Designation: F1974 – 09 (Reapproved 2015)

Standard Specification for Metal Insert Fittings for Polyethylene/Aluminum/ Polyethylene and Crosslinked Polyethylene/Aluminum/ Crosslinked Polyethylene Composite Pressure Pipe[1]

This standard is issued under the fixed designation F1974; 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 with split ring and compression nut (compression joint) and metal insert fittings with copper crimp rings (crimp joint) for four sizes of composite pressure pipe. These fittings are intended for use in 125 psi (690 kPa) cold- and hot-water distribution systems operating at temperatures up to and including 180°F (82°C). (When used in polyethylene/aluminum/polyethylene systems the maximum operating temperature is limited by the pipe to 140°F (60°C) and where applicable 180°F (82°C)). Included are the requirements for materials, workmanship, burst pressure, sustained pressure, excessive temperature and pressure, temperature cycling tests, and markings to be used on the fittings and rings. The fittings covered by this specification are intended for use in potable water distribution systems for residential and commercial applications, water service, underground irrigation systems, and radient panel heating systems, baseboard, snow- and ice-melt systems, and gases that are compatible with the composite pipe and fittings.

1.2 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.

NOTE 1—The tables show the "nominal size" in millimetres with the inch size in parentheses. This exception is made to harmonize the "nominal size" with the two pipe standards, Specifications F1281 and F1282.

1.3 The following precautionary caveat pertains only to the test method portion, Section 9, 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]

B16/B16M Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines

B36/B36M Specification for Brass Plate, Sheet, Strip, And Rolled Bar

B62 Specification for Composition Bronze or Ounce Metal Castings

B75/B75M Specification for Seamless Copper Tube

B134/B134M Specification for Brass Wire

B140/B140M Specification for Copper-Zinc-Lead (Red Brass or Hardware Bronze) Rod, Bar, and Shapes

B159/B159M Specification for Phosphor Bronze Wire

B283/B283M Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)

B371/B371M Specification for Copper-Zinc-Silicon Alloy Rod

B584 Specification for Copper Alloy Sand Castings for General Applications

D618 Practice for Conditioning Plastics for Testing

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

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2240 Test Method for Rubber Property—Durometer Hardness

E18 Test Methods for Rockwell Hardness of Metallic Materials

F412 Terminology Relating to Plastic Piping Systems

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

[1] This specification 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.

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

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

2.2 *ANSI Standards:*[3]

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 *Manufacturers Standardization Society Standard:*[4]

SP-104 Wrought Copper LW Solder Joint Pressure Fittings

2.4 *National Sanitation Foundation Standards:*[5]

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 F412 and abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

4. Classification

4.1 This specification covers two classes of fittings, fittings with split ring and compression nut and fittings with a copper crimp ring, suitable for use with four sizes of PEX/AL/PEX or PE/AL/PE pipe that meets the requirements of Specifications F1281 and F1282 respectively.

5. Materials and Manufacture

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

5.1.1 *Wrought Copper Fittings*—Wrought copper fittings shall be made from material meeting the requirements of Specification B75/B75M for one of the following coppers: copper UNS Nos. C10200, C10300, C10800, C12000, or C12200.

5.1.2 *Cast Copper Alloy Fittings*—Cast copper alloy fittings shall be made from material meeting the requirements of Specification B584, copper alloy UNS C84400, C85700, C85710, or Specification B62, copper alloy UNS C83600. When fittings are assembled with copper insert fittings, the insert fittings shall comply with 5.1.1.

5.1.3 *Cast Copper Alloy Valves*—Cast copper alloy valves shall be made from material meeting the requirements of Specification B62 copper alloy UNS No. C83600 or Specification B584 copper alloy UNS Nos. C83800, C87850, or C84400. When valves are assembled with copper insert fittings, the insert fittings shall comply with 5.1.1.

5.1.4 *Machined Brass Fittings*—Machined brass fittings shall be made from material meeting the requirements of Specification B140/B140M Copper Alloy UNS No. C31400, or Specification B16/B16M, Copper Alloy UNS No. C36000, or Specification B62, Copper Alloy UNS No. C83600 or Specification B36/B36M, Copper Alloy UNS No. C23000, or Copper Alloy UNS No. C27450, or Specification B371/B371M, Copper Alloy UNS No. C69300.

