



Standard Specification for Metal Mechanical Cold Flare Compression Fittings with Disc Spring for Crosslinked Polyethylene (PEX) Tubing¹²

This standard is issued under the fixed designation F1961; 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 mechanical cold flare compression fittings with integral disc spring suitable for use with cross-linked polyethylene PEX plastic tubing in $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ nominal diameters. that meets the requirements of Specifications **F876** and **F877**. These fittings are intended for use in 100 psi (689.5 kPa) cold and hot water distributions systems and hydronic heating 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.

1.2 *Units*—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 information only and are not considered 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:³

- A666** Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- B16/B16M** Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
- B140/B140M** Specification for Copper-Zinc-Lead (Red Brass or Hardware Bronze) Rod, Bar, and Shapes

- B283** Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)
- D1600** Terminology for Abbreviated Terms Relating to Plastics
- D2122** Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- E18** Test Methods for Rockwell Hardness of Metallic Materials
- 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

2.2 ASME Standards:⁴

- 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 NSF Standards:⁵

- NSF 14** Plastic Piping Components and Related Materials
- NSF 61** Drinking Water System Components-Health Effects

2.4 DIN Standard:⁶

- DIN 1766.**

2.5 Other Standard:⁷

- MSS SP-104**, Wrought Copper Solder Joint Pressure Fittings

3. Terminology

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

⁴ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁵ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.

⁶ Available from Deutsches Institut Fur Normung eV, Burggrafenstrasse 4 Berlin 30, West Germany D-1000.

⁷ Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, <http://www.msshq.com>.

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

4. Classification

4.1 This specification covers one class of mechanical cold flare compression fittings suitable for use with four sizes of PEX tubing that meets the requirements of Specifications **F876** and **F877**.

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 **B140/B140M** copper alloy UNS C31400, Specification **B16/B16M** Copper Alloy UNS C38500, or Copper Alloy UNS No. C27450, or DIN 17660–CuZn39Pb3.

5.1.2 *Forged Brass Fittings*—Forged brass fittings shall be made from material meeting the requirements of Specification **B283**, Copper Alloy UNS C37700, or Copper Alloy UNS No. C27450, or DIN 17660–CuZn40Pb2.

5.1.3 *Disc Spring*—The disc spring assembly consists of one conical compression washer and one flat washer. Both washers shall be made from material meeting the requirements of Specification **A666** stainless steel UNS S30100. The flat washer shall be ½ hard. The minimum hardness of the conical compression washer shall be HRC 40.

6. General Requirements

6.1 The following sections of Specification **F877** 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 Specification **F877**.

6.3 Performance Requirements:

6.3.1 *General*—All performance test shall be preformed in assemblies of fittings and PEX tubing as defined in 8.3. Fittings and compression sleeves shall meet the material and dimensional requirements of this standard. PEX tubing shall meet the requirements of Specifications **F876** and **F877**. Assembly of test specimens shall be in accordance with 9.2. Use separate set of assemblies for each performance test requirement.

6.3.2 *Dimensions*— Randomly selected fitting or fittings and PEX reinforcing 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 points spaced at approximately 45° apart around the circumference. Inspection and gauging of taper joint ends shall be in accordance with ANSI B16.18, or ANSI B16.22, or MSS SP-104. Inspection and gaging of taper pipe threads shall be in accordance with ANSI B1.20.1. All fittings that will be subjected to secondary processes of mechanical marking, which affect their dimensional tolerances, shall be tested in their final marked configuration.

7. Dimensions

7.1 *Dimensions and Tolerances*—The dimensions and tolerances of fitting components shall be as shown in **Figs. 1-3** when measured in accordance with **6.3.2**. Dimensions and properties of flat and conical compression washer components of disc springs shall be in accordance with **Table 1**.

7.1.1 *Alignment*—The maximum angular variation of any opening shall not exceed ½ ° off the true centerline axis.

7.1.2 *Fittings with Solder Joint Ends*—External dimensions of solder joint ends shall be in accordance with ANSI B.16.22, B16.18, or MSS SP-104.

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

8. Workmanship, Finish, and Appearance

8.1 The sealing 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 eye without magnification and that have potential to affect the wall integrity.

