



## Standard Specification for Metal Mechanical Cold Flare Compression Fittings with Disc Spring for Crosslinked Polyethylene (PEX) Tubing<sup>12</sup>

This standard is issued under the fixed designation F 1961; 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.

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$\epsilon$ <sup>1</sup> ~~NOTE—Section 10 was editorially updated in December 2002.~~

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### 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 F 876 and F 877. 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:

A 666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar<sup>3</sup>

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<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 April 10, 2002. Published January 2002<sup>3</sup>. Originally published as F1961-99, approved in 1999. Last previous edition approved in 2002 as F1961-9902.

<sup>2</sup> The cold flare compression fitting with integral disc spring is covered by a patent. Interested parties are invited to submit information regarding the identification of an alternative to this patented item to ASTM headquarters. Your comments will receive careful consideration at a meeting of F17, which you may attend.

B 16 Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines<sup>4</sup>  
 B 140/B 140M Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar and Shapes<sup>4</sup>  
 B 283 Specification for Copper and Copper-Alloy Die Forgings (Hot Pressed)<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>  
 E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>7</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 ASME Standards:<sup>8</sup>

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:<sup>9</sup>

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

## 2.4 DIN Standard:<sup>10</sup>

DIN 1766.

## 2.5 Other Standard:<sup>11</sup>

MSS 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 flare compression fittings suitable for use with four sizes of PEX tubing that meets the requirements of Specifications 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.

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 *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 A 666 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 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 Specification F 877.

#### 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 F 876 and F 877. Assembly of test specimens shall be in accordance with 9.2. Use separate set of assemblies for each performance test requirement.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>4</sup> Annual Book of ASTM Standards, Vol 02.01.

<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> Annual Book of ASTM Standards, Vol 03.01.

<sup>8</sup> Available from American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th St., New York, NY 10017.

<sup>9</sup> Available from National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.

<sup>10</sup> Available from Deutsches Institut Fur Normung eV, Burggrafenstrasse 4 Berlin 30, West Germany D-1000.

<sup>11</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 Oct. 10, 2002. Published January 2003. Originally approved in 1999. Last previous edition approved in 2002 as F1961-02.

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 D 2122. 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 F 876 and F 877.

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; F 1961, 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 1961.

