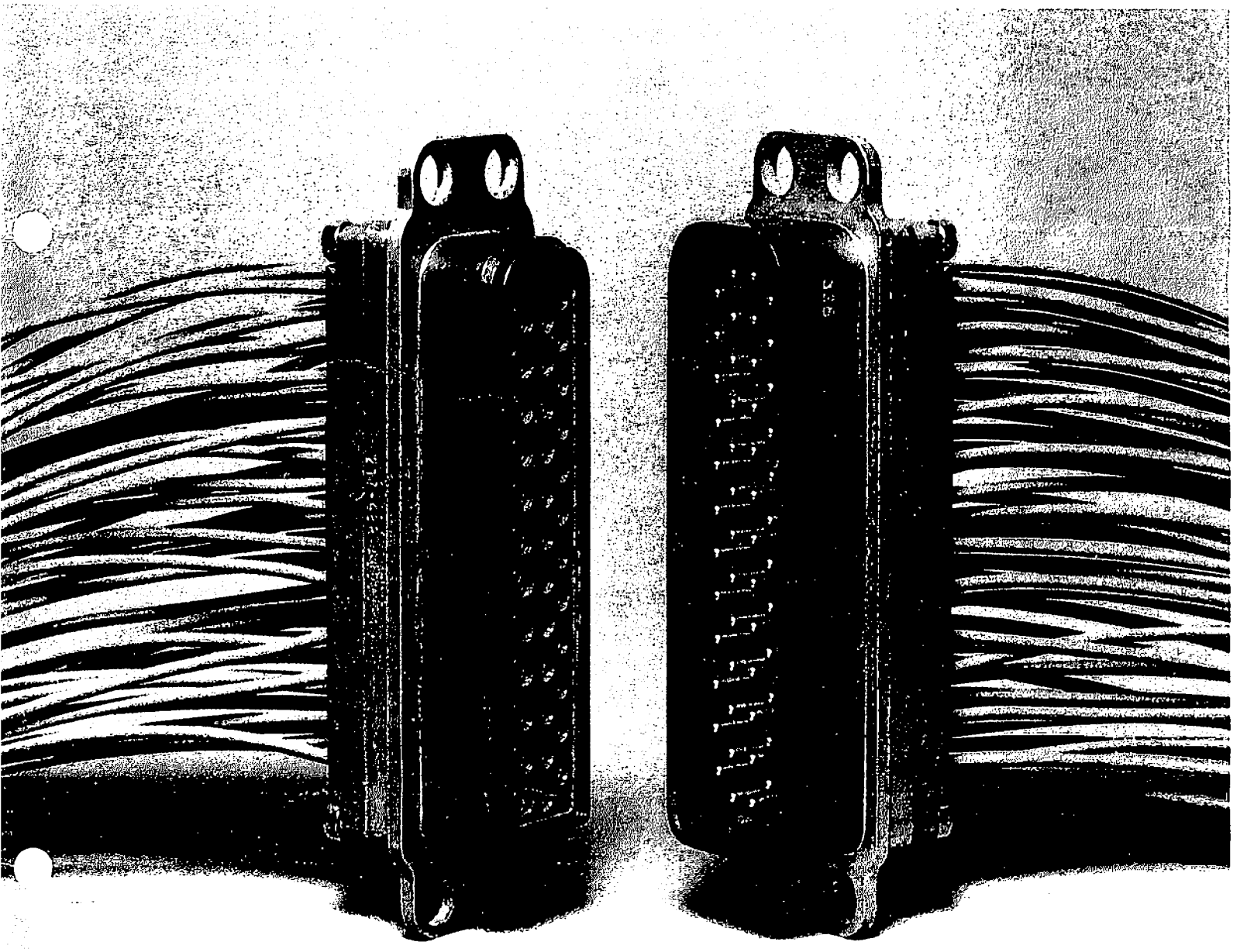
RP-5

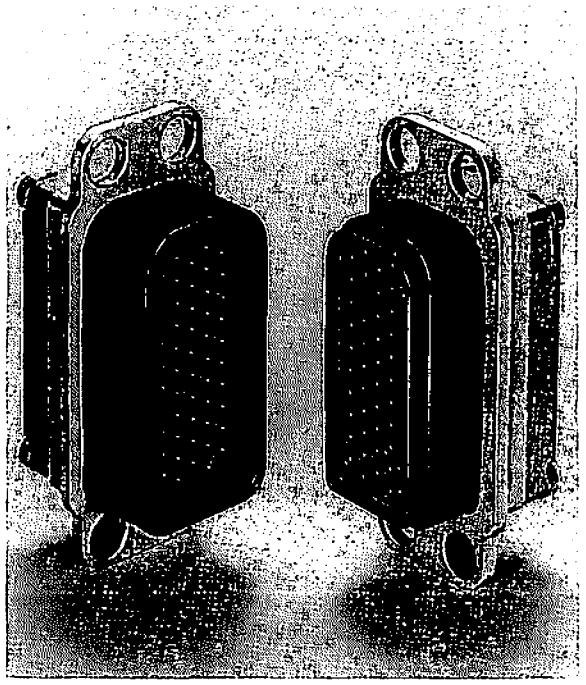
BUNKER RAMO AMPHENOL

217 SERIES
Rack and Panel Connectors



217 SERIES—MIL-C-26518

Miniature Environment Resistant Connectors



A Significant Advance In The State-of-the-Art

On the ground or in space, wherever there is a requirement for superior environmental protection, high performance, and minimum weight and bulk, 217 Series miniature environment resistant connectors are the answer.

In developing the 217 Series, AMPHENOL faced the problem of satisfying reliability, logistics, and present and anticipated environmental requirements for connector usage. To solve the problem, AMPHENOL had to generate advanced design concepts, formulate materials specifically for connector usage, and work out new production techniques. The resulting 217 Series connectors exceed the stringent requirements of both MIL-C-26518 (USAF) and MIL-C-38300 (USAF) for performance and reliability.

TWO VERSIONS—217 Series connectors are available in two different versions:

1. Both mating faces in silicone rubber, conforming to MIL-C-26518 (USAF).
2. The plug (with socket contacts) incorporating the AMPHENOL Ultra-Mate® principle—a hard dielectric face conforming to MIL-C-38300 (USAF).

Since the receptacle (with pin contacts) is identical in both versions, there is complete inter-mateability with either the standard resilient plug or the Ultra-Mate.

COMPLETE ENVIRONMENTAL SEALING—Monoblock construction, with bonded interfaces between the three dielectric components (insert, anti-deflection disc, and grommet) eliminates air voids and protects connectors from degrading moisture and altitude conditions. AMPHENOL-developed silicone rubber dielectric provides resilience and unsurpassed resistance to tear, compression set, fluids, and high temperatures. On mating, insert faces compress to form a resilient dielectric seal around each individual contact. Together with monoblock construction, this puts void-free, continuous dielectric around each contact through the entire connector length.