9. Assembly

9.1 *Joints*—Mechanical cold flare compression fittings shall be joined to PEX tubing by the procedure of 8.2. Fittings shall meet the dimensional tolerances of this standard. PEX tubing shall meet the requirements of Specifications **F876** and **F877**.

9.1.1 *Solder Joints*—Soldering of fitting 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*—Refer to **Fig. 4** for a cross-section of a fully-assembled cone union with PEX tubing and male fitting end. To affix the mechanical cold flare compression fitting to PEX tubing, the procedure shall be as follows:

9.2.1 Cut the tubing square using a cutter designed for plastic tubing. Inspect the end for burrs or foreign debris. Place the proper-size cone union assembly (female fitting) onto the assembly tool. Place the PEX tubing into the tool, so that the cut end abuts the cone union. Grip the PEX tubing by closing the locking handle of the tool until the tool locks. Fully close the compression lever. This action both presses the grip ring of the cone union assembly onto the PEX tubing, and flares the end of the PEX tubing to an angle of 22°. Open the compression lever to release the PEX tubing and the fitting. Tighten the cone union nut onto the mating (male) end of the desired fitting, until the torque shown in **Table 2** has been applied. Custom torque wrenches that are adjusted to slip at these torque values are available and appropriate.

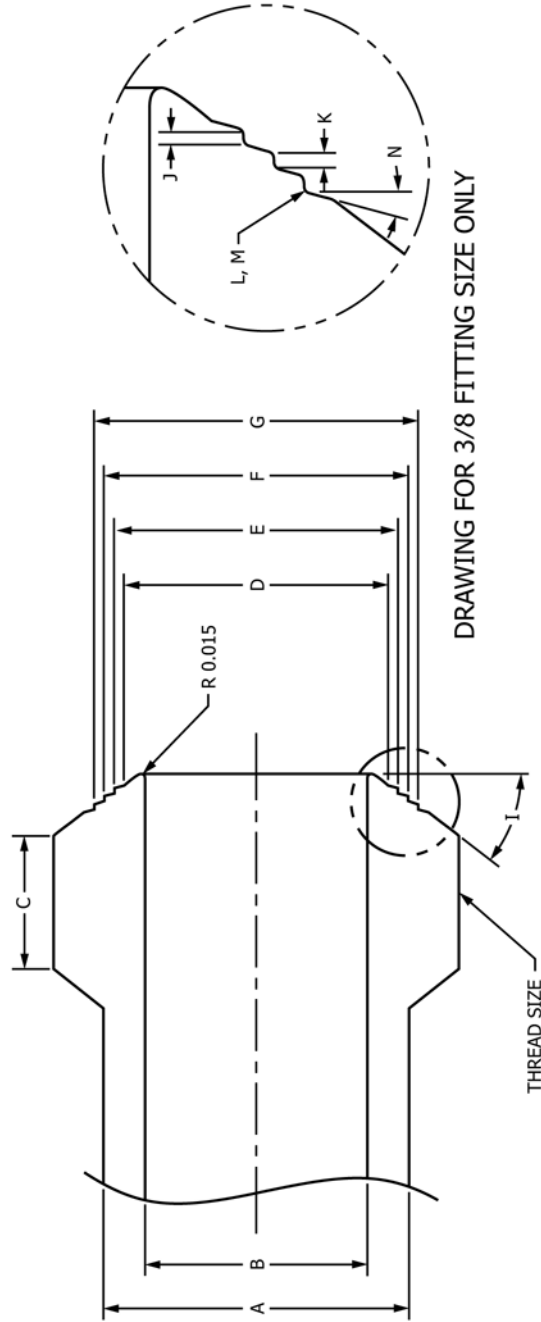
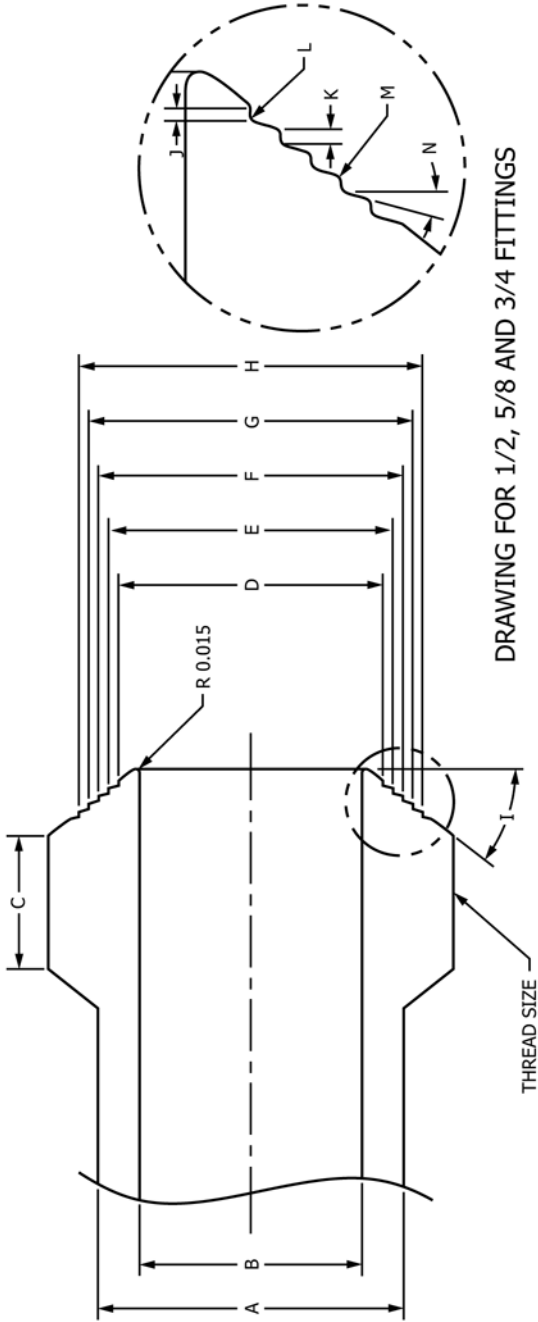
9.3 One assembly for testing purposes is one fitting with PEX tubing assembled onto each leg of the fitting.