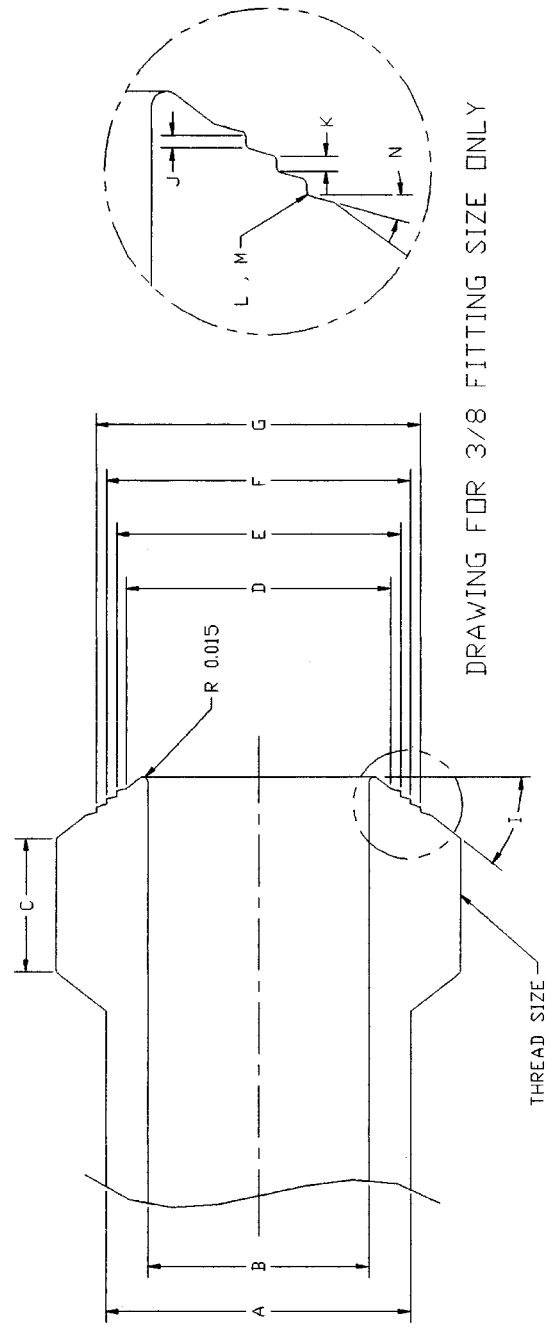
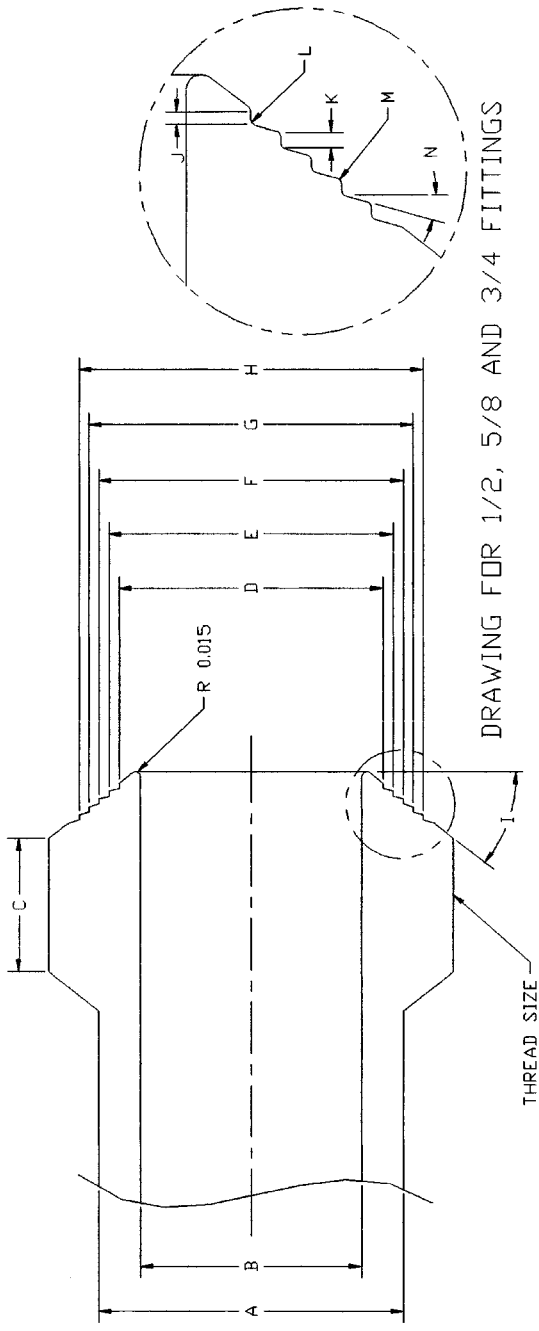
11.2.3 Markings on compression sleeves shall include manufacturer's trademark or some other identifying mark and ASTM F 1961.

