



Standard Specification for Mechanical Cold Expansion Insert Fitting With Compression Sleeve for Cross-linked Polyethylene (PEX) Tubing¹

This standard is issued under the fixed designation F 1865; 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 mechanical cold expansion insert fittings with compression sleeve suitable for use with cross-linked polyethylene PEX plastic tubing in $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, and 1 in. and larger nominal diameters that meet the requirements of Specifications F 876 and F 877. These fittings are intended for use in 100 psi (689.5 kPa) cold and hot water distributions systems operating at temperatures up to and including 180° F (82°C). Included are the requirements for materials, workmanship, dimensions, and markings to be used on the fittings and compression sleeves

1.2 The values stated in inch-pounds units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units which are provided for provided for information only and are not considered the standard.

1.3 *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 Machines²
- B 140/B 140M Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar and Shapes²
- B 283 Specification for Copper and Copper-Alloy Die Forgings (Hot Pressed)²
- D 1600 Terminology for Abbreviated Terms Relating to Plastics³
- D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings⁴

E 18 Test Method for Rockwell Hardness and Superficial Hardness of Metallic Materials⁵

F 412 Terminology Relating to Plastic Piping Systems⁴

F 876 Specification for Crosslinked Polyethylene (PEX) Tubing⁴

F 877 Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems⁴

2.2 ASME Standards:⁶

B 1.20.1 Pipe Threads General Purpose (inch)

B 16.18 Cast Copper Alloy Solder Joint Pressure Fittings

B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

2.3 NSF International Standards:⁷

NSF 14 Plastic Piping Components and Related Materials

NSF 61 Drinking Water System Components-Health Effects

2.4 MSS Standard:⁸

SP-104 Wrought Copper Solder Joint Pressure Fittings

3. Terminology

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

4. Classification

4.1 This specification covers one class of mechanical cold expansion insert fittings with compression sleeve suitable for use with PEX tubing that meets the requirements of Specification F 876 and F 877.

5. Materials and Manufacture

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

5.1.1 *Machined Brass Fittings*—Machined brass fittings shall be made from material meeting the requirements of Specification B 140 copper alloy UNS C31400, Specification B 16 Copper alloy UNS C38500, or DIN 17660 – CuZn39Pb3.

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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, United Engineering Center, 345 E. 47th St., New York, NY 10017.

⁷ Available from the National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.

⁸ Available from Manufacturer's Standardization Society of the Valve and Fittings Industry, 5203 Leesburg Pike, Suite 502, Falls Church, VA 22041.

5.1.2 *Forged Brass Fittings*—Forged brass fittings shall be made from material meeting the requirements of Specification B 283 Copper alloy UNS C37700, or DIN 17660-CuZn40Pb2.

5.1.3 *Compression Sleeves*—Compression sleeves shall be made from material meeting the requirements of Specification B 140 copper alloy UNS C37700, Specification B 16 Copper alloy UNS C38500, or DIN 17660-CuZn39PB3.

6. General Requirements

6.1 The following sections of Specification F 877 constitute a part of this specification:

- 6.1.1 Requirements,
- 6.1.2 Test Methods, and
- 6.1.3 Retest and Rejection

6.2 In addition, when a section with a title identical to that referenced in 6.1, above, appears in this specification, it contains additional requirements that supplement those appearing in F 877.

6.3 *Dimensions*—Randomly selected fitting or fittings shall be used to determine dimensions. Measurements shall be made