10. Quality Assurance

10.1 When the product or product packaging is marked with the ASTM designation F1961, 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.

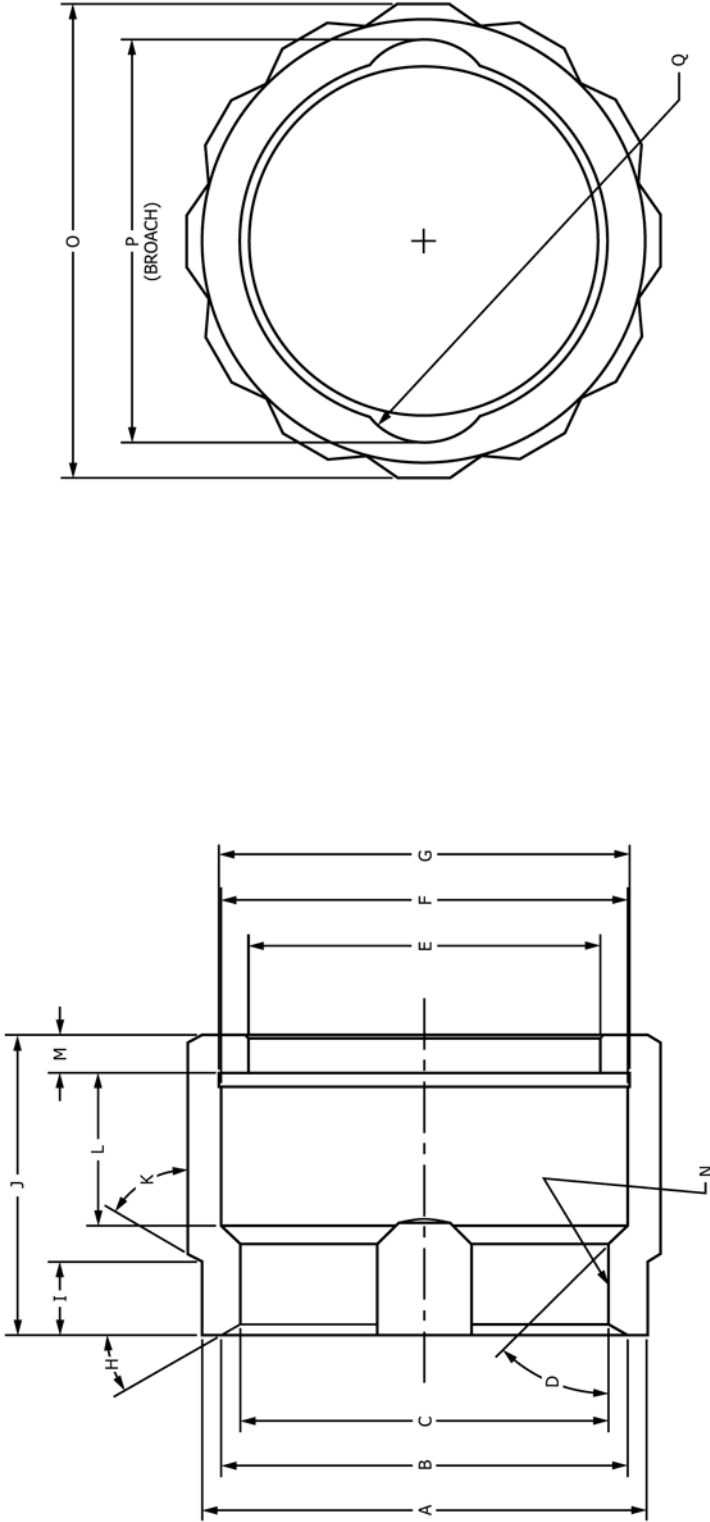
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
BREAK ALL EDGES .005 - .010.
INTERNAL RADIUS .000 - .010.
ALL DIAMETERS CONCENTRIC
TO .005.

