Insert Availability, Identification & Alternate Rotations

INSERT ARRANGEMENTS

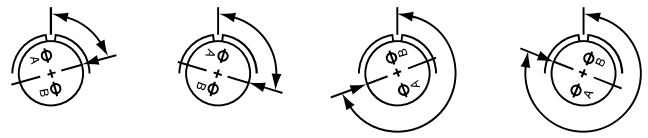
Insert Arrangement	Service Rating	Total Contacts	Contact Size		
			12	16	20
8-33	I	3			3
8-98	I	3			3
10-6	I	6			6
12-3	II	3		3	
12-8	I	8			8
12-10	I	10			10
14-4	I	4	4		
14-5	II	5		5	
14-9	I	9	4		5
14-12	I	12		4	8
14-15	I	15		1	14
14-18	I	18			18
14-19	I	19			19
16-8	II	8		8	
16-23S	I	23		1	22
16-26	I	26			26
18-8	I	8	8		
18-11	II	11		11	
18-30	I	30		1	29
18-32	I	32			32
20-16	II	16		16	
20-24S	I	24			24
20-39	I	39		2	37
20-41	I	41			41
22-12	I	12	12		
22-19S	I	19	19		
22-21	II	21		21	
22-32S	I	32			32
22-41	I	41		14	27
22-55	I	55			55
22-95	I	32	6		26
24-19S	II	19	19		
24-31	I	31		31	
24-61	I	61			61

Arrangements designated with an S are tooled in socket only.

ALTERNATE ROTATIONS OF INSERT

To avoid cross-plugging problems in applications requiring the use of more than one connector of the same size and arrangement, alternate rotations are available as indicated in the chart below.

As shown in the diagram, the front face of the pin insert is rotated within the shell in a clockwise direction from the normal shell key. The socket insert would be rotated counter-clockwise the same number of degrees in respect to the normal shell key.



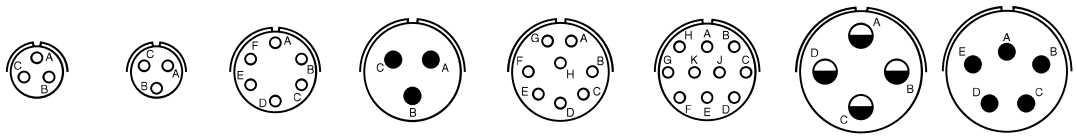
Position W Position X Position Y Position Z

View looking into front face of pin insert or rear of socket insert.

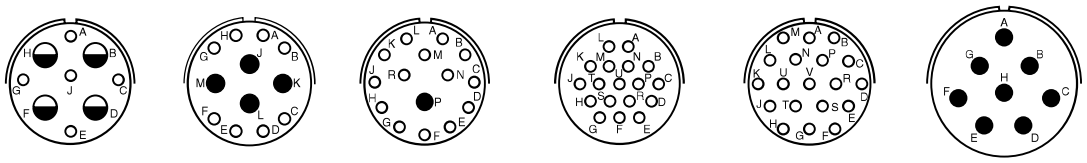
Insert Arrangement	Degrees			
	W	X	Y	Z
8-33	90	–	–	–
8-98	–	–	–	–
10-6	90	–	–	–
12-3	–	–	180	–
12-8	90	112	203	292
12-10	60	155	270	295
14-4	45	–	–	–
14-5	40	92	184	273
14-9	15	90	180	270
14-12	43	90	–	–
14-15	17	110	155	234
14-18	15	90	180	270
14-19	30	165	315	–
16-8	54	152	180	331
16-23	158	270	–	–
16-26	60	–	275	338
18-8	180	–	–	–
18-11	62	119	241	340
18-30	180	193	285	350
18-32	85	138	222	265
20-16	238	318	333	347
20-24	70	145	215	290
20-39	63	144	252	333
20-41	45	126	225	–
22-12	–	–	–	–
22-19	15	90	225	308
22-21	16	135	175	349
22-32	72	145	215	288
22-41	39	135	264	–
22-55	30	142	226	314
22-95	26	180	266	–
24-19	30	165	315	–
24-31	90	225	255	–
24-61	90	180	270	324

