used to derive this test pressure is 595 psi (4.10 MPa) at 210°F (99°C).



INSERT FOR BRASS OR COPPER ALLOY FITTINGS



INSERT FOR WROUGHT COPPER FITTINGS

C
ENTRANCE
CHAMFER
10 - 30 deg.

Size	A Outside Diameter of Rib[A]	B Minimum ID	D Distance to First Rib[B]	L Min Insert Length[A]	H Min Rib Height	Number of Ribs[C]	W Rib[D] Width	G Rib Spacing Typical	T1 Minimum Wall[E]	T2 Minimum Wall[E]	R Minimum Radius	S Minimum Average Diameter[F]	Maximum Flash and Mismatch, Total on Crest Diameter[G,H]
⅜ in.	0.345 ± 0.004	0.230	0.180-0.224	0.625	0.013	2	0.03–0.05	0.120–0.145	0.025	0.025	0.02	0.369	0.005
½ in.	0.471 ± 0.004	0.350	0.180-0.224	0.625	0.013	2	0.03–0.05	0.120–0.145	0.028	0.028	0.02	0.495	0.005
¾ in.	0.667 ± 0.004	0.530	0.180-0.224	0.625	0.013	2	0.03–0.05	0.120–0.145	0.037	0.032	0.02	0.691	0.005
1 in.	0.856 ± 0.004	0.710	0.180-0.224	0.795	0.015	3	0.03–0.05	0.120–0.145	0.041	0.035	0.02	0.880	0.005

[A] Measured from shoulder of rib to tube stop.
[B] Fitting shall be designed with sufficient overall dimensions to allow proper use of crimp tool without interference with previously completed crimps on the same fitting.
[C] Lead chamfer area is not considered a rib.
[D] Rib sides may be angled.
[E] Applies to entire fitting, not just insert area.
[F] The raised area serves as a tube stop for wrought copper fittings that do not have a shoulder.
[G] The maximum flash and mismatch at the root diameter between the ribs may not exceed 30 % of the rib height.
[H] The total flash and mismatch is assumed to be the difference between the dimensions X and Y (see Fig. 2). These dimensions may be measured with appropriate calipers or micrometers. See Fig. 3 for a graphic definition of flash and mismatch created by imperfection in die half interfaces.

FIG. 1 Fitting Insert Dimensions and Tolerances

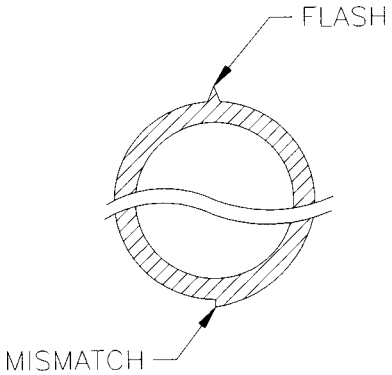


FIG. 2 Flash and Mismatch Created by Imperfection in Die Half Interfaces

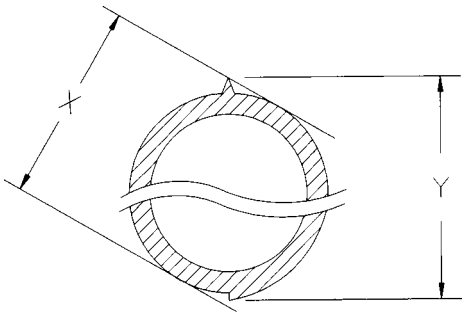


FIG. 3 Total Flash and Mismatch

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 is ⅛ to ¼ in. (3.2 to 6.4 mm) from the end of the tube. 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 4.