5.1.5 *Forged Brass Fittings*—Forged brass fittings shall be made from material meeting the requirements of Specification B283/B283M, Copper Alloy UNS No. C37700 or Specification B124, Alloy UNS No. C37700, Copper Alloy UNS No. C27450.

5.2 *Crimp Rings*—Crimp rings shall be made from copper UNS Nos. C10200, C12000, 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 E18.

5.3 *Split Rings*—Split rings shall be made from material meeting the requirements of Specification B140/B140M Copper Alloy UNS No. C31400, or Specification B16/B16M copper alloy UNS No. C36000, or Specification B159/B159M Copper Alloy UNS No. C51000 or Specification B134/B134M, UNS No. C27000 or Copper Alloy UNS No. C27450.

5.4 The O-rings used on the brass fittings to make a static seal shall be manufactured from ethylene propylene rubber (EPDM) or silicone rubber (Si), with a Shore A durometer between 60 and 70 when tested in accordance with ASTM Test Method D2240.

6. Performance Requirements

6.1 *General*—All performance tests shall be performed on assemblies of fittings and PEX/AL/PEX pipe. Fittings, split rings and crimp rings shall meet the material and dimensional requirements of this standard. PEX/AL/PEX pipe shall meet the requirements of Specification F1281. Assembly of test specimens shall be in accordance with either 8.1 or 8.2, as applicable. Each assembly shall contain at least one joint. 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 9.5.

6.3 *Hydrostatic Sustained Pressure Strength*—Pipe and fitting assemblies shall not separate or leak when tested in accordance with 9.6.

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) in accordance with 9.7.

TABLE 1 Minimum Hydrostatic Burst Strength Requirements for Fitting and PEX/AL/PEX Pipe Assemblies

Nominal PipeSize, mm (in.)		Minimum Burst Pressures at Different Temperatures			
		psi at 73.4°F	(kPa at 23°C)	psi at 180°F	(kPa at 82.2°C)
1216	(½)	870	(6000)	580	(4000)
1620	(⅝)	725	(5000)	550	(3800)
2025	(¾)	580	(4000)	465	(3200)
2532	(1)	580	(4000)	465	(3200)

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

[4] Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, http://www.mss-hq.org.

[5] Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48105, http://www.nsf.org.

6.5 *Excessive Temperature-Pressure Capability*—Assemblies shall not leak or separate when tested in accordance with 9.8.

7. Dimensions

7.1 *Dimensions and Tolerances*—The dimensions and tolerances of fittings, split rings and crimp rings shall be as shown in Tables 2-4 when measured in accordance with 9.4.

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 ANSI B16.22, ANSI B16.18, or MSS SP-104.

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

8. Workmanship, Finish, and Appearance

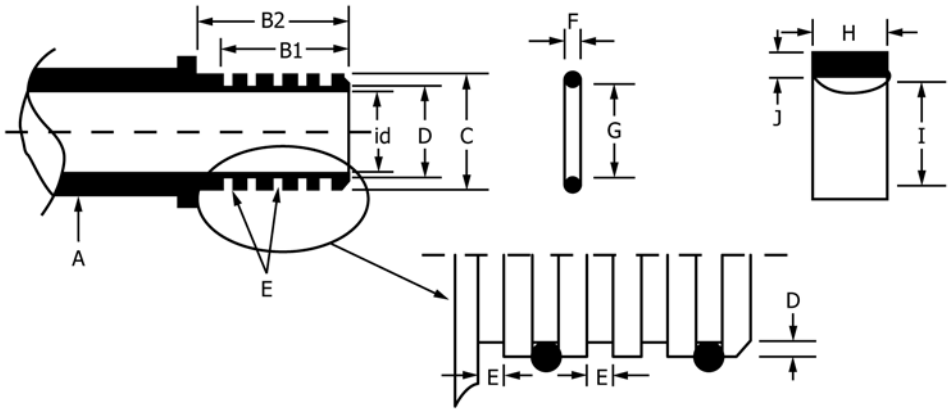
8.1 The sealing surfaces of the insert shall be smooth and free of foreign material. The fitting walls shall be free of cracks, holes, blisters, voids, foreign inclusions or other defects that are visible to the naked eye and that affect the wall integrity.