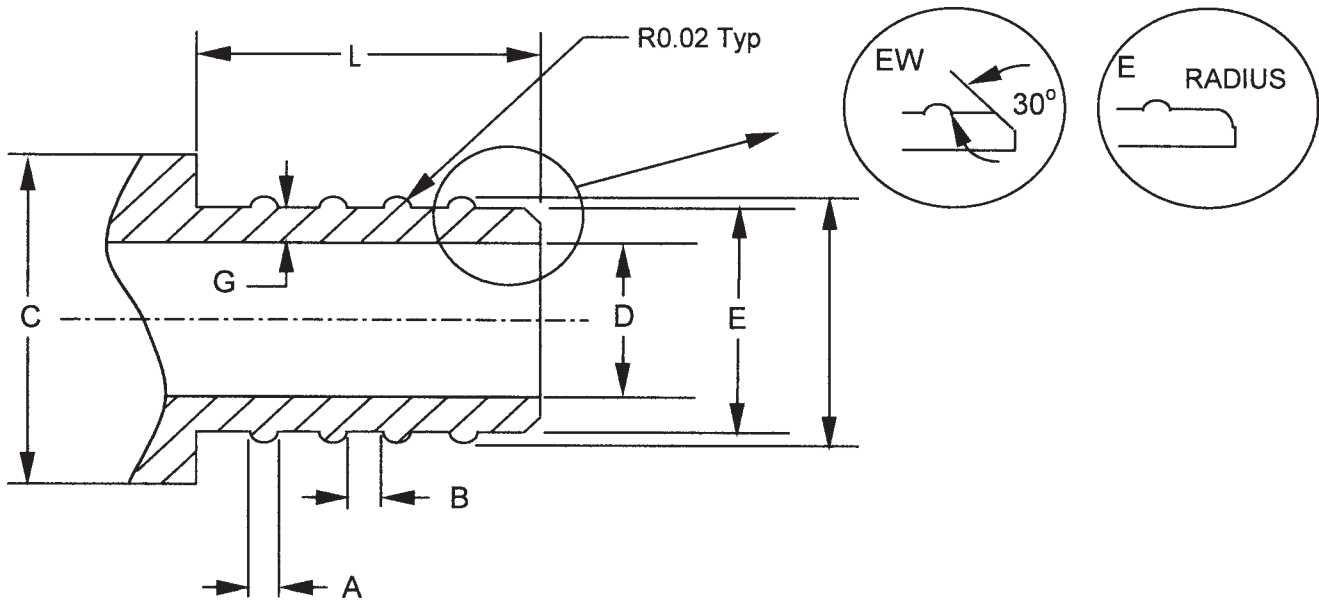
in accordance with Test Method D 2122. Determine the diameters by making measurements at four points spaced approximately 45° apart around the circumference. Inspection and gauging of solder joint ends shall be in accordance with ANSI B16.18, ANSI B16.22, or MSS SP-104. Inspection and gauging of taper pipe threads shall be in accordance with ANSI/ASME G1.20.1. All fittings that will be subjected to secondary processes of mechanical marking that affect their dimensional tolerances shall be tested in their final marked configuration.

7. Dimensions

7.1 *Dimensions and Tolerances*—The dimensions and tolerances of fittings and compression sleeves shall be as shown in Fig. 1 and Fig. 2 when measured in accordance with 6.3.

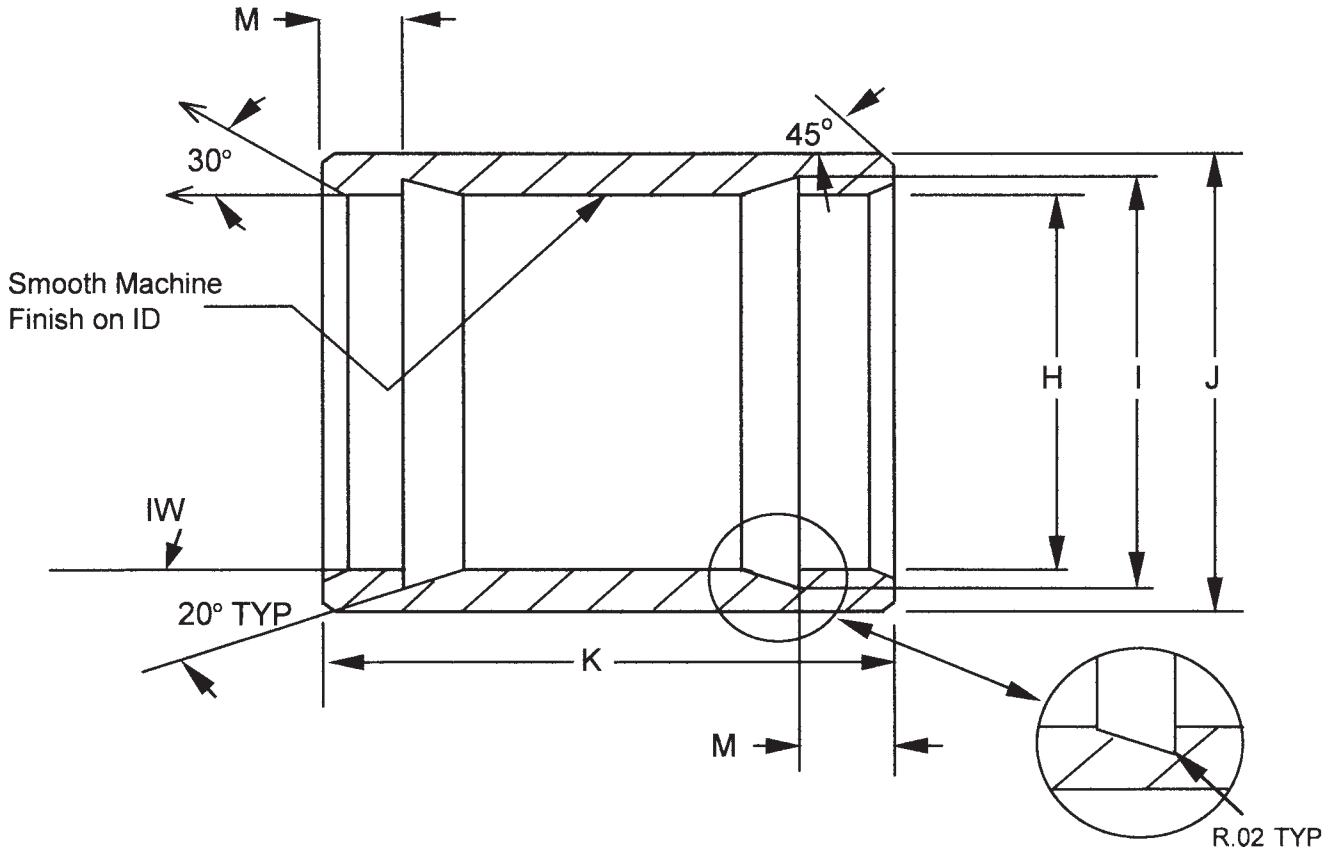
7.1.1 *Alignment*—The maximum angular variation of any opening shall not exceed 1/2° off the true centerline axis.