## 12. Keywords

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

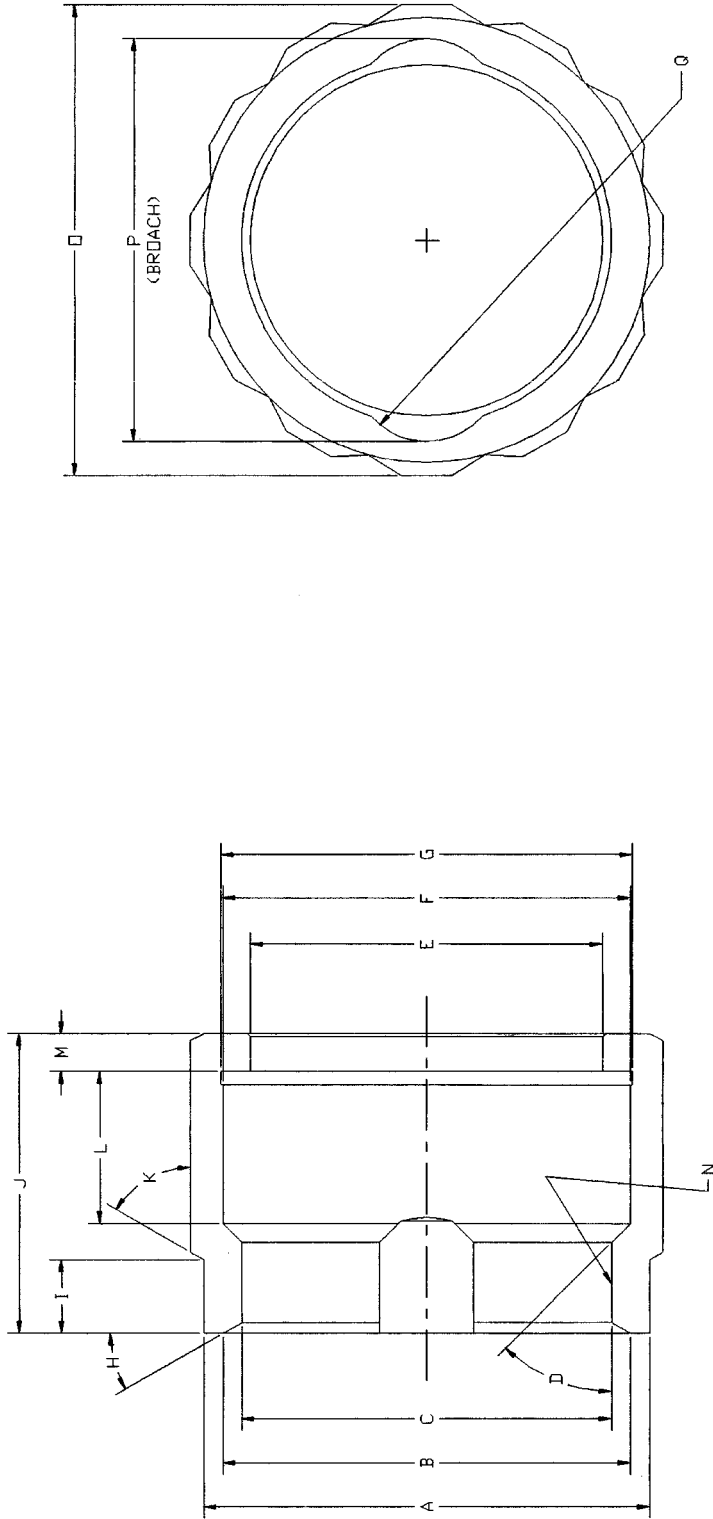
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES.  
BREAK ALL EDGES .005 - .010.  
INTERNAL RADIUS .000 - .010.  
ALL DIAMETERS CONCENTRIC  
TO .005.

.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°	.0105	.0106	R .006	R .006	15°	M17 X 1.25
1/2	ø .766	ø .492	.28	ø .585	ø .603	ø .650	ø .698	ø .745	38°	.011	.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'	DIM 'J'	DIM 'K'	DIM 'L'	DIM 'M'	DIM 'N'	DIM 'O'	DIM 'P'	DIM 'Q'
3/8	0.765	0.700	0.623-0.617	22°	0.610-0.606	0.685	0.701	30°	0.125								
1/2	0.967	0.890	0.807-0.803	22°	0.787-0.783	0.880	0.896	30°	0.156								
5/8	1.205	1.125	1.005	22°	0.923	1.095-1.110	1.111-1.126	30°	0.156								
3/4	1.330	1.215	1.103-1.097	45°	1.050-1.045	1.200-1.215	1.221-1.236	30°	0.220								