8.1.1 *Assembly*—Insert fittings shall be joined to PE/AL/PE or PEX/AL/PEX pipe by the use of either a crimp joint or a compression joint.

8.1.2 *Crimp Joints*—Crimp insert fittings shall be joined to PE/AL/PE or PEX/AL/PEX pipe by the compression of a copper crimp ring around the outer circumference of the pipe forcing the pipe material into annular spaces formed by ribs on the fitting. The dimensions and out-of-roundness of the crimp ring after it has been crimped shall be in accordance with Table 5.

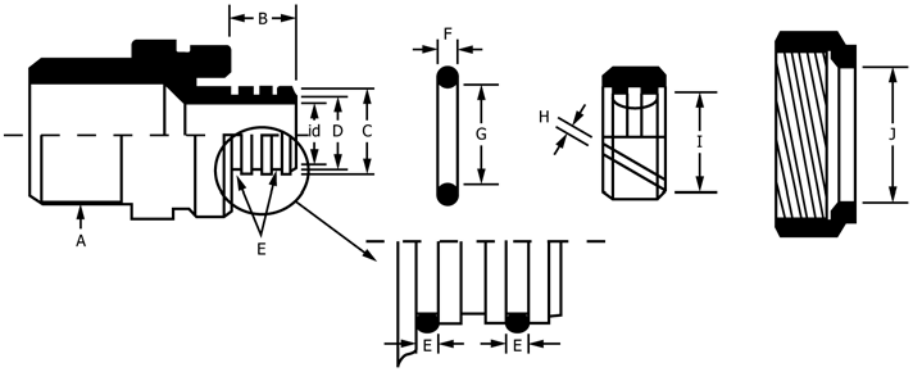
8.1.2.1 *Crimping Procedure*—To affix the insert fitting to the pipe with the crimp ring, the crimping procedure shall be as follows: slide the crimp ring onto the pipe, insert the ribbed end of the fitting into the end of the pipe until the pipe contacts the shoulder of the fitting or pipe stop. The crimp ring shall then be positioned on the pipe so the edge of the crimp ring is ⅛ to ¼ in. (3.2 to 6.4 mm) from the end of the pipe. 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 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 pipe. The crimp ring shall not be crimped more than once. Each

TABLE 2 Crimp Joint Fitting Dimensions



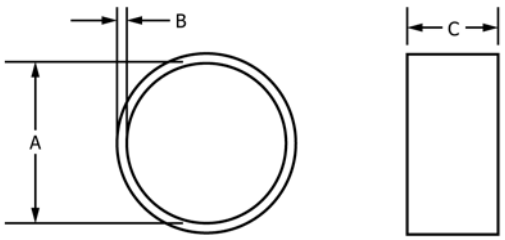
Dimension	1216 ½ in.	1620 ⅝ in.	2025 ¾ in.	2532 1 in.
A	Male and female copper solder on NPT thread ends refer to clauses 7.1.2 and 7.1.3. This end of the fitting may also be a part of a coupling tee, 90° elbow or other adapter.			
id	0.334 in. ±0.008 in.	0.452 in. ±0.008 in.	0.610 in. ±0.008 in.	0.807 in. ±0.008 in.
B1	0.591 in. ±0.025 in.	0.591 in. ±0.025 in.	0.591 in. ±0.025 in.	0.591 in. ±0.025 in.
B2	0.650 in. ±0.050 in.	0.650 in. ±0.050 in.	0.650 in. ±0.050 in.	0.650 in. ±0.050 in.
C	0.482 in. ±0.004 in.	0.620 in. ±0.004 in.	0.781 in. ±0.004 in.	0.998 in. ±0.004 in.
D (bottom of groove)	0.406 in. ±0.004 in.	0.543 in. ±0.004 in.	0.701 in. ±0.004 in.	0.902 in. ±0.004 in.
E	0.067 in. ±0.005 in.	0.067 in. ±0.005 in.	0.067 in. ±0.005 in.	0.079 in. ±0.005 in.
F	0.059 in. ±0.003 in.	0.059 in. ±0.003 in.	0.059 in. ±0.003 in.	0.071 in. ±0.003 in.
G	0.315 in. ±0.008 in.	0.409 in. ±0.008 in.	0.567 in. ±0.008 in.	0.764 in. ±0.008 in.

