



**DELPHI**



Delphi Connection Systems, formerly Packard-Hughes Interconnect, develops, engineers and manufactures MIL-C-28876 qualified fiber optic connectors and cable assemblies.

Delphi's M28876 fiber optic connectors feature low optical insertion loss, repeatability, exceptional strain relief, and reliability in harsh environments.

**Benefits/Features:**

- Available in 2, 4, 6, 8, 18 and 31 channel configurations
- Qualified to MIL-C-28876 specification
- Singlemode and multimode capability
- Hybrid (electro-optic) versions available
- Point-to-point interconnection system
- Full environmental sealing
- In-line and wall mount receptacle
- Utilizes field proven Delphi Termini\*\*
- Field maintainable
- Comprehensive range of cable assemblies

Commercial-Off-The-Shelf (COTS) equivalents are available that maintain key performance factors of the MIL-SPEC versions.

Complete tool kits and support infrastructure are commercially available to support this product line.

Delphi's M28876 connectors are used extensively by the United States and allied naval forces in shipboard applications, and have been on the United States government's Qualified Products List (QPL) since 1983.

**Typical Applications:**

- Navy shipboard
- Military and commercial
- Hybrid configurations for electro-optical signal transmission

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*Key Words:*

- |                 |                                   |
|-----------------|-----------------------------------|
| <i>COTS</i>     | — <i>Commercial-Off-The-Shelf</i> |
| <i>MIL-SPEC</i> | — <i>Military Specification</i>   |
| <i>MIL-STD</i>  | — <i>Military Standard</i>        |
| <i>SM</i>       | — <i>Singlemode</i>               |
| <i>MM</i>       | — <i>Multimode</i>                |

\* For those applications not requiring MIL-SPEC qualified parts, Delphi also offers full performance commercial equivalents.

\*\* Please refer to Delphi's Fiber Optic Termini MIL-T-29504 and Commercial Equivalent catalog.

# M28876 Cable Assemblies

Delphi Connection Systems provides complete cable assembly services in accordance with specifications for the application requirements. The performance capabilities designed into our MIL-C-28876 connectors (or COTS equivalents) are most effective when incorporated into properly terminated cable assemblies.



Delphi Connection Systems has held a leadership position in the designing, engineering, and manufacturing of fiber optic interconnects for more than 25 years. Our innovative fiber optic technologies in military, aerospace, and automotive systems underscore the high reliability of our harsh environment connectors and cable assemblies.

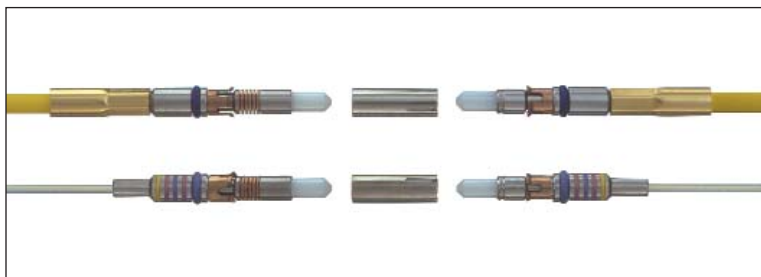
Delphi engineers can review drawings or provide design assistance to develop drawings, always providing the highest quality and performance to meet our customers' goals. We work with virtually any cable manufacturer to help select the cables that are most appropriate to the application.

Our facilities are equipped to provide a full range of assembly services to meet customers' needs, whether for full military compliance (MIL-STD-2042), specific customer defined requirements, or simply the "best commercial practices."

Delphi's quality systems are in place: Our employees are highly trained, skilled, and motivated, and our test equipment provides certification of cables prior to shipment. Tests reports are available with shipments.

## Fiber Termini – The foundation of our connectors and assemblies

Self-aligning termini provide perfect contact in every mating of Delphi's harsh environment products. The Optical Insertion Loss and Optical Backreflection for singlemode are based upon Delphi's field proven optical termini. These termini are available in both full MIL-SPEC and COTS versions.



Please refer to the Fiber Optic Termini MIL-T-29504 and Commercial Equivalent catalog covering the various options for fiber termini, crimp sleeves and sealing options available for these connectors.

# Connector Performance Criteria

Description	Specifications
<b>Optical Insertion Loss*</b>	9/125 SM Fiber -0.25 dB avg., 62.5/125 MM Fiber -0.6 dB avg. <i>Note - Values measured at 1300 nm per TIA/EIA-455-34</i>
<b>Optical Backreflection (SM)*</b>	Better than -40 dB with PC polish, better than -50 dB with enhanced PC polish
Durability	500 cycles per EIA-455-21
Vibration	Per MIL-STD-1344, Method 2005, Condition II & VI
Mechanical Shock	Per MIL-S-901, Grade A
Thermal Cycling	-62°C to +70°C per MIL-STD-1344, Method 1003
Corrosion Resistance	500 hour salt spray per MIL-STD-1344, Method 1001
Ozone Exposure	150 PPM/2 hours per MIL-STD-1344, Method 1007
Humidity	240 hours per MIL-STD-1344, Method 1002
Fluid Immersion	Per MIL-STD-1344, Method 1016
Crush Resistance	225 pounds per MIL-STD-1344, Method 2008.1
Maintenance Aging	Per MIL-STD-1344, Method 2002
Terminus Retention Force	22 pounds minimum per MIL-STD-1344, Method 2007
Insert Retention Axial	100 PSI minimum per MIL-STD-1344, Method 2010
Cable Pull Out Force	162 pounds minimum per MIL-STD-1344, Method 2009
Cable Seal Flexing	100 cycles per MIL-STD-1344, Method 2017
Impact	Per MIL-STD-1344, Method 2015
Flammability	Per MIL-STD-1344, Method 1012
Operating Temperature Range	-54°C to +65°C
Storage Temperature Range	-62°C to +71°C

*\*Optical performance data figures are derived from actual field measurements taken from thousands of mated pairs of termini across Delphi's line of multichannel connectors.*

## Standard Materials and Finishes

Description	Material	Finish
Insert	Per MIL-C-28876	Per MIL-C-28876
Boot, Strain Relief	Fluorosilicone	None
Connector and Backshell Housings	Per MIL-C-28876	Per MIL-C-28876

# Connectors

## MIL-SPEC Ordering Nomenclature

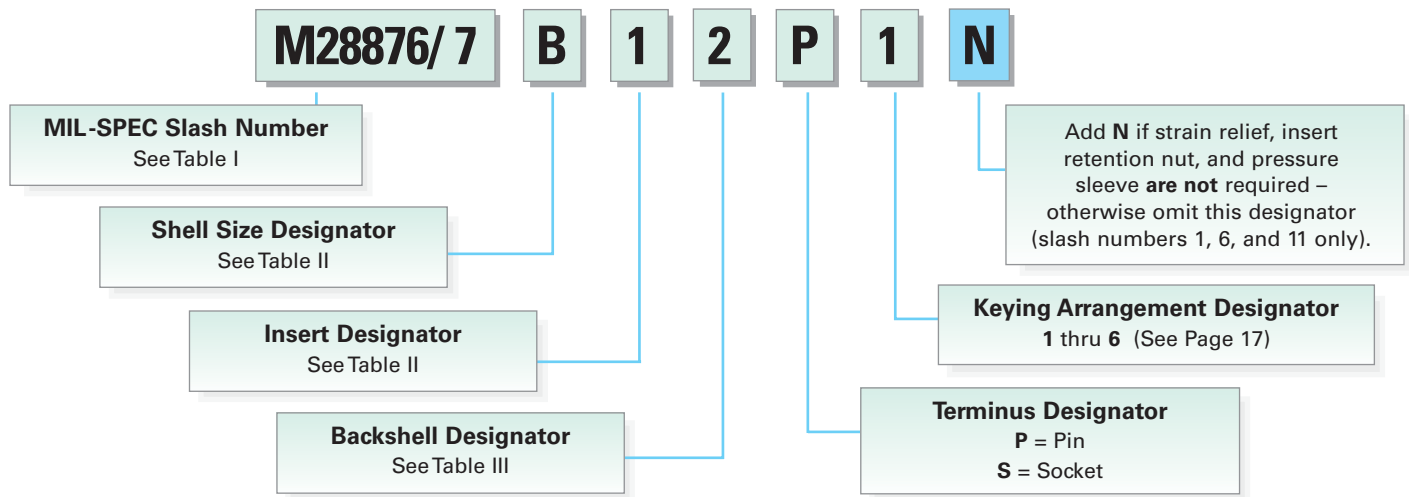


Table I			
Connector Type	Strain Relief	MIL-SPEC Slash Number	Commercial Equivalent Part Number
Receptacle, Wall Mount	None	<b>M28876/1</b>	4567626* 4565141
	Straight	<b>M28876/2</b>	1145840
	45°	<b>M28876/3</b>	1147630
	90°	<b>M28876/4</b>	1147640
Receptacle, In-Line	Straight	<b>M28876/5</b>	1145841
Plug	None	<b>M28876/6</b>	4567628* 4565143
	Straight	<b>M28876/7</b>	1145846
	45°	<b>M28876/8</b>	1147636
	90°	<b>M28876/9</b>	1147646
Receptacle, Jam Nut	None	<b>M28876/11</b>	4567627* 4565142
	Straight	<b>M28876/12</b>	1145844
	45°	<b>M28876/13</b>	1147634
	90°	<b>M28876/14</b>	1147644