Insert Arrangements

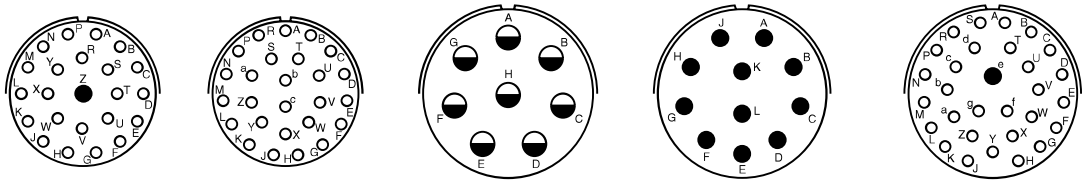
Front face of pin insert or rear face of socket insert illustrated



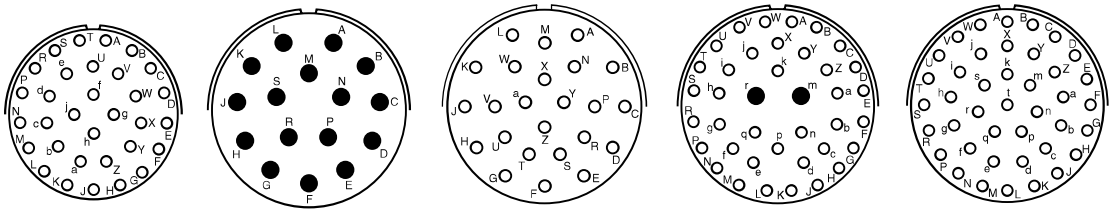
Insert Arrangement	8-33	8-98	10-06	12-03	12-08	12-10	14-04	14-05
Service Rating	I	I	I	II	I	I	I	II
Number of Contacts	3	3	6	3	8	10	4	5
Contact Size	20	20	20	16	20	20	12	16



Insert Arrangement	14-09		14-12		14-15		14-18	14-19	16-08
Service Rating	I		I		I		I	I	II
Number of Contacts	5	4	8	4	14	1	18	19	8
Contact Size	20	12	20	16	20	16	20	20	16



Insert Arrangement	16-23		16-26	18-08	18-11	18-30	
Service Rating	I		I	I	II	I	
Number of Contacts	22	1	26	8	11	29	1
Contact Size	20	16	20	12	16	20	16



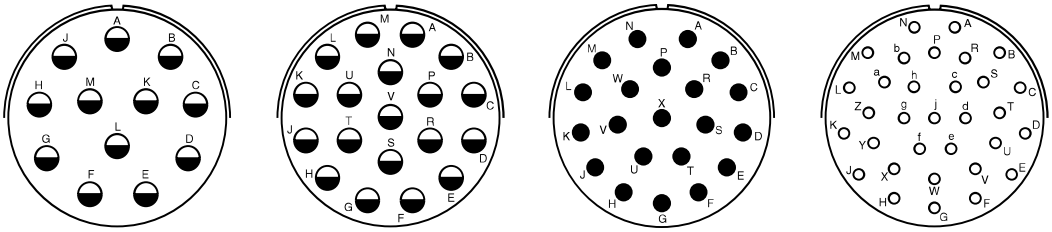
Insert Arrangement	18-32	20-16	20-24	20-39		20-41
Service Rating	I	II	I	I		I
Number of Contacts	32	16	24	37	2	41
Contact Size	20	16	20	20	16	20

NOTE: Connectors sold as mil-spec connectors will have mil-spec markings on the insert (a "snail-trail" designating the numerical path). Commercial versions will have insert markings as shown here.

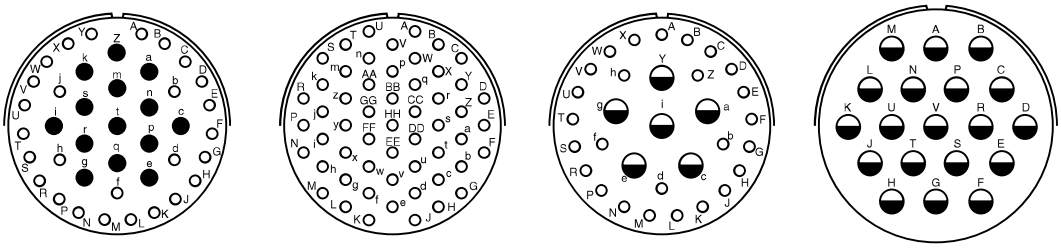
CONTACT LEGEND ○ 20 ● 16 ◒ 12

Insert Arrangements

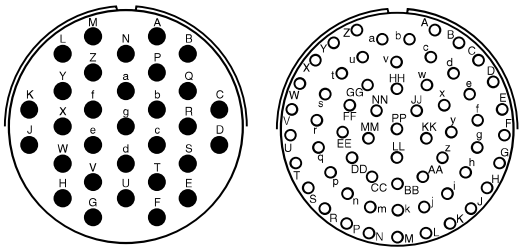
Front face of pin insert or rear face of socket insert illustrated