7.1.2 *Fittings with Solder Joint Ends*—Solder joint ends shall be in accordance with ASME B 16.22, ASME B 16.18 or MSS SP-104



Standard Size	Inches									
	A Rib Width Typ	Number of Ribs	B Gap Width Typ	C Stop Dia. min	D Inside Dia. min	E Insert Diameter	F Rib Diameter	G Minimum Wall	EW EX Depth	L
3/8 in.	0.04 + 0.01	4	0.071 ± 0.010	0.620	0.30	0.370 + 0.008	0.410 + 0.008	0.025	0.020	0.59
1/2 in.	0.04 + 0.01	4	0.071 ± 0.010	0.78	0.40	0.510 + 0.008	0.540 + 0.008	0.040	0.030	0.59
5/8 in.	0.04 + 0.01	4	0.071 ± 0.010	0.86	0.51	0.630 + 0.008	0.670 + 0.008	0.045	0.030	0.59
3/4 in.	0.04 + 0.01	5	0.102 ± 0.010	1.00	0.59	0.730 + 0.008	0.780 + 0.008	0.050	0.035	0.83
1 in.	0.04 + 0.01	5	0.126 ± 0.010	1.40	0.77	0.900 + 0.008	0.950 + 0.008	0.055	0.035	0.94
Metric Size STD (nom)	millimeters									
	A Rib Width Typ	Number of Ribs	B Gap Width Typ	C Stop Dia. min	D Inside Dia. min	E Insert Diameter	F Rib Diameter	G Minimum Wall	EW EX Depth	L
3/8 in. (10 mm)	(1 ± 0.25)	4	(1.8 ± 0.25)	(16)	(7.70)	(9.5 + 0.2)	(10.3 + 0.2)	(0.63)	(0.50)	(15)
1/2 in. (13 mm)	(1 ± 0.25)	4	(1.8 ± 0.25)	(20)	(10.3)	(13.0 + 0.2)	(13.8 + 0.2)	(1.0)	(0.80)	(15)
5/8 in. (16 mm)	(1 ± 0.25)	4	(1.8 ± 0.25)	(22)	(12.9)	(16.0 + 0.2)	17.0 + 0.2	(1.14)	(0.80)	(15)
3/4 in. (19 mm)	(1 ± 0.25)	5	(2.6 ± 0.25)	(27)	(15.0)	(18.6 + 0.2)	(19.8 + 0.2)	(1.27)	(0.89)	(21)
1 in. (25 mm)	(1 ± 0.25)	5	(3.2 ± 0.25)	(34)	(19.5)	(22.9 + 0.2)	(24.0 + 0.2)	(1.40)	(0.89)	(24)

FIG. 1 Mechanical Insert Dimensions and Tolerances



Standard Size	Inches					
	H Inside Diameter	I Groove Diameter	J Outside Diameter	K Length	M Groove Recess	IW Chamfer Depth
3/8 in.	0.52 ± 0.002	0.56 ± 0.01	0.63 ± 0.01	0.59 ± 0.02	0.14	0.04
1/2 in.	0.66 ± 0.002	0.7 ± 0.01	0.75 ± 0.01	0.59 ± 0.02	0.14	0.04
5/8 in.	0.80 ± 0.002	0.84 ± 0.01	0.94 ± 0.01	0.59 ± 0.02	0.14	0.04
3/4 in.	0.93 ± 0.002	0.97 ± 0.01	1.1 ± 0.01	0.73 ± 0.02	0.17	0.04
1 in.	1.15 ± 0.002	1.19 ± 0.01	1.3 ± 0.01	0.91 ± 0.02	0.22	0.04