.X +/- .020
.XX +/- .010
.XXX +/- .005
ANGLES +/- 1/2 DEGREE



FITTING SIZE	DIM 'A'	DIM 'B'	DIM 'C'	DIM 'D'	DIM 'E'	DIM 'F'	DIM 'G'	DIM 'H'	DIM 'I'	DIM 'J'	DIM 'K'	DIM 'L'	DIM 'M'	DIM 'N'	THREAD SIZE
3/8	ø .58	ø .330	.22	ø .408	ø .453	ø .501	ø .548	N/A	38°	.0106	.0106	R .006	R .006	15°	M17 X 1.25
1/2	ø .766	ø .492	.28	ø .555	ø .603	ø .650	ø .698	ø .745	38°	.0111	.0122	R .006	R .006	15°	M22 X 1.5
5/8	ø .82	ø .572	.35	ø .700	ø .760	ø .820	ø .880	ø .940	38°	.0137	.0154	R .006	R .006	15°	M27 X 1.5
3/4	ø .91	ø .660	.40	ø .788	ø .848	ø .908	ø .968	ø 1.028	38°	.0137	.0154	R .006	R .006	15°	M30 X 2.0

FIG. 1 Male Fitting Dimensions



FITTING SIZE	DIM 'A'	DIM 'B'	DIM 'C'	DIM 'D'	DIM 'E'	DIM 'F'	DIM 'G'	DIM 'H'	DIM 'I'
3/8	ø .765	ø .700	ø.623-.617	22°	ø.610-.606	ø.685	ø.701	30°	.125
1/2	ø .967	ø .890	ø.807-.803	22°	ø.787-.783	ø.880	ø.896	30°	.156
5/8	ø1.205	ø1.125	ø1.005	22°	ø.923	ø1.095-1.110	ø1.111-1.126	30°	.156
3/4	ø1.330	ø1.215	ø1.103-1.097	45°	ø1.050-1.045	ø1.200-1.215	ø1.221-1.236	30°	.220

