



# Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe<sup>1</sup>

This standard is issued under the fixed designation F 2080; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers metal cold-expansion fittings using metal compression-sleeves for use with cross-linked polyethylene (PEX) plastic pipe in 1/2-in., 3/4-in., and 1-in. nominal diameters, whereby the PEX pipe is cold-expanded before fitting assembly. These cold-expansion fittings and metal compression-sleeves are intended for use in residential and commercial, hot and cold, potable water distribution systems, as well as sealed central heating, including under-floor heating systems, with continuous operation at pressures up to and including 100 psi (690 kPa), and at temperatures up to and including 180°F (82°C).

1.2 Included in this specification are the requirements for materials, workmanship, dimensions, and markings to be used on the fittings and compression-sleeves. Performance requirements are as referenced in Specification F 877.

1.3 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 only.

1.4 The following precautionary caveat pertains only to the test method 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:

- A 582/A 582M Specification for Free-Machining Stainless and Heat Resisting Steel Bars<sup>2</sup>
- B 16/B 16M Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines<sup>3</sup>
- B 140/B 140M Specification for Copper-Zinc-Lead

(Leaded Red Brass or Hardware Bronze) Rod, Bar and Shapes<sup>3</sup>

B 283 Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)<sup>3</sup>

B 689 Specification for Electroplated Engineering Nickel Coatings<sup>4</sup>

B 851 Specification for Automated Controlled Shot Peening of Metallic Articles Prior to Nickel, Autocatalytic Nickel, or Chromium Plating, or As a Final Finish<sup>4</sup>

D 1600 Terminology for Abbreviated Terms Relating to Plastics<sup>5</sup>

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings<sup>6</sup>

F 412 Terminology Relating to Plastic Piping Systems<sup>6</sup>

F 876 Specification for Crosslinked Polyethylene (PEX) Tubing<sup>6</sup>

F 877 Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems<sup>6</sup>

### 2.2 Canadian Standards Association:

CAN/CSA B137.5 – M99<sup>7</sup>

### 2.3 ANSI Standards:

B1.20.1 Pipe Threads General Purpose (Inch)<sup>8</sup>

B16.18 Cast Copper Alloy Solder Joint Pressure Fittings (Inch)<sup>8</sup>

B16.22 Wrought Copper Alloy Solder Joint Pressure Fittings (Inch)<sup>8</sup>

### 2.4 NSF Standards:

Standard No. 14 for Plastic Piping Components and Related Materials<sup>9</sup>

Standard No. 61 for Drinking Water System Components – Health Effects<sup>9</sup>

### 2.5 MSS Standards:

<sup>4</sup> Annual Book of ASTM Standards, Vol 02.05.

<sup>5</sup> Annual Book of ASTM Standards, Vol 08.01.

<sup>6</sup> Annual Book of ASTM Standards, Vol 08.04.

<sup>7</sup> Available from the Canadian Standards Association, 178 Rexdale Blvd., Rexdale (Toronto), Canada M9W 1R3

<sup>8</sup> Available from the American National Standards Institute, 11 West 42<sup>nd</sup> St., 13<sup>th</sup> Floor, New York, NY 10036.

<sup>9</sup> Available from NSF International, P.O. Box 130140, Ann Arbor, MI 48113-0140.

<sup>1</sup> 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. Current edition approved Dec. 10, 2002. Published July 2003. last previous edition approved in 2001 as F2080-01.

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>3</sup> Annual Book of ASTM Standards, Vol 02.01.

SP-104 Wrought Copper Solder Joint Pressure Fittings<sup>10</sup>

### 3. Terminology

3.1 *Definitions*—Definitions of terms used in this specification are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cross-linked polyethylene, n*—plastics prepared by cross-linking (curing) polyethylene compounds (PEX).

3.2.2 *fitting assembly, n*—comprised of a metal cold-expansion fitting and a metal compression-sleeve, whereby the PEX pipe is cold-expanded before fitting insertion, and the compression-sleeve is pulled over the PEX pipe.

### 4. Classification

4.1 This specification covers one class of metal cold-expansion fittings with metal compression-sleeves suitable for use with PEX pipe that meets the requirements of Specifications F 876 and F 877.