Insert Arrangement	22-12	22-19	22-21	22-32
Service Rating	I	I	II	I
Number of Contacts	12	19	21	32
Contact Size	12	12	16	20



Insert Arrangement	22-41		22-55	22-95		24-19
Service Rating	I		I	I		II
Number of Contacts	27	14	55	26	6	19
Contact Size	20	16	20	20	12	12



Insert Arrangement	24-31	24-61
Service Rating	I	I
Number of Contacts	31	61
Contact Size	16	20

NOTE: Connectors sold as mil-spec connectors will have mil-spec markings on the insert (a "snail-trail" designating the numerical path). Commercial versions will have insert markings as shown here.

CONTACT LEGEND ○ 20 ● 16 ◒ 12

Class Descriptions, Performance Specifications

CLASS DESCRIPTIONS

Military MIL-DTL-26482, Series 2	Amphenol/Matrix Commercial MB1 Series	Description
Class L	Class R	Aluminum shell, electroless nickel finish, fluid resistant
Class E	–	Inactive, superceded by Class L*
Class R	–	Inactive, superceded by Class L*
Class A	Class A	Aluminum shell, black non-conductive anodized finish, fluid resistant
–	Class G	Stainless steel shell, passivated, fluid resistant
Class W	Class W	Aluminum shell, olive drab cadmium plated, corrosion/fluid resistant

* Ref. MIL-DTL-26482

PERFORMANCE SPECIFICATIONS

SERVICE RATINGS**

Service Rating	Recommended Operating AC Voltage at Sea Level	Test Voltage AC (RMS), 60 cps			
		Sea Level	50,000 ft.	70,000 ft.	110,000 ft.
I	600	1,500	500	375	200
II	1,000	2,300	750	500	200

** Service Rating is comparable to MS rating A. Miniature connectors rated Service Rating I will provide a minimum flashover voltage at sea level of 2,000 volts AC (RMS). Service Rating II is comparable to MS Service Rating D, and will provide a minimum flashover voltage of 2,800 volts AC (RMS) at sea level.

Please note that the electrical data given is not an establishment of electrical safety factors. This is left entirely in the designer's hands, as he can best determine which peak voltage, switching surges, transients, etc. can be expected in a particular circuit.

OPERATING TEMPERATURE RANGE

–65°C (–85°F) to 200°C (392°F)

ENVIRONMENTAL SEAL

Wired, mated connectors with the specified accessory attached will meet the altitude immersion test specified in MIL-DTL-26482.

DURABILITY

Minimum of 500 mating cycles.

SHOCK AND VIBRATION REQUIREMENTS

When tested as follows, the connector shall sustain no physical damage, or electrical discontinuity exceeding one microsecond.

SHOCK:

Pulse of an approximate half sine wave of 300g magnitude with duration of 3 milliseconds applied in three axes.

VIBRATION:

Sixteen hours of random vibration having a range of 50 to 2,000 Hz with a 41.7G peak level.

How to Order

	1.	2.	3.	4.	5.	6.	7.
MIL-DTL-26482, Series 2	Connector Type	Connector Style	Service Class	Shell Size/Insert Arrangement	Contact Type	Alternate Rotation of Insert	Modification Number
MILITARY	MS	3470	W	12-10	P	W	NA

1. MILITARY CONNECTOR TYPE

MS	Designates Military Standard

2. CONNECTOR STYLE

3470	Wall mount receptacle with narrow flange
3472	Wall mount receptacle with wide flange
3471	Cable connecting receptacle
3474	Jam nut receptacle
3476	Straight plug
3475	Straight plug with RFI grounding fingers

3. SERVICE CLASS

L	Aluminum shell, electroless nickel finish, fluid resistant insert
A	Aluminum shell, black anodized finish, non-conductive fluid resistant insert
W	Aluminum shell, olive drab cadmium plated, fluid resistant insert

Note: For stainless steel shell, passivated, order by Amphenol®/Matrix® commercial Class G. Class L inactivates classes E and R (Ref. MIL-DTL-26482)

4. SHELL SIZE & INSERT ARRANGEMENT FROM CHART ON PAGE J3.

First number represents Shell Size, second number is the Insert Arrangement.