Metric Size STD (nom)	millimetres					
	H Inside Diameter	I Groove Diameter	J Outside Diameter	K Length	M Groove Recess	IW Chamfer Depth
3/8 in. (10 mm)	(13.20 ± 0.05)	(14.2 + 0.15)	(16.00 ± 0.25)	(15.0 ± 0.5)	(3.5)	(1)
1/2 in. (13 mm)	(16.75 ± 0.05)	(17.75 + 0.15)	(19.00 ± 0.25)	(15.0 ± 0.5)	(3.5)	(1)
5/8 in. (16 mm)	(20.35 ± 0.05)	(21.3 + 0.15)	(24.00 ± 0.25)	(15.0 ± 0.5)	(3.5)	(1)
3/4 in. (19 mm)	(23.6 ± 0.05)	(24.5 + 0.15)	(28.00 ± 0.25)	(18.5 ± 0.5)	(4.25)	(1)
1 in. (25 mm)	(29.25 ± 0.05)	(30.2 + 0.15)	(33.00 ± 0.25)	(23.0 ± 0.5)	(5.6)	(1)

FIG. 2 Dimensions and Tolerances of Fittings and Compression Sleeves

7.1.3 *Tapered Threaded Ends*—Fitting threads shall be right-hand conforming to ASME B 1.20.1. They shall be taper threads (NPT).

8. Workmanship, Finish and Appearance

8.1 The sealing, mating and threaded surfaces of the fitting(s) 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 unmagnified eye and that may affect the wall integrity.

9. Assembly

9.1 *Joints*—Mechanical Cold Expansion Insert Fittings with Compression Sleeve shall be joined to the PEX tubing by

drawing a compression sleeve over the PEX tubing that has been cold expanded and into which the fitting has been inserted. This action forces the tubing into annular spaces formed by ribs on the fitting. Fittings and compression sleeves shall meet the dimensional tolerances of this Specification. PEX tubing shall meet the requirements of Specification F 876 or F 877.

9.1.1 *Solder Joints*—Soldering of fittings joints shall be completed prior to installation of the PEX tubing. Excessive heat from the soldering operation will damage the PEX tubing.

9.2 *Assembly Procedure*—To affix the mechanical cold expansion insert fitting with compression sleeve to the PEX tubing, the procedure shall be as follows: Cut the tubing square

using a cutter designed for plastic tubing. Inspect the end for burrs or foreign debris. Slide the compression sleeve onto the tubing at least 1 in. (25 mm) beyond the end of the tube. Insert the properly sized expansion tool (see Note 1) fully into the tubing until the end of the tube meets the stop on the tool. Expand the tubing to the fullest reach of the tool. The fullest reach of the tool shall not expand the inside diameter of the tubing more than 0.20 in. (5.0 mm) for sizes up to $\frac{5}{8}$ in. nominal and 0.24 in. (6.0 mm) for larger sizes up to 1 in. Insert the fitting into the expanded tube. Place the joining tool onto the fitting assembly in accordance with the tool manufacturers instructions (see Note 1). Operate the joining tool to slide the compression sleeve over the tubing and until it reaches the stop on the fitting. Remove the joining tool. Compression sleeves that are damaged in any way shall not be re-used.

NOTE 1—Tool manufacturers provide a variety of expansion tools and joining tools with adapters for use on the various fittings configurations and sizes. These tools may utilize mechanical, electrical, hydraulic, or pneumatic devices to actuate their mechanisms. One inch sizes may not require expansion.

10. Quality Assurance

10.1 When the product or product packing is marked with the ASTM designation F 1865, 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. Product Marking

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

11.2 *Content of Marking*:

11.2.1 Marking on fittings shall include manufacturer's name or trademark, or some other identifying mark. Additional marking shall include ASTM standard number and PEX, if size permits.

11.2.1.1 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.

11.2.2 Marking on packaging shall include manufacturer's name, fitting size, and ASTM F 1865.

11.2.3 Markings on compression sleeves shall include manufacturer's trademark or some other identifying mark and ASTM F 1865.

11.3 When the product is marked with this ASTM designation ASTM F 1865, 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.

12. Keywords

12.1 cold and hot water distribution; cold expansion insert fittings; compression sleeve; crosslinked polyethylene; PEX

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.

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