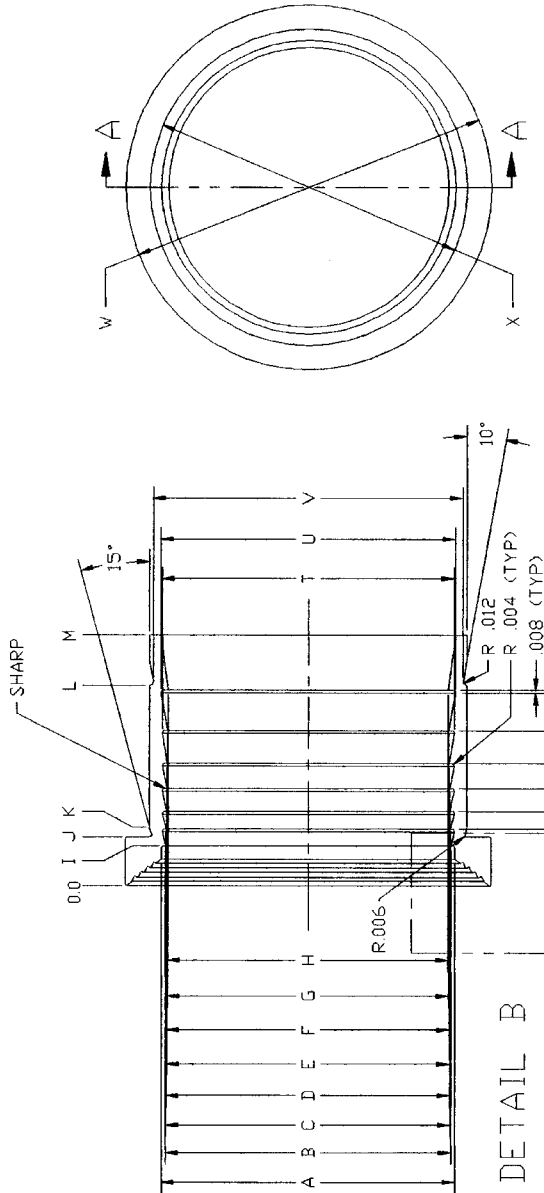
FITTING SIZE	DIM 'J'	DIM 'K'	DIM 'L'	DIM 'M'	DIM 'N'	DIM 'O'	DIM 'P'	DIM 'Q'
3/8	.495	60°	.235	.062	M7X1.25-6H P.D.:.6373/.6444	.828	.695-.690	R. 5/64 (TYP)
1/2	.610	45°	.283	.078	M22X1.5-6H P.D.:.8278/.8353	1.043	.885	R. 1/8 (TYP)
5/8	.812	60°	.375	.100	M27X1.5-6H P.D.:1.0247/1.0325	1.300	1.120	R. 1/4 (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. BRODACH MUST BREAK INTO RECESS.

FIG. 2 Union Nut Dimensions

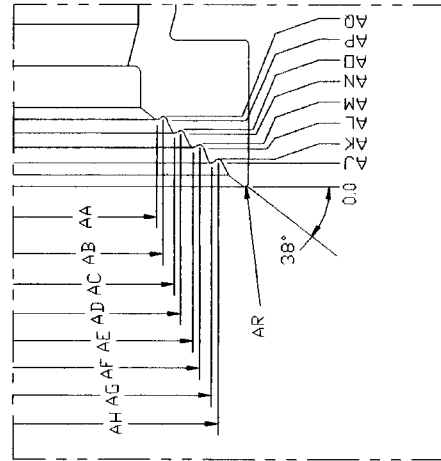
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES.  
BREAK ALL EDGES .005 - .010.  
INTERNAL RADIUS .000 - .010.  
ALL DIAMETERS CONCENTRIC  
TO .005.

.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	ø.470	ø.458	ø.451	ø.448	ø.446	N/A	N/A	N/A	.082	.098
1/2	ø.630	ø.610	ø.607	ø.600	ø.599	ø.594	N/A	N/A	.094	.113
5/8	ø.786	ø.731	ø.728	ø.726	ø.724	ø.722	ø.719	ø.716	.120	.146
3/4	ø.877	ø.852	ø.849	ø.847	ø.845	ø.843	ø.840	ø.837	.120	.146

SECTION A-A



DETAIL B

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	ø.481
1/2	.135	.442	.550	.157	.230	.322	.417	N/A	N/A	ø.630
5/8	.176	.560	.690	.170	.222	.290	.365	.445	.545	ø.751
3/4	.176	.598	.747	.170	.222	.290	.365	.464	.583	ø.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	ø.493	ø.510	ø.614-610	ø.532-528	ø.485	ø.498	ø.522	ø.535	ø.560	ø.572
1/2	ø.641	ø.667	ø.799-795	ø.689-685	ø.655	ø.667	ø.692	ø.704	ø.729	ø.741
5/8	ø.758	ø.804	ø.1001-997	ø.826-822	ø.819	ø.831	ø.854	ø.866	ø.891	ø.904
3/4	ø.879	ø.925	ø.1092-1088	ø.947-943	ø.910	ø.922	ø.945	ø.957	ø.982	ø.995