5. CONTACT TYPE

P	Pin contacts
S	Socket contacts
A	Less pins
B	Less sockets

Use A & B only when other than a full complement of power contacts is to be installed.

6. ALTERNATE ROTATION OF INSERT

"W", "X", "Y", "Z" designate that insert is rotated in its shell from normal position. No letter required for normal (no rotation) position. See page J3 for description of alternate positions. For ordering information on accessories, such as protection caps and backshell hardware, contact Amphenol Aerospace.

2. CONNECTOR STYLE

0	Wall mount receptacle with narrow flange
1	Wall mount receptacle with wide flange
3	Cable connecting receptacle
4	Jam nut receptacle
6	Straight plug
8	Straight plug with RFI grounding fingers

3. SERVICE CLASS

A	Aluminum shell, black anodized finish, non-conductive, fluid resistant insert
B	Black zinc conductive plating. Must also add modification number (A15) in step 7
C	Green zinc cobalt plating. Must also add modification number (981) in step 7
R	Aluminum shell, electroless nickel finish, fluid resistant insert
G	Stainless steel shell, passivated, fluid resistant insert
W	Aluminum shell, cadmium plated, olive drab finish, fluid resistant insert
DZ	Black zinc nickel
DT	Durmalon

4. SHELL SIZE & INSERT ARRANGEMENT FROM CHART ON PAGE J3.

First number represents Shell Size, second number is the Insert Arrangement.

5. CONTACT TYPE

P	Pin contacts
S	Socket contacts

6. ALTERNATE ROTATION OF INSERT

"W", "X", "Y", "Z" designate that insert is rotated in its shell from normal position. No letter required for normal (no rotation) position. See page J3 for description of alternate positions.

7. MODIFICATION NUMBER

(189)	E-nut M85049/31 configuration
(190)	Straight strain relief M85049/52 configuration
(191)	90° strain relief M85049/51 configuration
(A15)	Used with finish class B to designate conductive black zinc plating.
(981)	Used with finish class C to designate green zinc cobalt plating.

Wall Mounting Receptacle (with Narrow Flange)

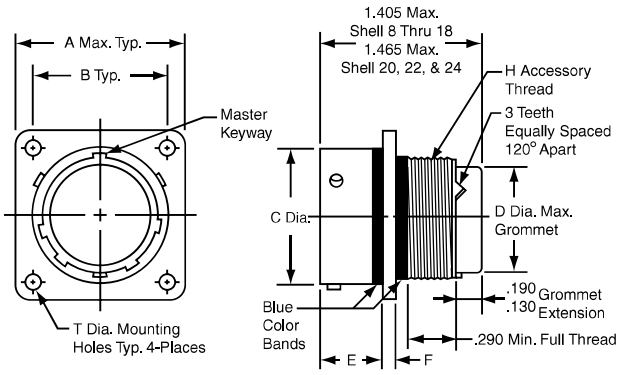
Military (MS3470), Commercial (MB10)

PART NUMBER BUILDER Page J7

MILITARY
MS3470

Commercial

MB10



Shell Size	A Max.	B ±.005	C Dia. ±.003	D Dia. Max.	E	F ±.016	H Accessory Thread Class 2A	T Dia. ±.005
8	.828	.594	.471	.305	.462/.431	.062	.5000-20 UNF	.120
10	.954	.719	.588	.405	.462/.431	.062	.6250-24 UNEF	.120
12	1.047	.812	.748	.531	.462/.431	.062	.7500-20 UNEF	.120
14	1.141	.906	.873	.665	.462/.431	.062	.8750-20 UNEF	.120
16	1.234	.969	.998	.790	.462/.431	.062	1.0000-20 UNEF	.120
18	1.328	1.062	1.123	.869	.462/.431	.062	1.0625-18 UNEF	.120
20	1.453	1.156	1.248	.994	.587/.556	.094	1.1875-18 UNEF	.120
22	1.578	1.250	1.373	1.119	.587/.556	.094	1.3125-18 UNEF	.120
24	1.703	1.375	1.498	1.244	.620/.589	.094	1.4375-18 UNEF	.147

All dimensions for reference only.