### 5. Materials and Manufacture

5.1 *Fittings*—Cold-expansion fittings shall be made from one of the following materials:

5.1.1 *Machined Brass*—Machined brass cold-expansion fittings shall be made from material meeting the requirements of Specification B 16/B 16M, copper-alloy UNS C36000, or Specification B 140, copper alloy UNS C31400, or Specification B 283, copper-alloy UNS C89844.

5.1.2 *Machined Stainless Steel*—Machined stainless steel cold-expansion fittings shall be made from material meeting the requirements of Specification A 582, stainless steel alloy 304L.

5.1.3 *Forged Brass*—Forged brass cold-expansion fittings shall be made from material meeting the requirements of Specification B 283, copper-alloy UNS C37700 or UNS C89844.

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

5.2 *Compression-Sleeves*—Metal compression-sleeves shall be made from one of the following materials:

5.2.1 *Machined Brass*—Machined brass compression-sleeves shall be made from material meeting the requirements of Specification B 16/B 16M copper-alloy UNS C36000.

5.2.2 *Machined Stainless Steel*—Machined stainless steel compression-sleeves shall be made from material meeting the requirements of Specification A 582/A 582M, stainless steel alloy 304L.

5.3 *Plating*—Plating of either fitting component with nickel or chrome, or other metal is optional and must fall within the dimensional tolerances of this specification. Plating can not negatively affect the quality of markings or the ability to meet S1.2.

5.3.1 *Nickel Plating*—Application of electroplated nickel coating shall meet the requirements of Specifications B 689 and B 851.

5.3.2 *Chrome Plating*—Application of electroplated chrome coating shall meet the requirements of Specification B 851.

### 6. Performance Requirements

6.1 *General*—All performance tests shall be conducted on assemblies of fittings (cold-expansion fittings and compression-sleeves) and PEX pipe. Fittings shall meet the material and dimensional requirements of this specification. PEX pipe shall meet the requirements of Specifications F 876 and F 877. Assembly of test specimens shall be in accordance with 9.3. Each assembly shall contain at least two joints. Use separate sets of assemblies for each performance test requirement.

6.2 Fittings shall comply with the following performance requirements of Specification F 877. When a section with an identical title appears in this Specification, it contains additional requirements that supplement those found in Specification F 877.

6.2.1 Requirements,

6.2.2 Test Methods, and

6.2.3 Retest and Rejection.

### 7. Dimensions

7.1 *Dimensions and Tolerances*—The dimensions and tolerances of the cold-expansion fittings and compression-sleeves, when measured in accordance with 10.1, shall be as shown in Table 1 and Table 2.

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 end dimensions shall be in accordance with ANSI B16.18, ANSI B16.22, or MSS SP-104.

7.1.3 *Tapered Threaded-Ends*—Fitting threads shall be right-hand, conforming to ANSI B1.20.1, and shall be tapered threads (NPT).

7.1.4 *Inside Diameter*—The minimum inside diameter, shown as Dimension F in Table 1, applies to the entire fitting not just the insert area. When fitting had ends that are of different sizes of configurations ( i.e. threaded, solder), or both, the minimum ID applies to entire insert area.

### 8. Workmanship, Finish and Appearance

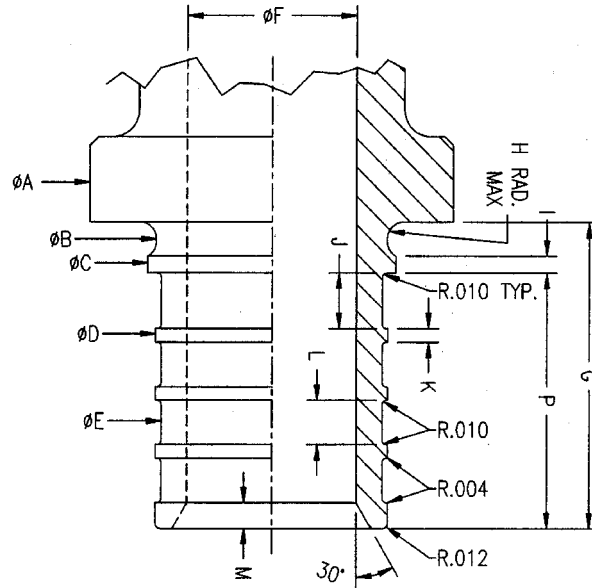
8.1 The fittings shall be made from materials that are homogeneous throughout. All sealing surfaces shall be smooth and free of foreign material. The walls of cold-expansion fittings and compression-sleeves shall be free of cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the unaided eye and that affect wall integrity.