\* These items do not contain a strain relief, insert retention nut, or pressure sleeve. This is to expose accessory threads for addition of backshell.

Table II (See Page 16)			
Shell Size	Shell Size Designator	Number of Cavities	Insert Designator
11	<b>A</b>	02	<b>1</b>
13	<b>B</b>	04	<b>1</b>
15	<b>C</b>	06	<b>2</b>
		08	<b>1</b>
23	<b>F</b>	18	<b>2</b>
		31	<b>1</b>

Table III				
Backshell Designator	Maximum Allowable Cable Diameter by Shell Size			
	11	13	15	23
<b>1</b>	.250 [6.35]	.285 [7.24]	.500 [12.70]	.866 [22.00]
<b>2</b>	.346 [8.79]	.346 [8.79]	.250 [6.35]	1.000 [25.40]
<b>3</b>			.375 [9.53]	.600 [15.24]

Omit backshell designator if strain relief is not required.

Dimensions shown are for reference only. Unless otherwise specified, dimensions are in inches and [millimeters].

# Connectors

## Commercial Equivalent Ordering Nomenclature

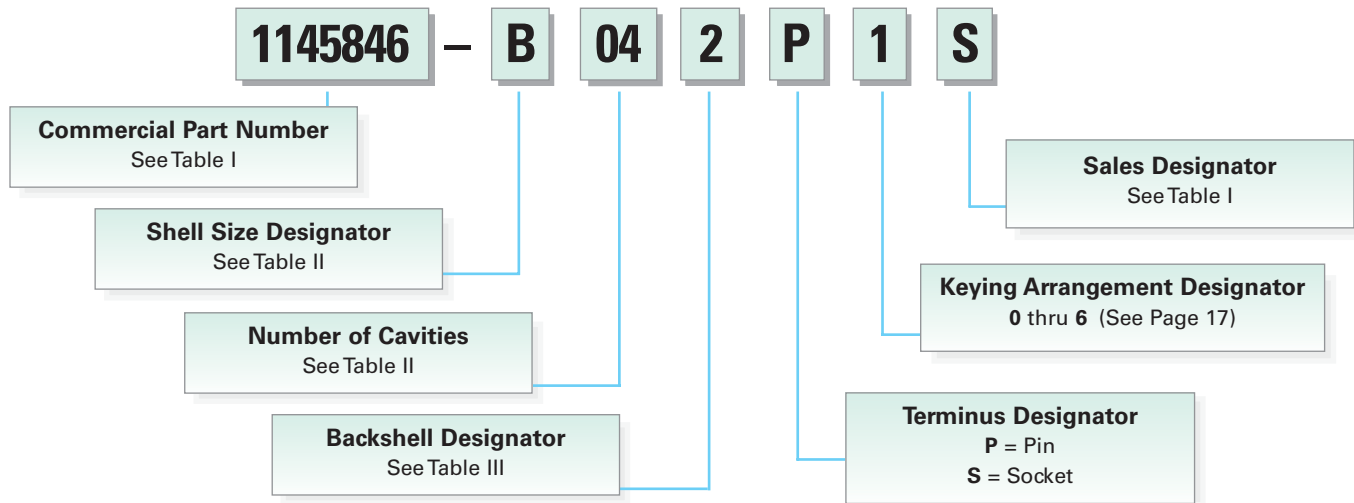


Table I					
Connector Type	Strain Relief	Commercial Part Number	Sales Designator	MIL-SPEC Equivalent Slash Number	
Receptacle, Wall Mount	None	4567626*	H	M28876/1	
		4565141	S		
	Straight	45°	1145840	S	M28876/2
		90°	1147630	S	M28876/3
Receptacle, In-Line	Straight	45°	1147640	S	M28876/4
		90°	1145841	S	M28876/5
Plug	None	4567628*	H	M28876/6	
		4565143	S		
	Straight	45°	1145846	S	M28876/7
		90°	1147636	S	M28876/8
Receptacle, Jam Nut	None	4567627*	H	M28876/11	
		4565142	S		
	Straight	45°	1145844	S	M28876/12
		90°	1147634	S	M28876/13
		90°	1147644	S	M28876/14

\* These items do not contain a strain relief, insert retention nut, or pressure sleeve. This is to expose accessory threads for addition of backshell.

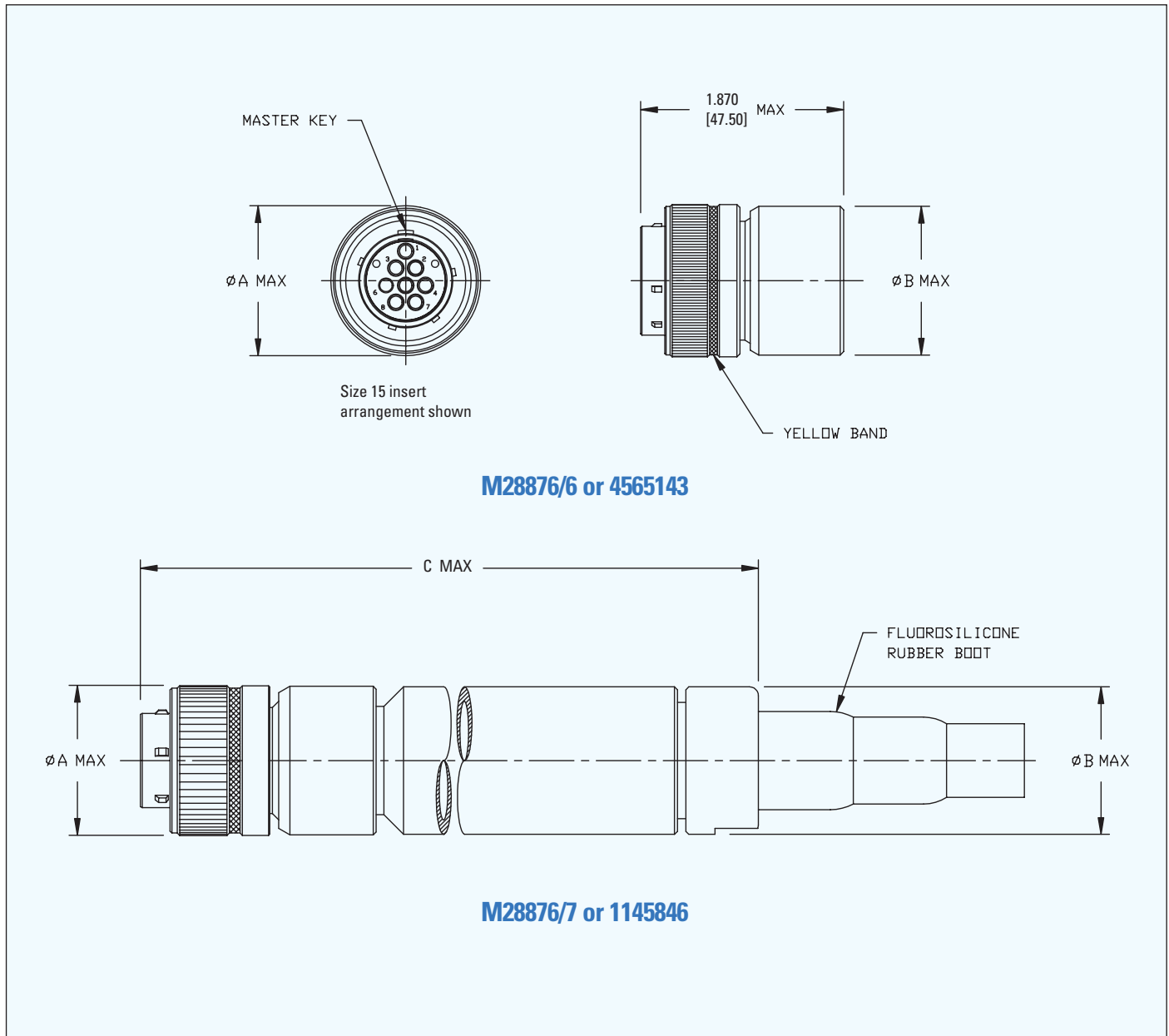
Table II (See Page 16)			
Shell Size	Shell Size Designator	Number of Cavities	Insert Designator
11	A	02	1
13	B	04	1
15	C	06	2
		08	1
23	F	18	2
		31	1