26482

Wall Mounting Receptacle (with Wide Flange)

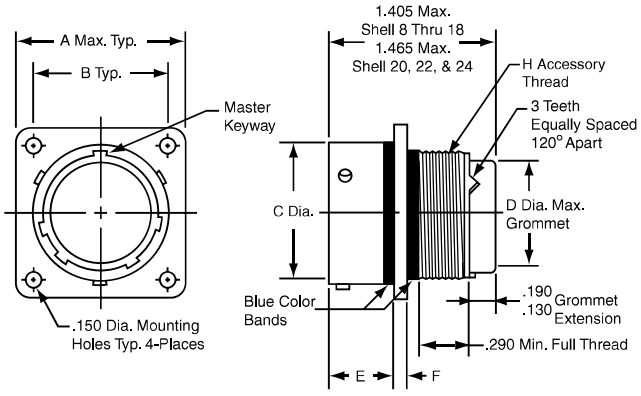
Military (MS3472), Commercial (MB11)

PART NUMBER BUILDER Page J7

MILITARY
MS3472

Commercial

MB11



Shell Size	A Max.	B ±.005	C Dia. ±.003	D Dia. Max.	E	F ±.016	H Accessory Thread Class 2A
8	1.065	.734	.471	.305	.493/.462	.062	.5000-20 UNF
10	1.141	.812	.588	.405	.493/.462	.062	.6250-24 UNEF
12	1.266	.938	.748	.531	.493/.462	.062	.7500-20 UNEF
14	1.360	1.031	.873	.665	.493/.462	.062	.8750-20 UNEF
16	1.453	1.125	.998	.790	.493/.462	.062	1.0000-20 UNEF
18	1.532	1.203	1.123	.869	.493/.462	.062	1.0625-18 UNEF
20	1.688	1.297	1.248	.994	.587/.556	.094	1.1875-18 UNEF
22	1.766	1.375	1.373	1.119	.587/.556	.094	1.3125-18 UNEF
24	1.891	1.500	1.498	1.244	.620/.589	.094	1.4375-18 UNEF

All dimensions for reference only.

Cable Connecting Receptacle

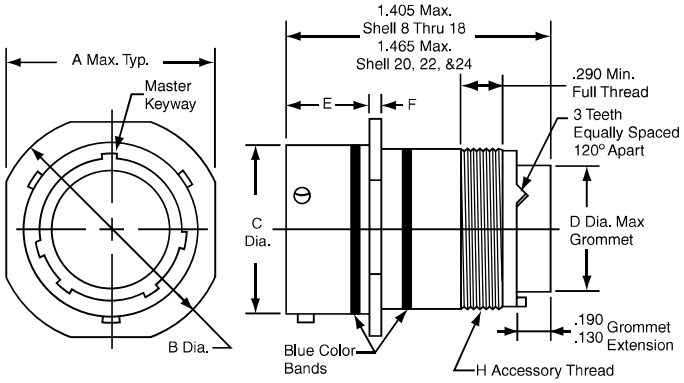
Military (MS3471), Commercial (MB13)

PART NUMBER BUILDER Page J7

MILITARY
MS3471

Commercial

MB13



Shell Size	A Max.	B Dia. ±.020	C Dia. ±.003	D Dia. Max.	E	F ±.016	H Accessory Thread Class 2A
8	.828	.938	.471	.305	.462/.431	.062	.5000-20 UNF
10	.954	1.062	.588	.405	.462/.431	.062	.6250-24 UNEF
12	1.047	1.156	.748	.531	.462/.431	.062	.7500-20 UNEF
14	1.141	1.250	.873	.665	.462/.431	.062	.8750-20 UNEF
16	1.234	1.344	.998	.790	.462/.431	.062	1.0000-20 UNEF
18	1.328	1.438	1.123	.869	.462/.431	.062	1.0625-18 UNEF
20	1.453	1.562	1.248	.994	.587/.556	.094	1.1875-18 UNEF
22	1.578	1.688	1.373	1.119	.587/.556	.094	1.3125-18 UNEF
24	1.703	1.812	1.498	1.244	.620/.589	.094	1.4375-18 UNEF

All dimensions for reference only.