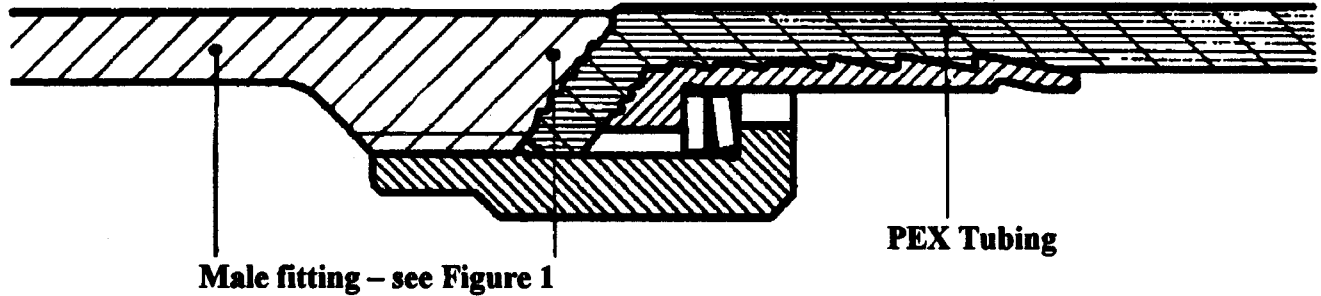
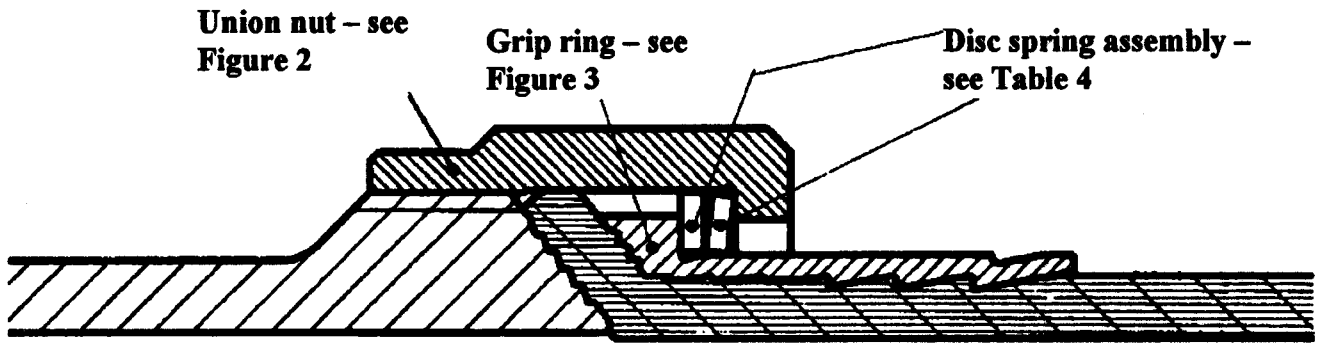
FITTING SIZE	DIM 'AG'	DIM 'AH'	DIM 'AI'	DIM 'AJ'	DIM 'AK'	DIM 'AL'	DIM 'AM'	DIM 'AN'	DIM 'AO'	DIM 'AP'
3/8	N/A	N/A	.013	.018	.027	.032	.042	.047	N/A	N/A
1/2	ø.760	N/A	.010	.022	.027	.037	.042	.052	.056	N/A
5/8	ø.928	ø.941	.024	.026	.038	.043	.053	.057	.066	.071
3/4	ø.1019	ø.1032	.024	.028	.038	.043	.053	.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	<sup>A</sup>	<sup>A</sup>
	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	<sup>A</sup>	<sup>A</sup>
	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	<sup>A</sup>	<sup>A</sup>
	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	<sup>A</sup>	<sup>A</sup>
	Conical compression	1.172 to 1.176	0.964 to 0.968	0.053 to 0.057	0.015	23000 to 48000

<sup>A</sup>Not applicable.



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

**TABLE 2 Torque Values for Tightening Cone Union Assemblies**

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

<sup>A</sup>All torque values are specified as the above  $\pm$  10 %.

## 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.

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