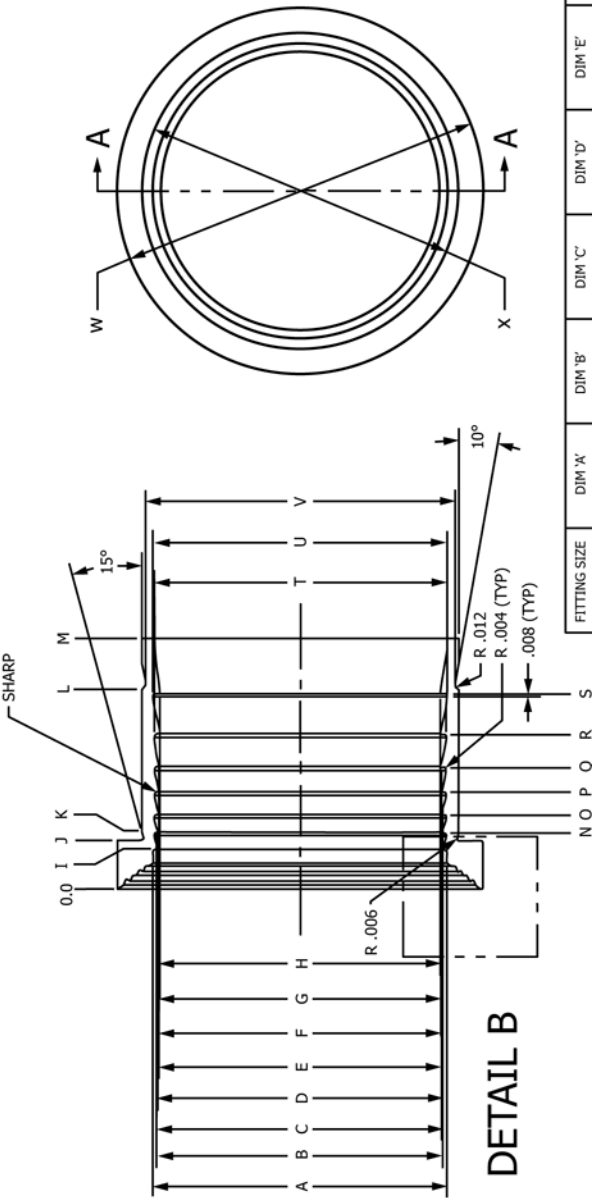
FITTING SIZE	DIM 'J'	DIM 'K'	DIM 'L'	DIM 'M'	DIM 'N'	DIM 'O'	DIM 'P'	DIM 'Q'
3/8	.495	60°	.235	.062	M17x1.25-6H P.D.:.6373/.6444	.828	.695-.690	R. 5/64 (TYP)
1/2	.610	45°	.283	.078	M22x1.5-6H P.D.:.8278/.8353	1.043	.885	R. 1/8 (TYP)
5/8"	.812	60°	.375	.100	M27x1.5-6H P.D.:1.0247/1.0325	1.300	1.120	R. 1/4 (TYP)
3/4	.895	60°	.455	.112	M30x2.0-6H P.D.:1.1300/1.1388	1.408	1.205	R. 7/32 (TYP)

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES.
 BREAK ALL EDGES .005 - .015.
 ALL TOLERANCES ARE +/- .005
 BROACH MUST BREAK INTO RECESS.

FIG. 2 Union Nut Dimensions

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
BREAK ALL EDGES .005 - .010.
INTERNAL RADIUS .000 - .010.
ALL DIAMETERS CONCENTRIC
TO .005.

.X +/- .020
.XX +/- .010
.XXX +/- .005
ANGLES +/- 1/2 DEGREE



FITTING SIZE	DIM 'A'	DIM 'B'	DIM 'C'	DIM 'D'	DIM 'E'	DIM 'F'	DIM 'G'	DIM 'H'	DIM 'I'	DIM 'J'
3/8	0.470	0.458	0.451	0.448	0.446	N/A	N/A	N/A	.082	.098
1/2	0.630	0.610	0.607	0.600	0.599	0.594	N/A	N/A	.094	.113
5/8	0.786	0.731	0.728	0.726	0.724	0.722	0.719	0.716	.120	.146
3/4	0.877	0.852	0.849	0.847	0.845	0.843	0.840	0.837	.120	.146

FITTING SIZE	DIM 'K'	DIM 'L'	DIM 'M'	DIM 'N'	DIM 'O'	DIM 'P'	DIM 'Q'	DIM 'R'	DIM 'S'	DIM 'T'
3/8	.128	.340	.452	.130	.182	.240	.308	N/A	N/A	0.481
1/2	.135	.442	.550	.157	.230	.322	.417	N/A	N/A	0.630
5/8	.176	.560	.690	.170	.222	.290	.365	.445	.545	0.751
3/4	.176	.598	.747	.170	.222	.290	.365	.464	.583	0.872