Jam Nut Receptacle

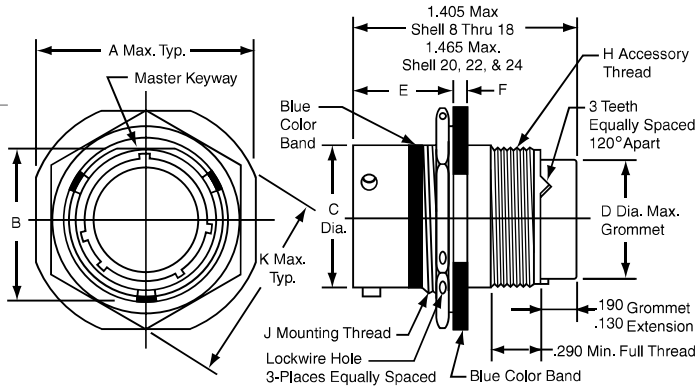
Military (MS3474), Commercial (MB14)

PART NUMBER BUILDER Page J7

MILITARY
MS3474

Commercial

MB14



Shell Size	A Max.	B ±.005	C Dia. ±.003	D Dia. Max.	E	F	H Accessory Thread Class 2A	J Mounting Thread Class 2A	K Max.
8	.954	.525	.471	.305	.707/.658	.113/.086	.5000-20 UNF	.5625-24 UNEF	.767
10	1.078	.650	.588	.405	.707/.658	.113/.086	.6250-24 UNF	.6875-24 UNEF	.892
12	1.266	.813	.748	.531	.707/.658	.113/.086	.7500-20 UNEF	.8750-20 UNEF	1.079
14	1.391	.937	.873	.665	.707/.658	.113/.086	.8750-20 UNEF	1.0000-20 UNEF	1.205
16	1.516	1.061	.998	.790	.707/.658	.113/.086	1.0000-20 UNEF	1.1250-18 UNEF	1.329
18	1.641	1.186	1.123	.869	.707/.658	.113/.086	1.0625-18 UNEF	1.2500-18 UNEF	1.455
20	1.828	1.311	1.248	.994	.772/.721	.148/.096	1.1875-18 UNEF	1.3750-18 UNEF	1.579
22	1.954	1.436	1.373	1.119	.772/.721	.148/.096	1.3125-18 UNEF	1.5000-18 UNEF	1.705
24	2.078	1.561	1.498	1.244	.772/.721	.148/.096	1.4375-18 UNEF	1.6250-18 UNEF	1.829

All dimensions for reference only.

Straight Plug

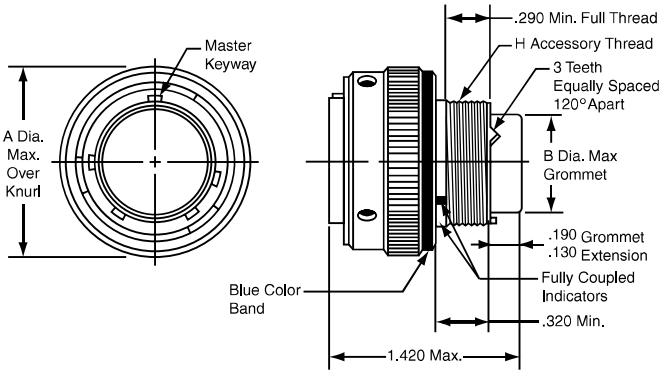
Military (MS3476), Commercial (MB16)

PART NUMBER BUILDER Page J7

MILITARY
MS3476

Commercial

MB16



Shell Size	A Dia. Max.	B Dia. Max.	H Accessory Thread Class 2A
8	.782	.305	.5000-20 UNF
10	.926	.405	.6250-24 UNEF
12	1.043	.531	.7500-20 UNEF
14	1.183	.665	.8750-20 UNEF
16	1.305	.790	1.0000-20 UNEF
18	1.391	.869	1.0625-18 UNEF
20	1.531	.994	1.1875-18 UNEF
22	1.656	1.119	1.3125-18 UNEF
24	1.777	1.244	1.4375-18 UNEF

All dimensions for reference only.

26482

Straight Plug (With RFI Grounding Fingers)

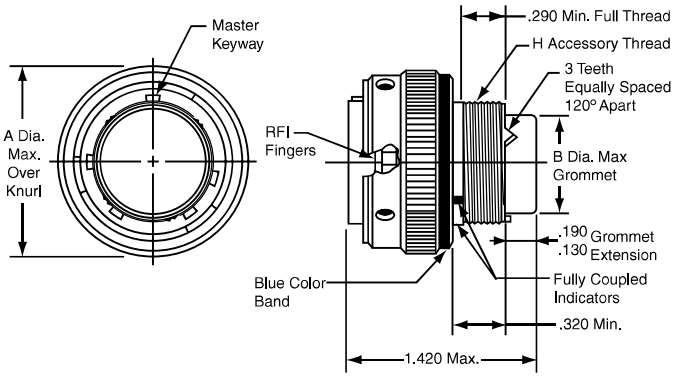
Military (MS3475), Commercial (MB18)