TABLE 3 Compression Joint Fitting Dimensions



Dimension	1216 ½ in.	1620 ⅝ in.	2025 ¾ in.	2532 1 in.
A	Male and Female copper solder on NPT thread ends refer to clauses 7.1.2 and 7.1.3. This end of the fitting may also be a part of a coupling tee, 90° elbow or other adapter.			
id	0.334 in. ±0.008 in.	0.452 in. ±0.008 in.	0.610 in. ±0.008 in.	0.807 in. ±0.008 in.
B	0.370 in. ±0.050 in.	0.370 in. ±0.050 in.	0.370 in. ±0.050 in.	0.472 in. ±0.050 in.
C	0.482 in. ±0.004 in.	0.620 in. ±0.004 in.	0.781 in. ±0.004 in.	0.998 in. ±0.004 in.
D	0.406 in. ±0.004 in.	0.543 in. ±0.004 in.	0.701 in. ±0.004 in.	0.902 in. ±0.004 in.
E	0.067 in. ±0.005 in.	0.067 in. ±0.005 in.	0.067 in. ±0.005 in.	0.079 in. ±0.005 in.
F	0.059 in. ±0.003 in.	0.059 in. ±0.003 in.	0.059 in. ±0.003 in.	0.071 in. ±0.003 in.
G	0.315 in. ±0.008 in.	0.409 in. ±0.008 in.	0.567 in. ±0.008 in.	0.764 in. ±0.008 in.
H	0.157 in. ±0.008 in.	0.177 in. ±0.008 in.	0.177 in. ±0.008 in.	0.197 in. ±0.008 in.
I	0.638 in. ±0.008 in.	0.795 in. ±0.008 in.	0.992 in. ±0.008 in.	1.276 in. ±0.008 in.
J	0.650 in. ±0.008 in.	0.815 in. ±0.008 in.	1.024 in. ±0.008 in.	1.291 in. ±0.008 in.

TABLE 4 Copper Crimp Ring Dimensions



Dimension	1216 ½ in.	1620 ⅝ in.	2025 ¾ in.	2532 1 in.
A Inside Diameter	0.652 ±0.002	0.812 ±0.002	1.009 ±0.002	1.284 ±0.002
B Wall Thickness	0.052 ±0.002	0.050 ±0.002	1.049 ±0.002	1.049 ±0.002
C Width	0.394 ±0.020	0.394 ±0.020	0.394 ±0.020	0.394 ±0.020

crimp shall be checked to determine conformance to the after crimped dimensional requirements of Table 5.

8.2 *Compression Joints*—Compression insert fittings shall be joined to PE/AL/PE or PEX/AL/PEX pipe through the compression of a split ring, by an compression nut, around the outer circumference of the pipe forcing the pipe material into the annular space formed by ribs on the fitting.

8.2.1 *Compression Jointing Procedure*—To affix the insert fitting to the pipe with the split ring, and compression nut the procedure shall be as follows: slide the compression nut and

TABLE 5 Crimp Ring Dimensions After Crimping on Pipe/Fitting Assembly

Dimension	1216 (½ in.)	1620 (⅝ in.)	2025 (¾ in.)	2532 (1 in.)
Final Crimped Outside Diameter[A,B]	0.705 ± 0.008	0.854 ± 0.008	1.039 ± 0.008	1.307 ± 0.008

[A] For all diameters except for the area of scoring caused by the crimping tool.
[B] The 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. (0.150 mm).

split ring onto the pipe, insert the ribbed end of the fitting into the end of the pipe until the pipe contacts the shoulder of the fitting or pipe stop. Position and compress the split ring by tightening the compression nut onto the insert fitting.

9. Test Methods

9.1 *Conditioning*—Condition specimens at 73 ± 4°F (23 ± 2°C) and 50 ± 5 % relative humidity for not less than 4 h prior to testing. Use Test Method D618 to the extent possible as a guide to other conditions.