Table III				
Backshell Designator	Maximum Allowable Cable Diameter by Shell Size			
	11	13	15	23
1	.250 [6.35]	.285 [7.24]	.500 [12.70]	.866 [22.00]
2	.346 [8.79]	.346 [8.79]	.250 [6.35]	1.000 [25.40]
3			.375 [9.53]	.600 [15.24]

Omit backshell designator if strain relief is not required.

Dimensions shown are for reference only. Unless otherwise specified, dimensions are in inches and [millimeters].

# Plug Connectors



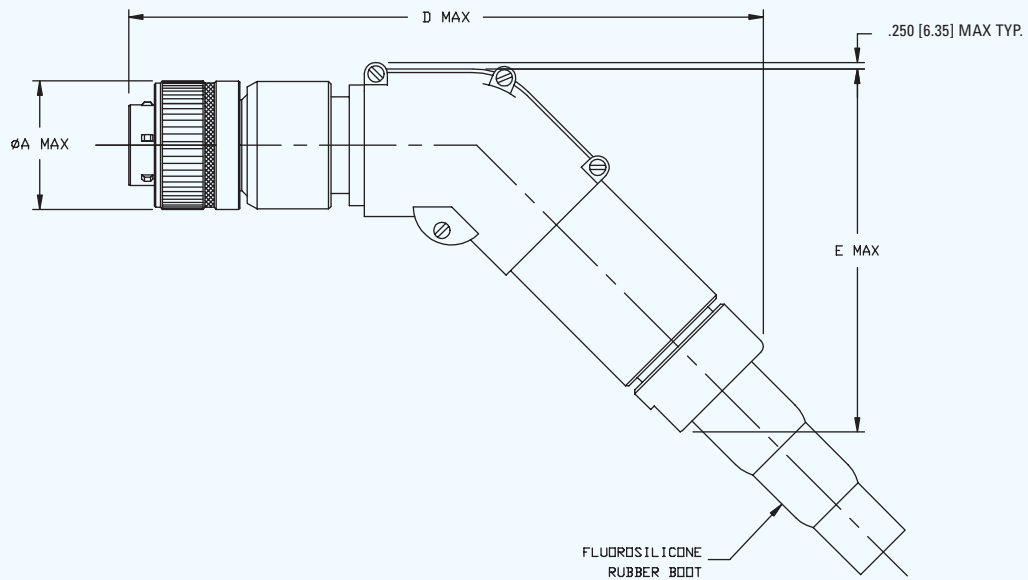
**Dimension Table, Plug Connectors**

Connector Size	ØA Max.	ØB Max.	C Max.	D Max.	E Max.	F Max.	G Max.
11	1.028 [26.11]	.960 [24.38]	5.960 [151.38]	6.090 [154.69]	3.540 [89.92]	4.190 [106.43]	4.250 [107.95]
13	1.141 [28.98]	1.085 [27.56]	5.960 [151.38]	6.160 [156.46]	3.580 [90.93]	4.190 [106.43]	4.250 [107.95]
15	1.263 [32.08]	1.257 [31.93]	5.960 [151.38]	6.440 [163.58]	3.850 [97.79]	4.440 [112.78]	4.500 [114.30]
23	1.705 [43.31]	1.703 [43.26]	5.960 [151.38]	7.350 [186.69]	5.000 [127.00]	4.850 [123.19]	5.000 [127.00]

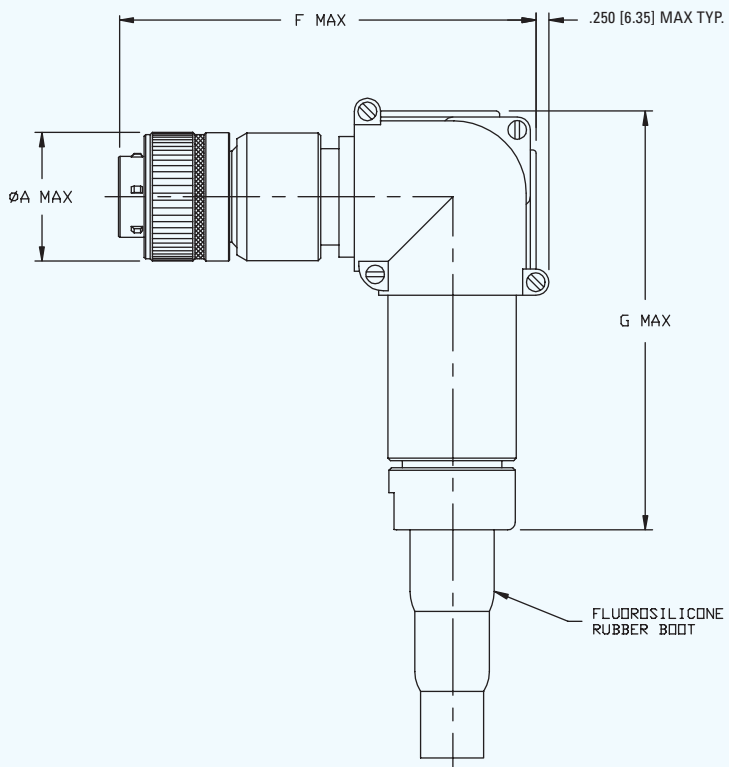
*Dimensions shown are for reference only. Unless otherwise specified, dimensions are in inches and [millimeters].*