A pressurizing seal around each contact prevents the passage of air or moisture through the contact hole, and twin sealing risers at each wire hole in the grommet double-seal each individual wire. A continuous barrier on the periphery of the socket insert mates with a recess around the pin insert to form an additional compression seal. A dynamic lip seal between mated shells constitutes still another barrier to dirt and moisture, and protects the integrity of the face seals.

GO/NO-GO RELIABILITY—When an Ultra-Mate connector mates, you can be sure there is proper electrical contact. In Ultra-Mate connectors of the 217 Series, the socket contacts are closely surrounded by hard dielectric. Where connector pins are slightly misaligned, the beveled entry of Ultra-Mate connectors guides them in right. However, if the pins are badly bent, the hard dielectric presents a closed entry and prevents mating. To insure contact seal, there is an additional resilient layer behind the hard face.

LIGHT WEIGHT AND HIGH CONTACT DENSITY—Connector shells are of high-strength, impact-extruded aluminum forgings with a high strength-to-weight ratio. The insert arrangement is designed for the maximum number of contacts within the area available.

POKE-HOME® CONTACTS—The Poke-Home contacts can be individually inserted or removed without disassembling the connector or disturbing adjacent contacts. Even in the Ultra-Mate connectors, which have a hard dielectric face, they can be released from the front. These high temperature, MIL-C-26636 contacts are crimped quickly, consistently, and reliably with either hand or power tools, shown on page 16. They have high electrical conductivity, present a smooth configuration, and completely protect electrical contact pressure-members from environmental and handling damage. The contacts come in sizes 12, 16, 20, and shielded, with rhodium-over-silver plating.