### 9. Assembly

9.1 *Joints:*

9.1.1 *Cold-Expansion Joints*—Fittings shall be joined to PEX pipe by first expanding the end of the pipe with the expander tool, inserting the cold-expansion fitting into expanded pipe, then pulling the compression-sleeve over the PEX pipe and the fitting, compressing the pipe between the

<sup>10</sup> Available from Manufacturer's Standardization Society of the Valve and Fittings Industry, 5203 Leesburg Pike, Suite 502, Falls Church, VA 22041.



NOTE 1—All dimensions shall be measured with appropriate micrometers, such as pin or ball micrometers for wall thickness, and outside-diameter micrometers with flat anvils, or vernier calipers, to measure outside diameter and width of cold-expansion fittings and compression-sleeves.

NOTE 2—The average measurement is obtained from measurements taken in at least four locations spaced at approximately 45° around the circumference, in accordance with 10.1.

FIG. 1 Cold-Expansion Fitting

TABLE 1 Cold-Expansion Fittings (Fig. 1) Dimensions and Tolerances, in.

Size	A <sup>A</sup>	B	C	D	E	F	G	H	I	J	K	L	M	P
3/8 in.	0.745*	0.408	0.451	0.408	0.385	0.280	0.519	0.034	0.034	0.075	0.023	0.059	0.055	0.407
		0.420	0.461	0.418	0.391	0.292	0.543	0.044	0.044	0.085	0.033	0.069	0.065	0.419
1/2 in.	0.840*	0.538	0.578	0.540	0.515	0.390	0.700	0.034	0.034	0.124	0.026	0.098	0.055	0.585
		0.550	0.590	0.552	0.525	0.402	0.720	0.044	0.044	0.136	0.036	0.110	0.065	0.600
5/8 in.	1.110*	0.596	0.671	0.634	0.608	0.480	0.820	0.034	0.034	0.137	0.026	0.133	0.055	0.703
		0.608	0.683	0.646	0.616	0.492	0.840	0.044	0.044	0.147	0.036	0.145	0.065	0.715
3/4 in.	1.110*	0.703	0.778	0.742	0.715	0.590	0.820	0.034	0.034	0.136	0.026	0.134	0.055	0.700
		0.715	0.790	0.754	0.725	0.602	0.840	0.044	0.044	0.148	0.036	0.146	0.065	0.715
1 in.	1.375*	0.900	0.988	0.944	0.908	0.768	1.070	0.054	0.034	0.180	0.034	0.180	0.062	0.915
		0.912	1.000	0.956	0.918	0.780	1.090	0.064	0.044	0.192	0.044	0.192	0.072	0.930

<sup>A</sup>"A" dimensions (OD) are minimums. No maximum OD is specified, as this is a function of assembly tool geometry.

TABLE 2 Compression-Sleeves (Fig. 1) Dimensions and Tolerances, in.

Size	A	B	C	D	E	F	G <sup>A</sup>	H <sup>B</sup>
3/8 in.	0.160	0.210	0.380	0.780	0.566	0.525	0.730*	0.118
	0.174	0.222	0.395	0.795	0.579	0.533		
1/2 in.	0.160	0.210	0.380	0.780	0.680	0.648	0.820*	0.118
	0.174	0.222	0.395	0.795	0.693	0.656		
5/8 in.	0.160	0.210	0.380	0.900	0.821	0.774	1.075*	0.118
	0.174	0.222	0.395	0.915	0.836	0.782		
3/4 in.	0.160	0.210	0.380	0.900	0.925	0.900	1.075*	0.118
	0.174	0.222	0.395	0.915	0.938	0.908		
1 in.	0.160	0.290	0.505	1.235	1.195	1.152	1.350*	0.197
	0.174	0.302	0.520	1.250	1.208	1.160		

<sup>A</sup>G dimensions (OD) are minimums. No maximum OD is specified, as this is a function of assembly tool geometry.

<sup>B</sup>H dimensions are an external radii. Tolerance is + 0.020/- 0.000.

compression-sleeve and the fitting. Cold-expansion fittings and compression-sleeves shall meet the dimensional and material

requirements of this specification. PEX pipe shall meet the requirements of Specifications F 876 and F 877.