PART NUMBER BUILDER Page J7

MILITARY
MS3475

Commercial

MB18



Shell Size	A Dia. Max.	B Dia. Max.	H Accessory Thread Class 2A
8	.782	.305	.5000-20 UNF
10	.926	.405	.6250-24 UNEF
12	1.043	.531	.7500-20 UNEF
14	1.183	.665	.8750-20 UNEF
16	1.305	.790	1.0000-20 UNEF
18	1.391	.869	1.0625-18 UNEF
20	1.531	.994	1.1875-18 UNEF
22	1.656	1.119	1.3125-18 UNEF
24	1.777	1.244	1.4375-18 UNEF

All dimensions for reference only.

Contact Information, Sealing Plugs, Crimping and Insertion/Removal Tools

CRIMP CONTACTS

Contact Size	Wire Range		Socket Contacts		Pin Contacts	
	AWG	mm2	Military Part Number		Military Part Number	
20	24-20	0.2-0.6	M39029/5-115		M39029/4-110	
16	20-16	0.5-1.4	M39029/5-116		M39029/4-111	
12	14-12	2-3	M39029/5-118		M39029/4-113	

CONTACT CURRENT RATING AND RETENTION

Contact Size*	DC Test Amperage	Contact Retention	
		Axial Load	
		lb.	N
20	7.5	20	89.0
16	13.0	25	111.2
12	23.0	30	133.4

* Organize individual circuits to maintain heat rise within operating temperature requirements.

SEALING PLUGS

Contact Size	Sealing Plugs	
	Military Part Number	
20	MS27488-20-2	
16	MS27488-16-2	
12	MS27488-12-2	

CRIMPING TOOLS

Contact Size	Wire Range		Finished Wire Dia. Range		Crimping Tool Part Number	Turret or Positioner Part Number
	AWG	mm^2	Inch	mm		
20	24-20	0.2-0.6	.040-.083	1.02-2.11	M22520/1-01 or M22520/2-01	M22520/1-02 or M22520/2-02
16	20-16	0.5-1.4	.053-.103	1.34-2.62	M22520/1-01	M22520/1-02
12	14-12	2-3	.097-.158	2.46-4.01	M22520/1-01	M22520/1-02

INSERTION/REMOVAL TOOLS

Contact Size	Color Code	Military Part Number
20	Red/White	M81969/14-11
16	Blue/White	M81969/14-03
12	Yellow/White	M81969/14-04

Note: Each connector is furnished with contacts inserts requiring 1 to 26 of each contact, two spa more than 26 contacts, and a minimum of one sealing plug up to 15% of the number of contacts.

Assembly Instructions

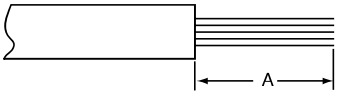
Military (MS3476), Commercial (MB16)

WIRE STRIPPING

1. Strip wire to required length. (See Figure at right). When using hot wire stripping do not wipe melted insulation material on wire strands; with mechanical strippers do not cut or nick strands.
2. See Table 1 for proper finished outside wire dimensions.
3. Twist strands together to form a firm bundle.
4. Insert stripped wire into contact applying slight pressure until wire insulation butts against wire well. Check inspection hole to see that wire strands are visible. If there are strayed wire strands, entire wire end should be re-twisted.

When wire is stripped and properly installed into contact, the next step is to crimp the wire inside the contact by using the proper crimping tool.

STRIPPING DIMENSIONS



Wire Size	A
20	.188 (4.77)
16	.188 (4.77)
12	.188 (4.77)

TABLE 1

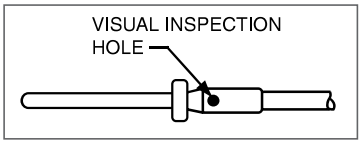
Contact Size	Wire Dimension (inches)**	
	Min.	Max.
12	.040	.083
16	.053	.103
20	.097	.153

** Min. diameters to ensure moisture proof assembly; max. diameters to permit use of metal removal tools.

CRIMPING

See table on preceding page for recommended M22520 series crimping tools, turret head or positioner selection settings according to contact size, part number and wire gauge size.