FITTING SIZE	DIM 'U'	DIM 'V'	DIM 'W'	DIM 'X'	DIM 'AA'	DIM 'AB'	DIM 'AC'	DIM 'AD'	DIM 'AE'	DIM 'AF'
3/8	0.493	0.510	0.614-610	0.532-528	0.485	0.498	0.522	0.535	0.560	0.572
1/2	0.641	0.667	0.799-.795	0.689-.685	0.655	0.667	0.692	0.704	0.729	0.741
5/8"	0.758	0.804	0.1001-.997	0.826-.822	0.819	0.831	0.854	0.866	0.891	0.904
3/4	0.879	0.925	0.1092-1.088	0.947-.943	0.910	0.922	0.945	0.957	0.982	0.995

FITTING SIZE	DIM 'AG'	DIM 'AH'	DIM 'AI'	DIM 'AJ'	DIM 'AK'	DIM 'AL'	DIM 'AM'	DIM 'AN'	DIM 'AO'	DIM 'AP'
3/8	N/A	N/A	.013	.018	.027	.032	.042	.047	N/A	N/A
1/2	0.760	N/A	.010	.022	.027	.037	.042	.052	.056	N/A
5/8"	0.928	0.941	.024	.028	.038	.043	.053	.057	.066	.071
3/4	0.1019	0.1032	.024	.028	.038	.043	.053	.057	.066	.071

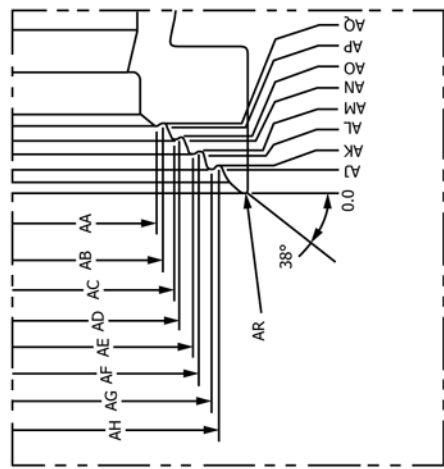


FIG. 3 Grip Ring Dimensions

TABLE 1 Dimensions and Properties of Flat and Conical Compression Washers for Disc Springs

Nominal Fitting Size, in.	Shape	Outside Diameter, in.	Inside Diameter, in.	Thickness, in.	Spring Height, in.	Initial Spring Constant, lbf/in.
3/8	flat	0.675 to 0.681	0.539 to 0.545	0.023 to 0.027	^A	^A
	Conical compression	0.660 to 0.664	0.544 to .0548	0.028 to 0.032	0.010	16000 to 23000
1/2	flat	0.866 to 0.870	0.697 to 0.701	0.037 to 0.041	^A	^A
	Conical compression	0.854 to 0.858	0.700 to 0.704	0.037 to 0.041	0.011	25000 to 42000
5/8	flat	1.080 to 1.088	0.835 to 0.841	0.038 to 0.042	^A	^A
	Conical compression	1.067 to 1.071	0.843 to 0.847	0.048 to 0.052	0.016	18000 to 26000
3/4	flat	1.192 to 1.198	0.956 to 0.962	0.048 to 0.052	^A	^A
	Conical compression	1.172 to 1.176	0.964 to 0.968	0.053 to 0.057	0.015	23000 to 48000

^ANot applicable.