# Plug Connectors



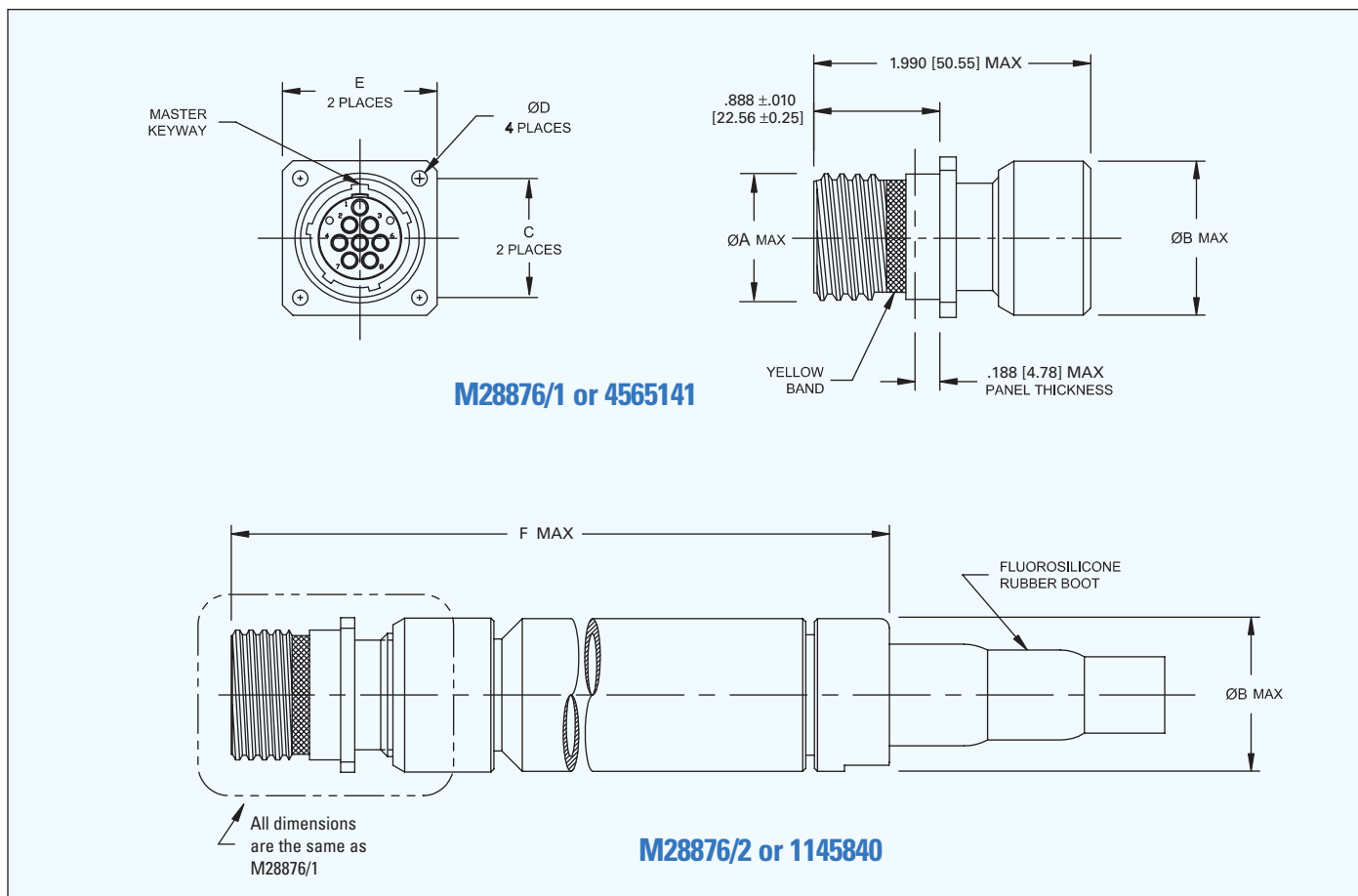
**M28876/8 or 1147636**



**M28876/9 or 1147646**

Dimensions shown are for reference only. Unless otherwise specified, dimensions are in inches and [millimeters].

# Wall Mount Receptacles

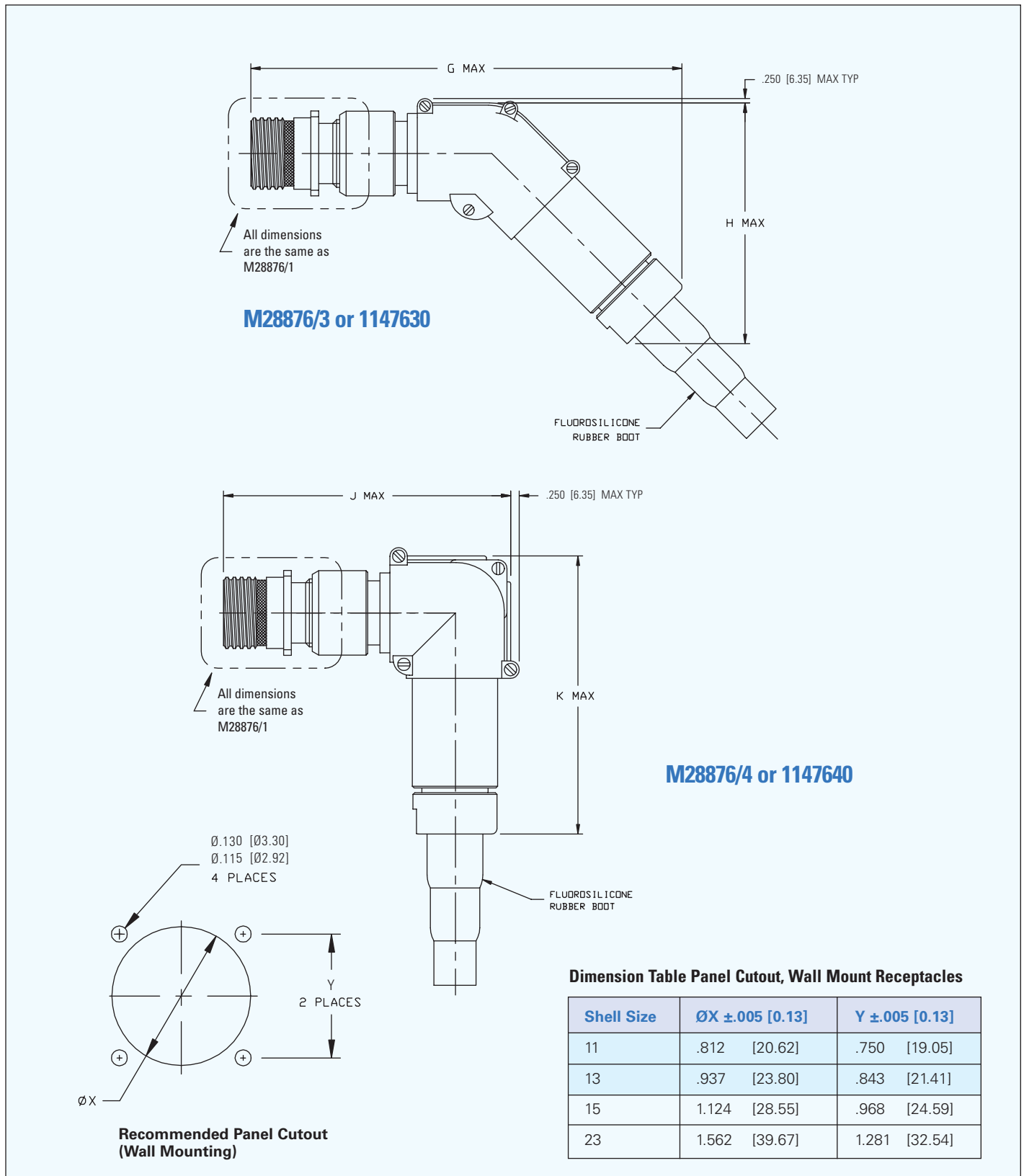


**Dimension Table, Wall Mount Receptacles**

Connector Size	ØA Max.	ØB Max.	C	ØD	E	F Max.	G Max.	H Max.	J Max.	K Max.
11	.750 [19.05]	.960 [24.38]	.750 [19.05]	.130 [3.30]	1.043 [26.49]	6.150 [156.21]	6.150 [156.21]	3.540 [89.92]	4.250 [107.95]	4.250 [107.95]
				.115 [2.92]	1.001 [25.43]					
13	.875 [22.23]	1.085 [27.56]	.843 [21.41]	.130 [3.30]	1.158 [29.41]	6.150 [156.21]	6.250 [158.75]	3.580 [90.93]	4.250 [107.95]	4.250 [107.95]
				.115 [2.92]	1.116 [28.35]					
15	1.062 [26.97]	1.257 [31.93]	.968 [24.59]	.130 [3.30]	1.278 [32.46]	6.150 [156.21]	6.500 [165.10]	3.850 [97.79]	4.500 [114.30]	4.500 [114.30]
				.115 [2.92]	1.236 [31.39]					
23	1.500 [38.10]	1.703 [43.26]	1.281 [32.54]	.130 [3.30]	1.738 [44.15]	6.150 [156.21]	7.500 [190.50]	5.000 [127.00]	5.000 [127.00]	5.000 [127.00]
				.115 [2.92]	1.698 [43.13]					