VARIETY OF CONFIGURATIONS—Plugs and receptacles are available in two shell sizes with various contact arrangements. Contacts are crimp applied. Connectors are mated under tension by dual spring-loaded mounting assemblies and fixed bushings. Either the plug or the receptacle may be spring loaded. The receptacle mounts on the panel front or rear.

Performance Characteristics

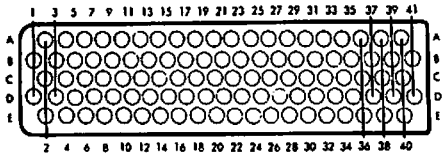
217 SERIES—MIL-C-26518

TEST	SPECIFICATION REQUIREMENTS	TEST RESULTS
Dielectric Withstanding Voltage (Mated)	No flashover at 1500 volts AC(RMS) at sea level, 1250 volts AC(RMS) at 10,000 feet altitude, and 1000 volts AC(RMS) at 110,000 feet altitude.	No flashover was evident at 1500, 1250, and 1000 volts AC(RMS) when tested at the respective altitudes.
Dielectric Withstanding Voltage (Unmated)	No flashover at 1500 volts AC(RMS) at sea level, 1250 volts AC(RMS) at 10,000 feet altitude and 200 volts AC(RMS) at 110,000 feet altitude.	No flashover was evident at 1500, 1250, and 200 volts AC(RMS) when tested at the respective altitudes.
Insulation Resistance	5,000 Megohms minimum insulation resistance at room temperature, 2,000 megohms insulation resistance at 500°F.	500,000 Megohms minimum insulation resistance at room temperature, and 12,000 megohms minimum insulation resistance at 500°F.
Temperature Life	Must carry specified current for 1000 hours.	Connectors did carry specified current for 1000 hours, and will pass remaining specification test.
Thermal Shock	Connectors must be subjected to 5 cycles of −67°F to +500°F, and be capable of passing remaining specification requirements.	The connectors met or exceeded specification requirements after subjection to thermal shock.
Physical Shock	Subject to 50 gravity units transient.	Passed all subsequent tests after subjection to gravity units transient.
Vibration	15 G's for 3 hours at 392°F. 15 G's for 3 hours at −67°F.	No discontinuity or damage occurred during this test.
Air Leakage	With a 30 PSI pressure differential across the connector during exposure to extremes of high and low temperature the connectors shall show evidence of not more than 1 cubic in/hr. leakage.	No detectable leak was observed.
Moisture Resistance	Per MIL-STD-202, method 106, maintain 1000 megohms minimum insulation resistance.	Connectors maintained 6000 meghoms minimum insulation resistance.
Altitude Immersion	Three (3) cycles).	Maintains 10,500 megohms insulation resistance and 1,500 VAC(RMS) applied potential.
Corrosion	50 Hours salt spray.	No base metal exposed.
Fluid Immersion	20 Hour immersion in MIL-L-9236 aviation lubricating oil and MIL-H-5606 hydraulic fluid.	Connectors can be properly mated and unmated, and no flashover occurred when 1500 VAC(RMS) was applied at sea level.
Ozone Exposure	.010/.015% by volume for 2 hours.	No cracking or damage occurred to the connector dielectrics.
Maintenance Aging	10 Insertions and removals of the contacts.	No damage occurred to contacts or connectors.
Removable Contact Retention	20 Lbs. minimum after 10 cycles, size 20. 25 Lbs. minimum after 10 cycles, size 16. 30 Lbs. minimum after 10 cycles, size 12.	Contacts held specified axial load after 10 cycles.
Contact Insertion Force	8 Pounds maximum	7 Pounds 4 oz. maximum
Contact Deflection	.012 Inches maximum displacement when specified load is applied from front.	Contacts held specified axial load after 10 cycles.
Coupling Durability	500 Mating Cycles	No damage detrimental to the operation of the connector.
Mating and Unmating Forces	Maximum mating or unmating force: Size A, 60 Lbs.; Size B, 40 Lbs.; Size C, 25 Lbs.	Connectors meet MIL-C-26518B (USAF) requirements.
Sand and Dust exposure	Per MIL-E-5272 condition B	No damage occurred.