9.2 *Test Conditions*—Conduct the tests in the standard laboratory atmosphere at 73 ± 4°F (23 ± 2°C) and 50 ± 5 % relative humidity unless otherwise specified in the test methods or in this specification.

9.3 *Sampling*—Take a sample of the fittings, crimp rings and PEX/AL/PEX pipe sufficient to determine conformance with this specification at random.

9.4 *Dimensions*—Any randomly selected fitting or fittings and crimp ring or crimp rings shall be used to determine dimensions. Make measurements in accordance with Test Method D2122. Determine the diameters by making measurements at four locations spaced at approximately 45° apart around the circumference. Inspection and gauging of solder joint ends shall be in accordance with ANSI B16.18, ANSI B16.22, or MSS SP-104.

9.5 *Burst Pressure*—Determine the minimum burst pressure in accordance with Test Method D1599 on at least six joint assemblies, for each temperature in Table 1. The six joint assemblies are contained in a single specimen. Leakage or separation at any of the joints tested at less than the minimum burst requirements for the temperatures specified in Table 1, shall constitute a failure in this test.

9.6 *Hydrostatic Sustained Pressure*—Perform the test on at least six assemblies in accordance with Test Method D1598, except for the following:

9.6.1 Test temperature shall be at 180 ± 4°F (82 ± 2°C).

9.6.2 Test pressure shall be 320 psi (2205 kPa).

9.6.3 The external test environment shall be air or water.

9.6.4 Fill the specimens with water at a temperature of at least 120°F (50°C).

9.6.5 The six joint assemblies are permitted to be contained in a single specimen.

9.6.6 Leakage or separation at any joint tested at less than 1000 h at the sustained pressure shall constitute failure in this test.

9.7 *Thermocycling:*

9.7.1 *Summary of Test Method*—This test method describes a pass-fail test for thermally cycling assemblies comprised of insert fitting and pipe over a critical temperature range for a selected number of cycles while subjected to an internal pressure. The test provides a measure of resistance to failure due to the combined effects of differential thermal expansion and creep of connections intended for use up to and including 180°F (82°C).

9.7.2 *Apparatus*—A compressed air or nitrogen pressure source capable of maintaining an internal pressure of 100 ± 10 psi (690 ± 69 kPa) on the specimens is required. A dip test apparatus capable of automatically immersing test samples at prescribed intervals in temperature controlled water baths capable of providing continuous water temperatures of 60 ± 4°F (16 ± 2°C) and 180 ± 4°F (82 ± 2°C).

9.7.3 *Specimen Assembly*—Test six assemblies. Attach the assemblies to a common manifold in such a way to allow free end movement of the tubing. Assembly strictly according to the instructions of the fitting manufacturer. Close the specimen assemble with any suitable end closures that allow "free end" mounting and will not leak under the thermocycling conditions, and connect the specimen assembly to the pressure source.

9.7.4 *Procedure*—Pressurize the specimen assembly with nitrogen or air to 100 ± 10 psi (690 ± 69 kPa), immerse in 60 ± 4°F (16 ± 2°C) water, and check for leaks. Eliminate all leaks before the thermocycling test is started. With the specimen assembly pressurized to 100 ± 10 psi (690 ± 69 kPa), thermally cycle it between 60 ± 4°F (16 ± 2°C) and 180 ± 4°F (82 ± 2°C) by means of immersion in water using the following test cycle (Note 2):

Water immersion at 180°F	2 min minimum
Air immersion at ambient	2 min maximum
Water immersion at 60°F	2 min minimum
Air immersion at ambient	2 min maximum

NOTE 2—If the test must be interrupted before completion, samples are to be kept at room temperature until the test is restarted.

9.7.4.1 Upon completion of 1000 cycles, immerse the specimen assembly again in 60°F (16 ± 2°C) water, and check for leaks. Any evidence of leakage at the fittings or separation of the fittings from the pipe constitutes failure.

9.7.4.2 If no failures are evident, the specimen assembly shall immediately be tested for joint integrity (hydrostatic burst) at 73°F (23°C) in accordance with Test Method D1599. Leakage or separation during the hydrostatic burst test of any of the joints in the assembly at less than the pressure shown in Table 1 shall constitute failure of this test.