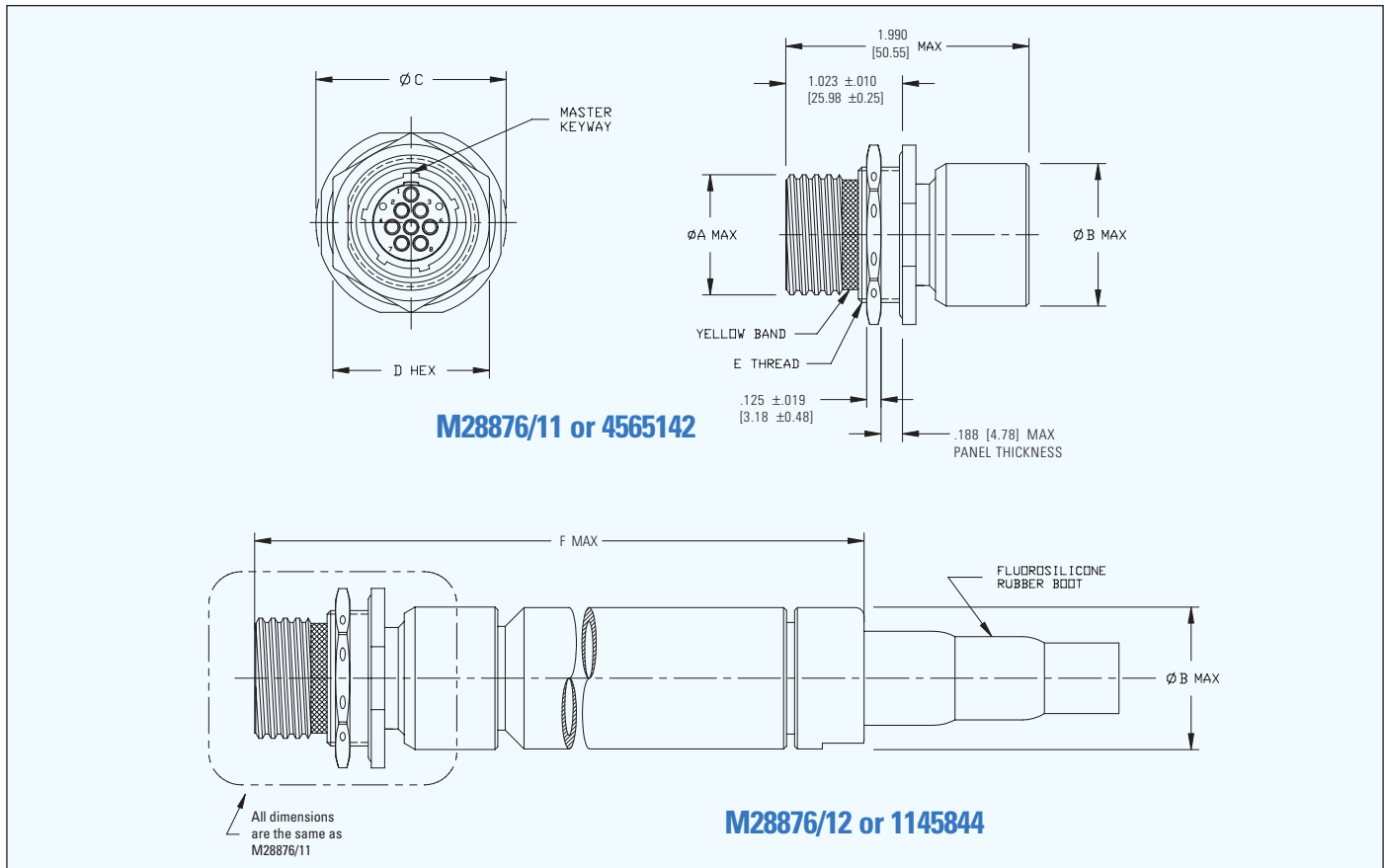
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# Wall Mount Receptacles



Dimensions shown are for reference only. Unless otherwise specified, dimensions are in inches and [millimeters].

# Jam Nut Receptacles

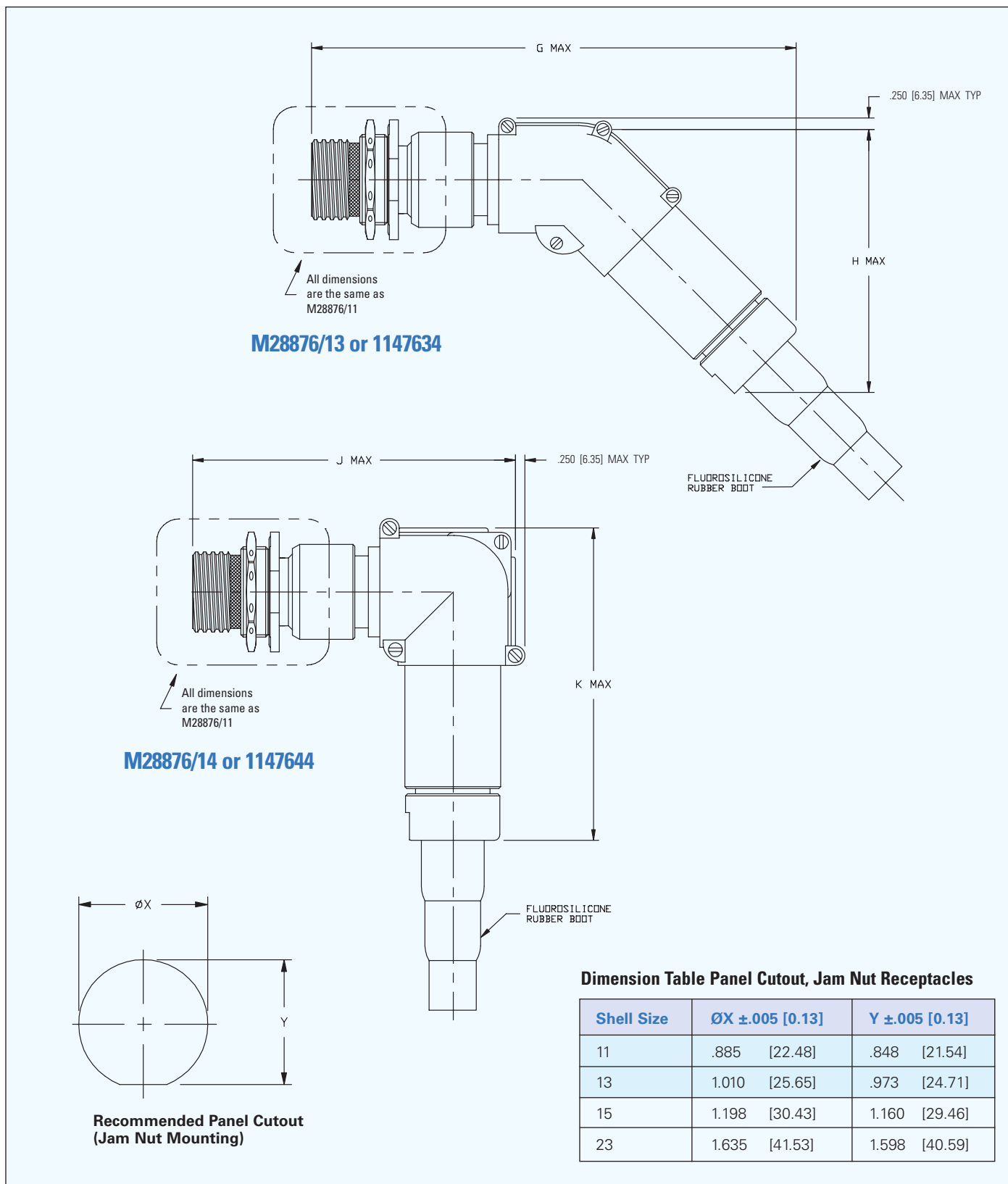


**Dimension Table, Jam Nut Mounting Receptacles**

Connector Size	ØA Max.	ØB Max.	ØC	D Hex	E Thread	F Max.	G Max.	H Max.	J Max.	K Max.
11	.750 [19.05]	.960 [24.38]	1.368 [34.75]	1.079 [27.41]	.875-20	6.150 [156.21]	6.150 [156.21]	3.540 [89.92]	4.250 [107.95]	4.250 [107.95]
			1.345 [34.16]	1.045 [26.54]	UNEF					
13	.875 [22.23]	1.085 [27.56]	1.508 [38.30]	1.205 [30.61]	1.000-20	6.150 [156.21]	6.250 [158.75]	3.580 [90.93]	4.250 [107.95]	4.250 [107.95]
			1.485 [37.72]	1.171 [29.74]	UNEF					
15	1.062 [26.97]	1.257 [31.93]	1.680 [42.67]	1.392 [35.36]	1.187-18	6.150 [156.21]	6.500 [165.10]	3.850 [97.79]	4.500 [114.30]	4.500 [114.30]
			1.600 [40.64]	1.358 [34.49]	UNEF					
23	1.500 [38.10]	1.703 [43.26]	2.118 [53.80]	1.829 [46.46]	1.625-18	6.150 [156.21]	7.500 [190.50]	5.000 [127.00]	5.000 [127.00]	5.000 [127.00]
			2.095 [53.21]	1.795 [45.59]	UNEF					