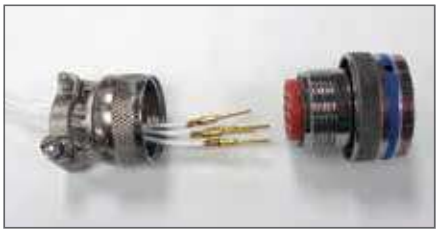
1. Insert stripped wire into contact crimp pot. Wire must be visible through inspection hole.
2. Using correct crimp tool and locator, cycle the tool once to be sure the indentors are open, insert contact and wire into locator. Squeeze tool handles firmly and completely to insure a proper crimp. The tool will not release unless the crimp indentors in the tool head have been fully actuated.
3. Release crimped contact and wire from tool. Be certain the wire is visible through inspection hole in contact.



Example M22520 Series Crimping Tool for size 20, 16 or 12 contacts, and has a positioner that can be dialed for each contact size.

CONTACT INSERTION

1. First remove hardware from the plug and receptacle and slide the hardware over wires in proper sequence.



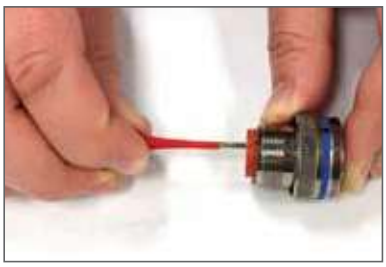
Note: All plastic tools are double-ended. The colored side is the insertion tool and the white side is the removal tool.

2. Use proper plastic or metal insertion tool for corresponding contact. (Consult tool table on preceding page). Slide correct tool (with plastic tool use colored end) over wire insulation and slide forward until tool bottoms against rear contact shoulder.

Plastic tool with contact in proper position.

Metal tool with contact.

3. Next align the tool and contact up to the properly identified cavity at rear of connector plug. Use firm, even pressure; do not use excessive pressure. It is recommended to start at the center cavity. Contact must be aligned with grommet hole and not inserted at an angle. Push forward until contact is felt to snap into position within insert.



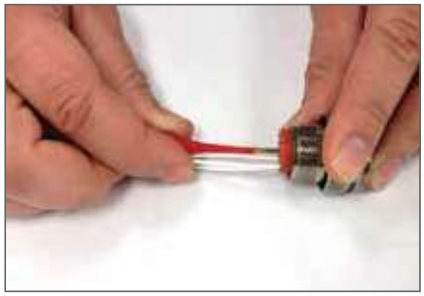
Continued on next page.

Assembly Instructions

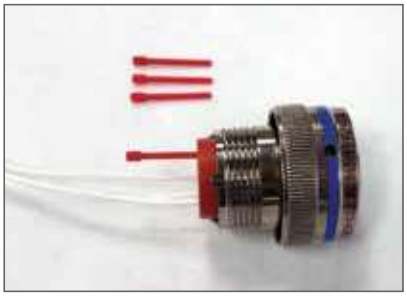
Military (MS3476), Commercial (MB16)

CONTACT INSERTION, CONT.

4. Remove tool and pull back lightly on wire, making sure contact stays properly seated and isn't dragged back with the tool. Repeat operation with remainder of contacts to be inserted, beginning with the center cavity and working outward in alternating rows.



5. After all contacts are inserted, fill any empty cavities with wire sealing plugs. (Refer to sealing plug charts for Series III on page 18, for Series I, II, and SJT on page 19.



CAUTION when inserting or removing contacts, do not spread or rotate tool tips.

6. Reassemble plug or receptacle hardware - slide forward and tighten using connector pliers. Connector holding tools are recommended while tightening back accessories. When using strain relief, center wires at bar clamp. Slide clamp grommet into position and tighten clamp bar screws. When tightening screws, pressure should be applied in the same direction that clamp is threaded to rear threads of connector. When not using clamp grommet, build up wire bundle with vinyl tape so clamp bar will maintain pressure on wires.

CONTACT REMOVAL

1. Remove hardware from plug or receptacle and slide hardware back along wire bundle.

2. Use proper plastic or metal removal tool for corresponding contact. (Consult tool table on page 277). Slide correct size tool over wire insulation.

Use white end of plastic tool for removal of contacts.

3. Insert plastic or metal removal tool into contact cavity until tool tips enter rear grommet and come to a positive stop. Hold tool tip firmly against positive stop on contact shoulder. Grip wire and simultaneously remove tool and contact. (On occasion, it may be necessary to remove tool, rotate 90° and reinsert.)

Removal of contacts with metal tool.