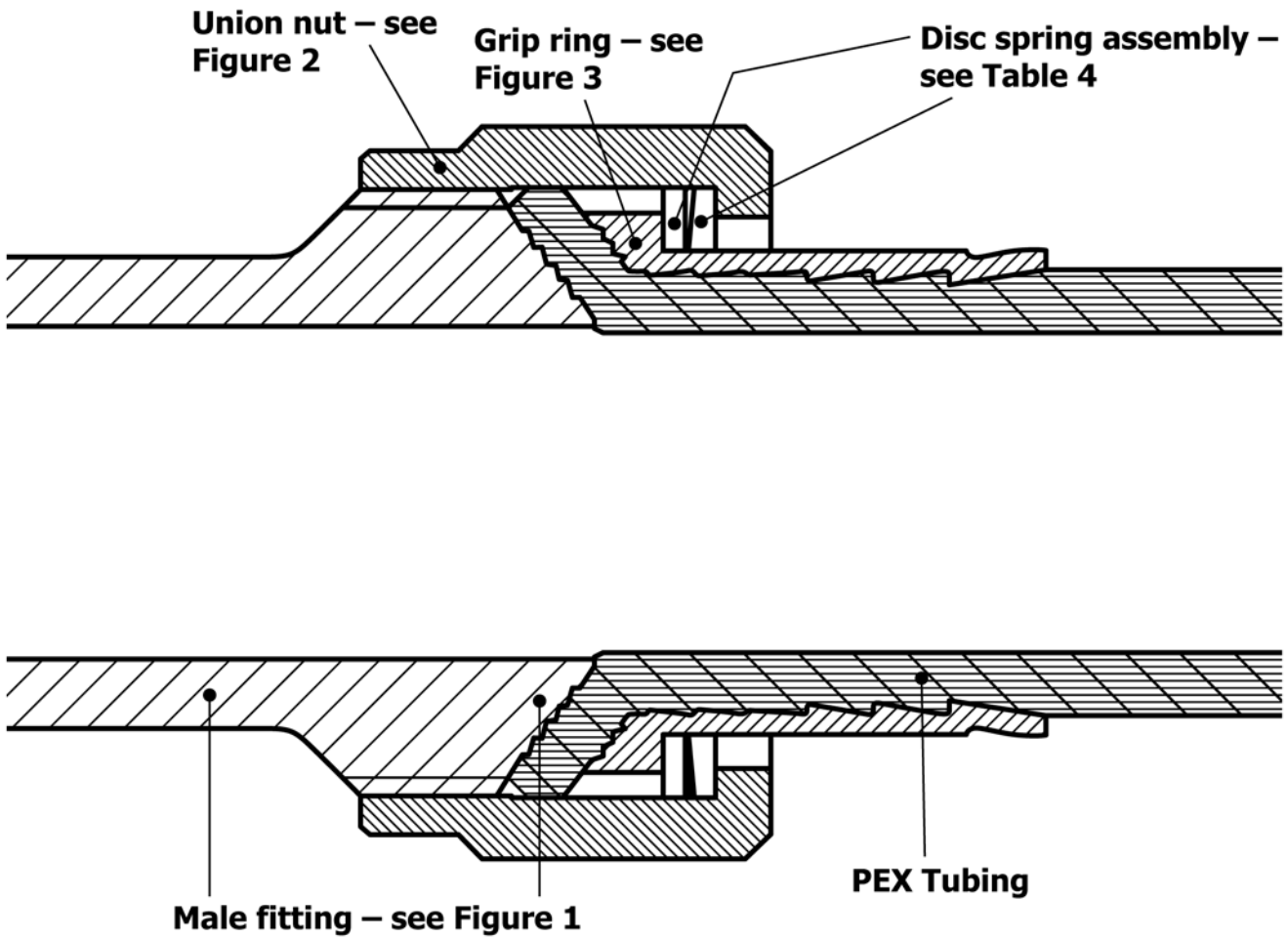


FIG. 4 Cross-Section (Typical) of Cone Union/PEX Tube/Male Fitting

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.

TABLE 2 Torque Values for Tightening Cone Union Assemblies

Size, in.	Torque, lbf/in. (N/m) ^A
3/8	125 (14)
1/2	140 (16)
5/8	300 (35)
3/4	450 (50)

^AAll torque values are specified as the above $\pm 10\%$.

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 F1961.

11.2.3 Markings on compression sleeves shall include manufacturer's trademark or some other identifying mark and ASTM F1961.

12. Keywords

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

SUPPLEMENTARY REQUIREMENTS

S1. POTABLE WATER REQUIREMENTS

S1.1 This requirement applies whenever a regulatory authority or user calls for product to be used to convey or be in contact with potable water.

S1.2 Products intended for the transport of potable water shall be evaluated, tested and certified for conformance with ANSI/NSF 61 or the health effects portion of NSF 14 by an

acceptable certifying organization when required by the regulatory authority having jurisdiction.

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F1961-02a) that may impact the use of this standard.

(1) Added Copper alloy UNS No. C27450 to 5.1.1 and 5.1.2.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/