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# Jam Nut Receptacles



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# Dust Covers

## MIL-SPEC Ordering Nomenclature

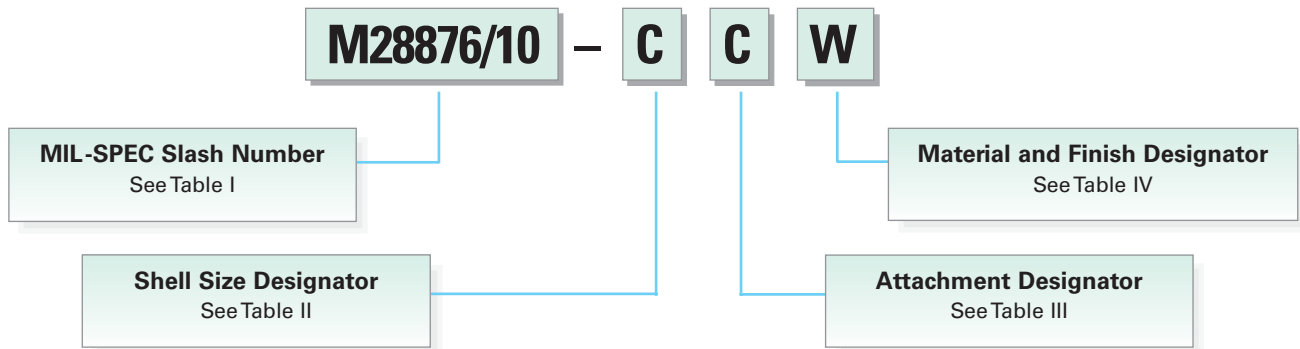
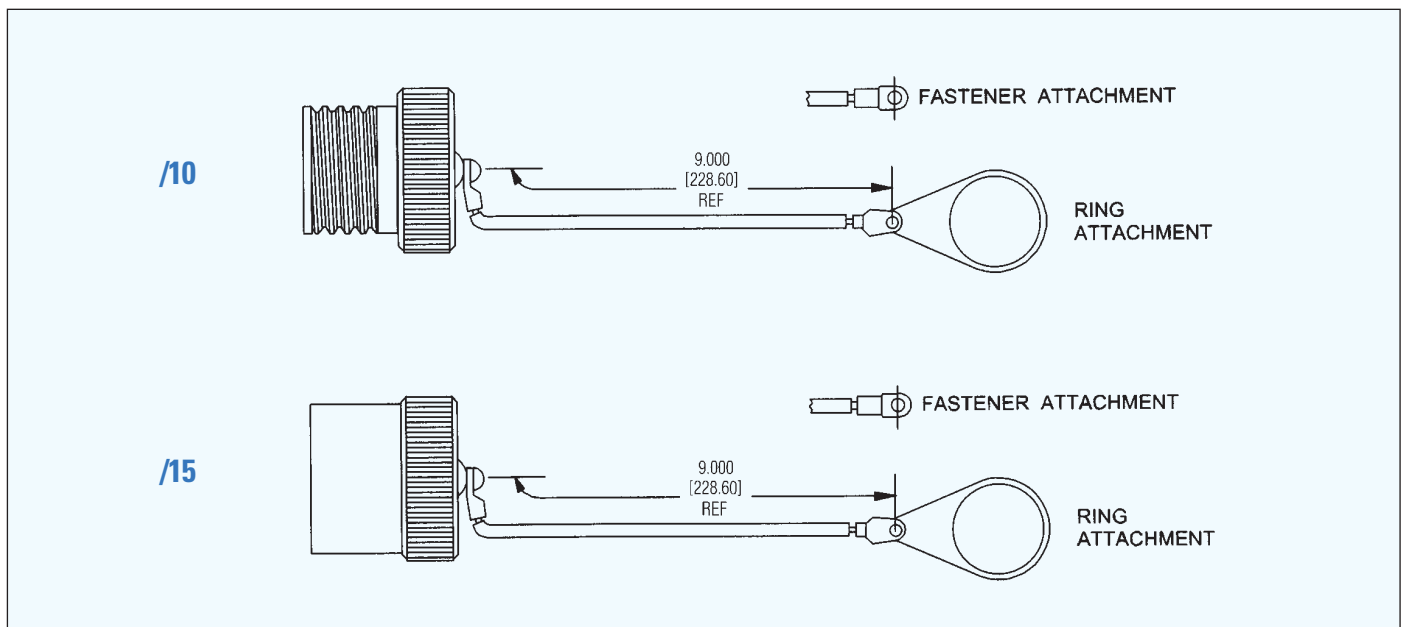


Table I		
Connector Type	MIL-SPEC Slash Number Part Number	Commercial Equivalent
Plug	<b>M28876/10</b>	4565071
Receptacle	<b>M28876/15</b>	4565070

Table II	
Shell Size Designator	Shell Size
<b>A</b>	11
<b>B</b>	13
<b>C</b>	15
<b>F</b>	23

Table III	
Attachment Designator	Attachment
<b>C</b>	Wire Rope with Fastener
<b>D</b>	Wire Rope with Ring
<b>E</b>	Without Wire Rope

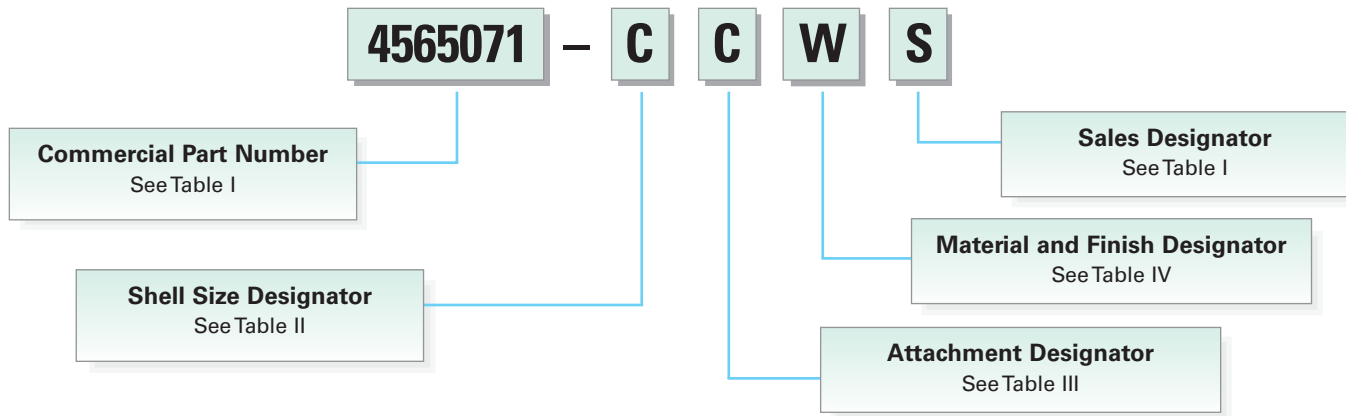
Table IV	
Material and Finish Designator	Material and Finish
<b>W</b>	Aluminum with finish per MIL-C-28876