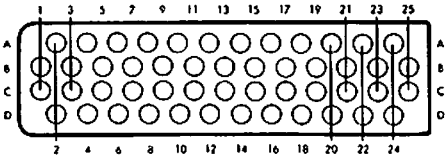
217 SERIES Available Insert Arrangements

Showing Rear Face of Pin Inserts

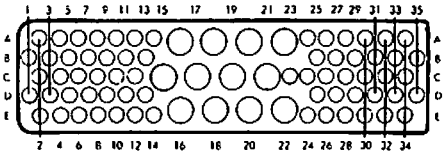
SIZE A SHELL



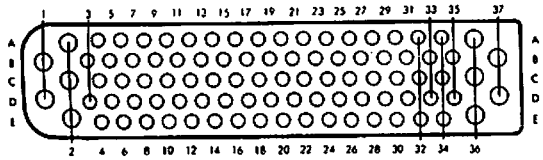
102–SIZE NO. 20 CONTACTS △



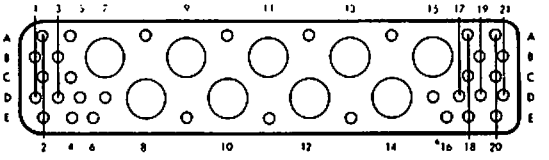
50–SIZE NO. 16 CONTACTS



65–SIZE NO. 20 CONTACTS
*12–SIZE NO. 12 CONTACTS △

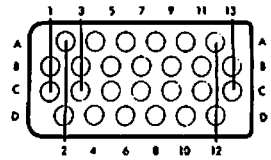


82–SIZE NO. 20 CONTACTS
10–SIZE NO. 16 CONTACTS △

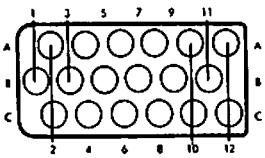


33–SIZE NO. 20 CONTACTS
9–SIZE NO. 2 SHIELDED CONTACTS △

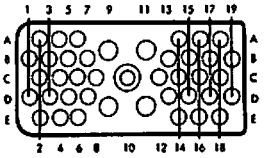
SIZE B SHELL



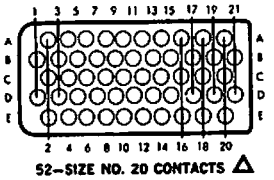
26–SIZE NO. 16 CONTACTS



*18–SIZE NO. 12 CONTACTS