9.7.5 *Interpretation of Results*—Failure of any one of six specimens in the assembly shall constitute failure of this test.

9.8 *Excessive Temperature and Pressure Capability*—Test six assemblies in accordance with Test Method D1598, except the following:

9.8.1 Test temperature shall be 210 ± 4°F (99 ± 2°C).

9.8.2 Test Pressure shall be 150 psi (1034 kPa).

9.8.3 The external test environment shall be air.

9.8.4 Fill specimens with water at a temperature of at least 120°F (50°C).

9.8.5 Leakage or separation at any joint tested at less than 720 h (30 days) at the test pressure shall constitute failure in this test.

10. Retests

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

11. Product Marking

11.1 *Quality Assurance*—When the product or product packing is marked with the ASTM designation F1974, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

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

11.3 *Content of Marking:*

11.3.1 Marking on fittings shall include:

11.3.1.1 Manufacturer's name or trademark, or some other identifying mark and

11.3.1.2 F1974.

11.3.2 Marking on packaging shall include:

11.3.2.1 Manufacturer's name

11.3.2.2 fitting size, and

11.3.2.3 ASTM F1974.

11.3.3 Marking on crimp rings shall include:

11.3.3.1 Manufacturer's name or trademark, or some other identifying mark and

11.3.3.2 The code letters, PAP.

11.4 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.

12. Keywords

12.1 cold and hot water distribution; copper crimp rings; crosslinked polyethylene; metal insert fittings; PAP; PE/AL/PE; PEX/AL/PEX; polyethylene

SUPPLEMENTARY REQUIREMENTS

This requirement applies whenever a regulatory authority or user calls for product to be used to convey or be in contact with potable water.

S1. *Potable Water Requirements*—Products intended for the transport of potable water shall be evaluated, tested and certified for conformance with ANSI/NSF Standard No. 61 or the health effects portion of NSF Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

APPENDIX

(Nonmandatory Information)

X1. CRIMP GAGE

X1.1 This appendix provides dimensions for gages to check the after crimped dimensions of the four sizes of crimp connections covered 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 diameter of the crimped ring and do not provide a check for the out-of-round dimensions. 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 in diameter than those allowed by this standard.

X1.3 *Use of the Crimp Gage*—Slide the correct size section of the gage over the crimped ring in at least two places. The gage should slide over the crimped ring easily. If the section does not slide over the ring, the crimped joint should be replaced. Additionally, the crimp tool may need to be adjusted; 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. Gauging 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.

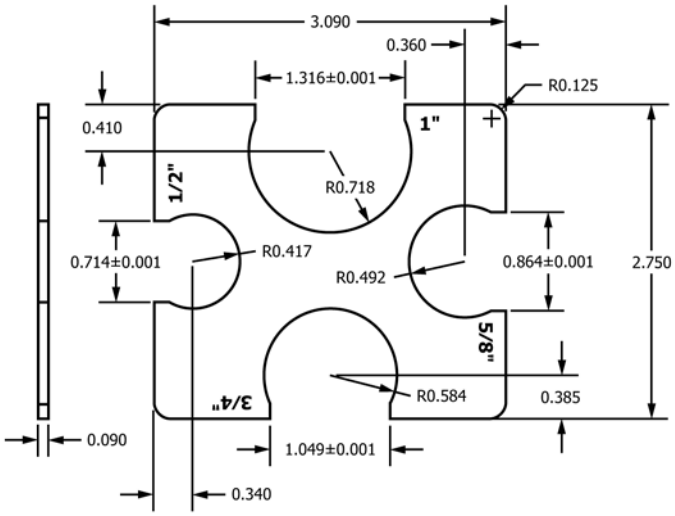


FIG. X1.1 Crimp Gages

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F1974–08) that may impact the use of this standard.

(1) Copper Alloy UNS No. C27450 was added to 5.1.4, 5.1.5, and 5.3.

Committee F17 has identified the location of selected changes to this standard since the last issue (F1974–04) that may impact the use of this standard.

(1) Specification B371/B371M was added to Section 2, Referenced Documents.

(2) Copper UNS alloy number C69300 and C87850 were added to the materials listed in Section 5.