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# Dust Covers

## Commercial Equivalent Ordering Nomenclature

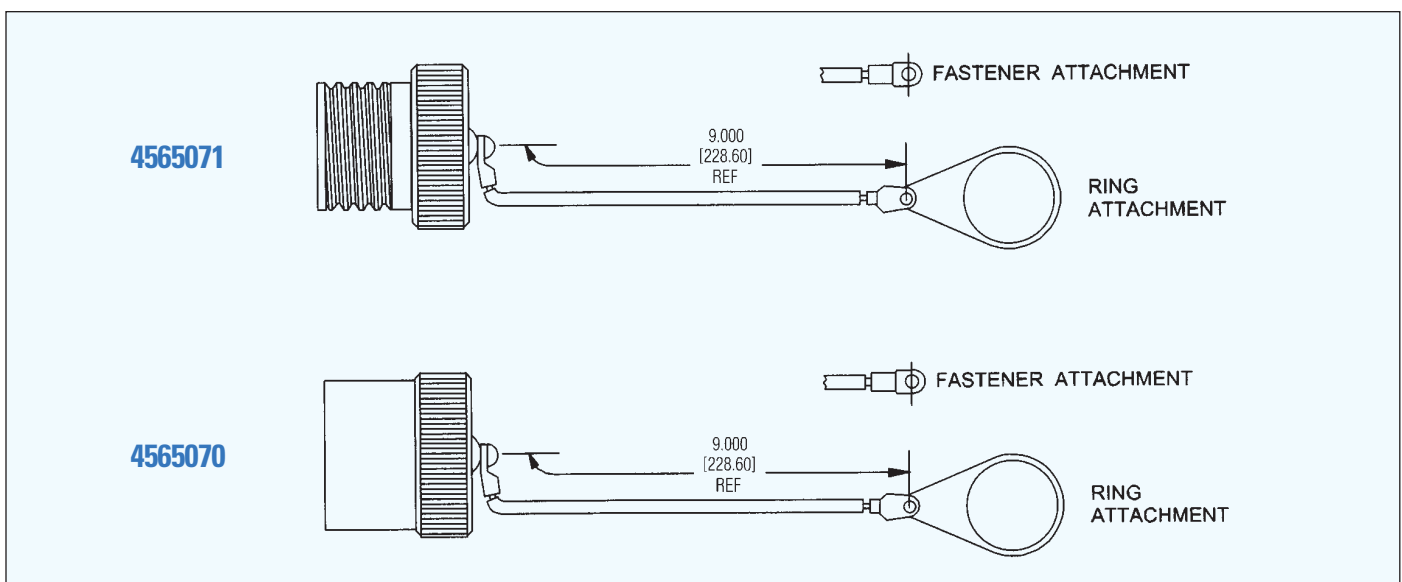


Connector Type	Commercial Part Number	Sales Designator	MIL-SPEC Equivalent Slash Number
Plug	4565071	S	M28876/10
Receptacle	4565070	S	M28876/15

Shell Size Designator	Shell Size
A	11
B	13
C	15
F	23

Attachment Designator	Attachment
C	Wire Rope with Fastener
D	Wire Rope with Ring
E	Without Wire Rope

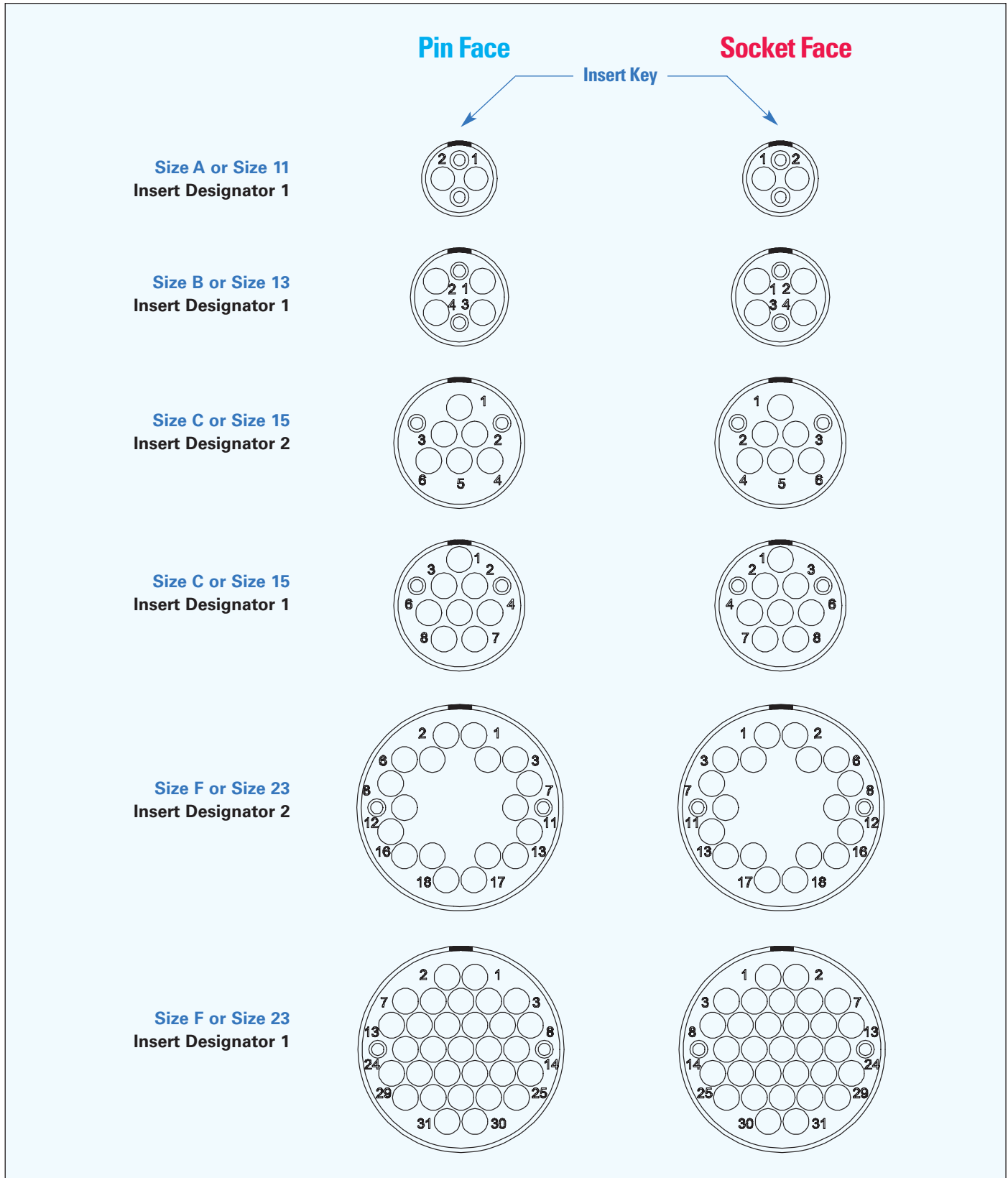
Material and Finish Designator	Material	Finish
W	Aluminum	Per MIL-C-28876



Dimensions shown are for reference only. Unless otherwise specified, dimensions are in inches and [millimeters].

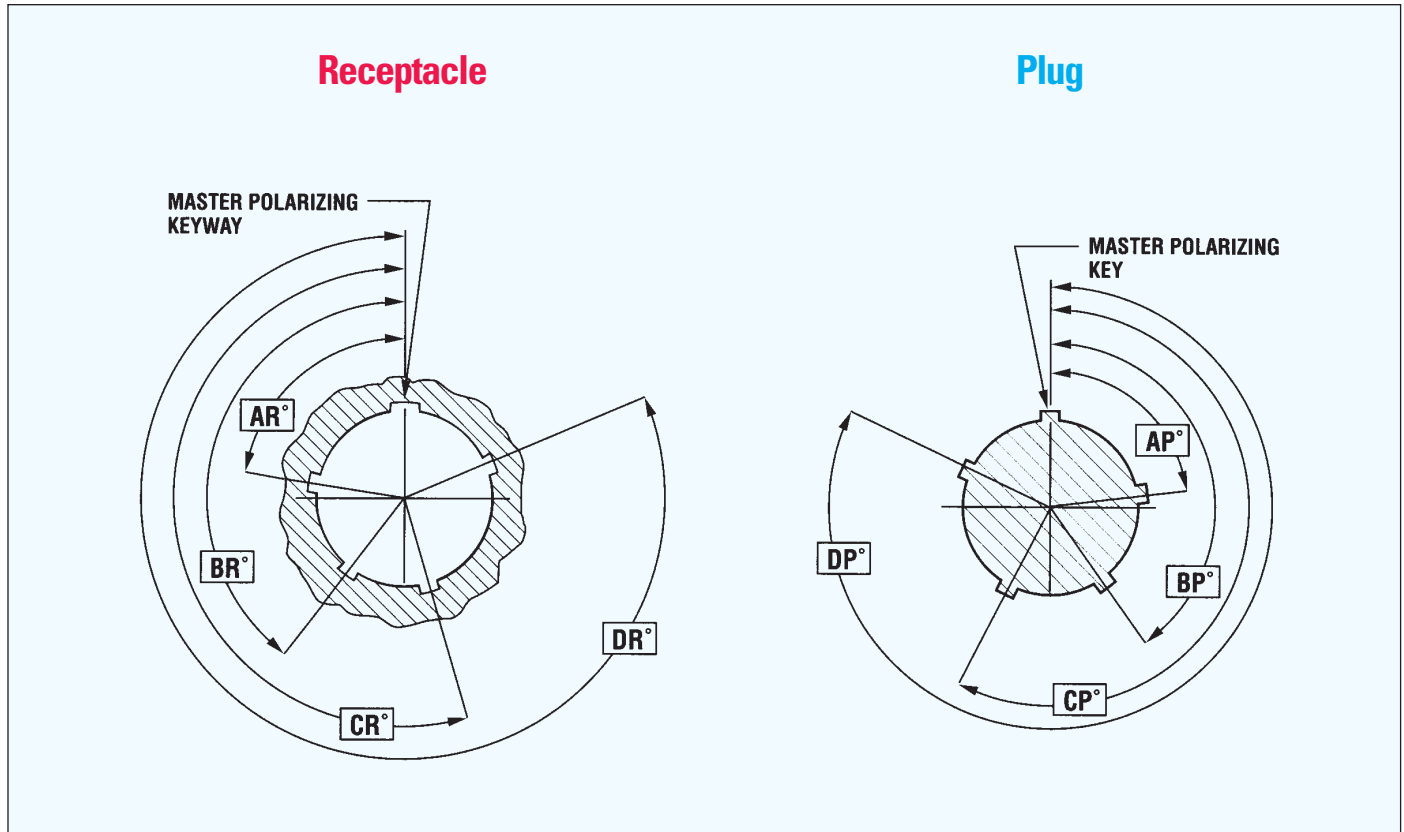
# Insert Arrangements

## Shell Sizes





# Keying Arrangements



Shell Size	Keying Arrangement Designators	AR° or AP°	BR° or BP°	CR° or CP°	DR° or DP°
11 and 13	0*	–	–	–	–
	1	95	141	208	236
	2	113	156	182	292
	3	90	145	195	252
	4	53	156	220	255
	5	119	146	176	298
	6	51	141	184	242
15 and 23	0*	–	–	–	–
	1	80	142	196	293
	2	135	170	200	310
	3	49	169	200	244
	4	66	140	200	257
	5	62	145	180	280
	6	79	153	197	272

\* 0 indicates universal keying arrangement and is available on commercial equivalent connector only.

# Fiber Optic Product Families

Product Catalogs Available

Connector Families	Benefits/ Features	Applications/ Markets	Materials & Latching Mechanism
<p><b>Termini</b></p> 	<ul style="list-style-type: none"> <li>■ 16 gauge termini</li> <li>■ Fiber sizes: Singlemode – 6/125, 9/125 Multimode – 50/125, 62.5/125, 100/140</li> <li>■ Free floating, self-aligning design</li> <li>■ Individual seal and retaining clip</li> <li>■ Qualified to MIL-T-29504 specification (commercial equivalent available)</li> </ul>	<ul style="list-style-type: none"> <li>■ Military/Aerospace</li> <li>■ Shipboard/Pierside</li> <li>■ Harsh environment</li> <li>■ Broadcast</li> <li>■ Telecom/Datacom</li> <li>■ Hybrid electronics</li> </ul>	<ul style="list-style-type: none"> <li>■ Stainless steel with ceramic alignment system</li> <li>■ Rear-insertion/ front-release</li> </ul>
<p><b>M28876</b></p> 	<ul style="list-style-type: none"> <li>■ Channels: 2, 4, 6, 8, 18 and 31</li> <li>■ Shell sizes: 11, 13, 15 and 23</li> <li>■ Utilizes field proven Delphi termini</li> <li>■ Singlemode and multimode capability</li> <li>■ In-line and wall mount receptacles</li> <li>■ Full environmental sealing</li> <li>■ Field maintainable</li> <li>■ Point-to-point interconnect system</li> <li>■ Qualified to MIL-C-28876 specification (commercial equivalent available)</li> <li>■ Hybrid configurations for electro-optical signal transmission</li> </ul>	<ul style="list-style-type: none"> <li>■ Navy shipboard</li> <li>■ Military and commercial</li> </ul>	<ul style="list-style-type: none"> <li>■ Per MIL-C-28876 specification</li> <li>■ Threaded coupling</li> </ul>
<p><b>Hermaphroditic</b></p> 	<ul style="list-style-type: none"> <li>■ Channels: 4, 6 and 12</li> <li>■ Utilizes field proven Delphi termini</li> <li>■ Singlemode and multimode capability</li> <li>■ Full environmental sealing</li> <li>■ Field maintainable</li> <li>■ Plug-to-plug in-line cable linking system</li> <li>■ Compliant with SMPTE Standard 358M-2001 (4 channel)</li> </ul>	<ul style="list-style-type: none"> <li>■ Broadcast</li> <li>■ Military pierside and tactical field usage</li> <li>■ Petroleum field exploration</li> <li>■ Field deployed equipment</li> </ul>	<ul style="list-style-type: none"> <li>■ Aluminum</li> <li>■ Composite</li> <li>■ Threaded coupling</li> </ul>
<p><b>Edgecard</b></p> 	<ul style="list-style-type: none"> <li>■ Channels: multiple configurations</li> <li>■ Utilizes field proven Delphi termini</li> <li>■ Singlemode and multimode capability</li> <li>■ Field maintainable</li> <li>■ VME circuit board PO position connector available</li> <li>■ Hybrid configurations for electro-optical signal transmission</li> </ul>	<ul style="list-style-type: none"> <li>■ Printed circuit board</li> <li>■ Edgeboard (backplane) mount</li> <li>■ Avionics</li> <li>■ Satellites</li> <li>■ Shipboard</li> <li>■ Tight packaging areas</li> </ul>	<ul style="list-style-type: none"> <li>■ Aluminum</li> <li>■ Stainless steel</li> <li>■ Blind-mating</li> <li>■ Jackscrew</li> </ul>
<p><b>Snap Lock</b></p> 	<ul style="list-style-type: none"> <li>■ Single channel</li> <li>■ Utilizes field proven Delphi termini</li> <li>■ Singlemode and multimode capability</li> <li>■ In-line plug</li> <li>■ In-line and panel mount receptacles</li> <li>■ Easy connect/disconnect</li> <li>■ Compact</li> </ul>	<ul style="list-style-type: none"> <li>■ Anywhere single channel connectors are typically used</li> </ul>	<ul style="list-style-type: none"> <li>■ Aluminum</li> <li>■ Push/pull collet coupling</li> </ul>

# Factory Support

## DELPHI

With a company history that includes Hughes Connecting Devices Division and more recently Packard-Hughes Interconnect, Delphi Connection Systems offers more than 40 years of technology and expertise in the military and commercial connector markets.

Delphi Connection Systems provides complete interconnect assembly solutions tested in accordance with applicable performance criteria. For additional product information or application support, please contact your local Delphi Connection Systems' sales representative or contact us directly at **[1] 949.660.5701** or visit our website at **[www.delphi.com/connect](http://www.delphi.com/connect)**.

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# Distribution Support



- Connectors
- Termini
- Tools
- Training

### **KITCO Fiber Optics**

5269 Cleveland Street  
Virginia Beach, Virginia 23462  
U.S.A.  
Tel: [1] 757.518.8100  
Fax: [1] 757.518.9700

**[www.kitcofo.com](http://www.kitcofo.com)**



- Connectors
- Termini
- Tools

### **Koehlke Components, Inc.**

1201 Commerce Center Blvd.  
Franklin, Ohio 45005  
U.S.A.  
Tel: [1] 937.435.5435  
Fax: [1] 937.435.1894

**[www.koehlke.com](http://www.koehlke.com)**

**Military Products**

17150 Von Karman Avenue  
Irvine, California 92614  
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