36–SIZE NO. 20 CONTACTS
4–SIZE NO. 16 CONTACTS △
* 1–SIZE NO. 1 SHIELDED CONTACT

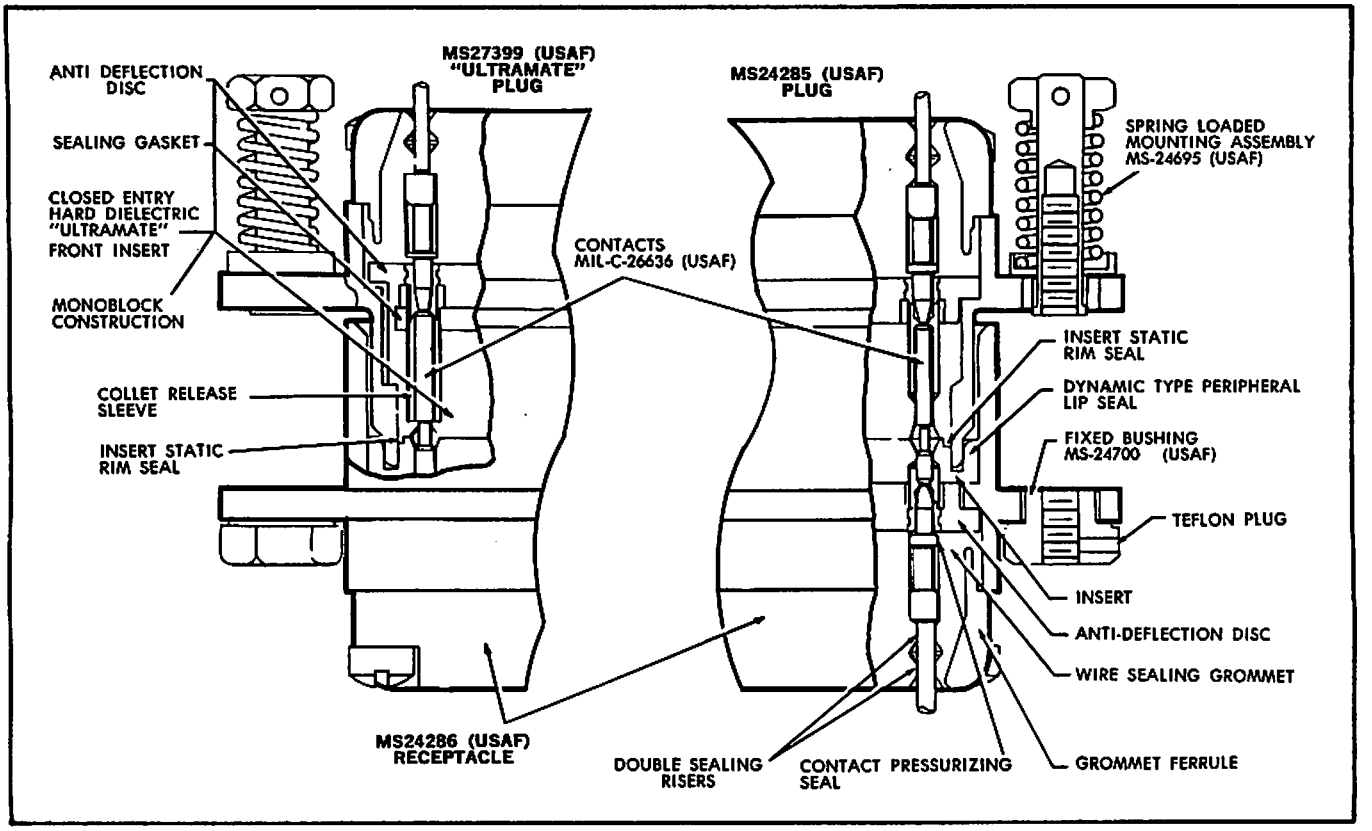


52–SIZE NO. 20 CONTACTS △

No. 1 Shielded contact is interchangeable with size no. 12 contact.

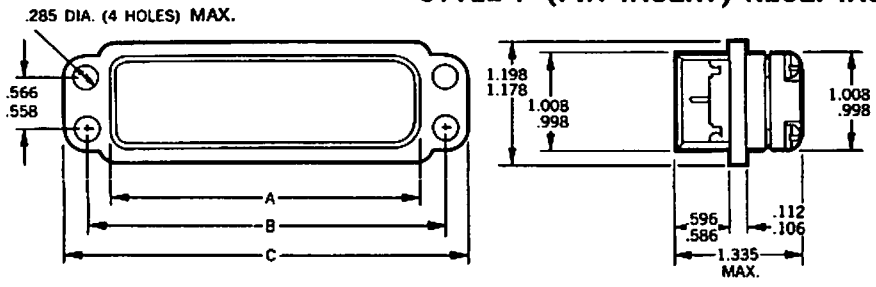
△ Available in closed entry hard dielectric "ULTRAMATE."

Special insert arrangements and coupling mechanisms may be obtained by contacting Amphenol Connector Division.



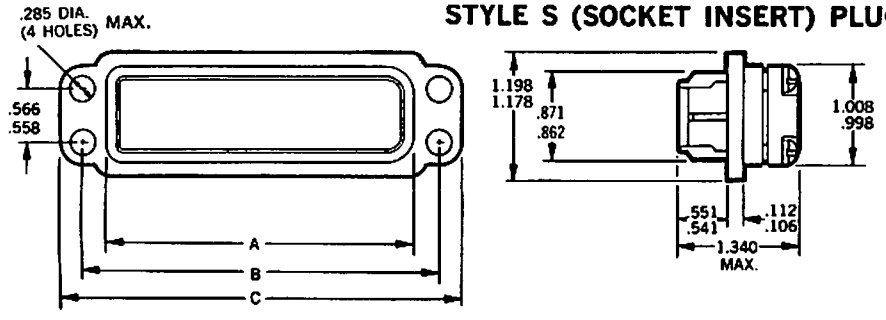
217 SERIES ULTRAMATE & MIL-C-26518 RACK & PANEL CONNECTORS
EMPLOYING MIL-C-26636 (USAF) CRIMP CONTACTS

STYLE P (PIN INSERT) RECEPTACLES



Shell Size	A ±.005	B ±.004	C ±.005
A	3.375	3.875	4.296
B	1.945	2.445	2.866
C	1.516	2.000	2.421

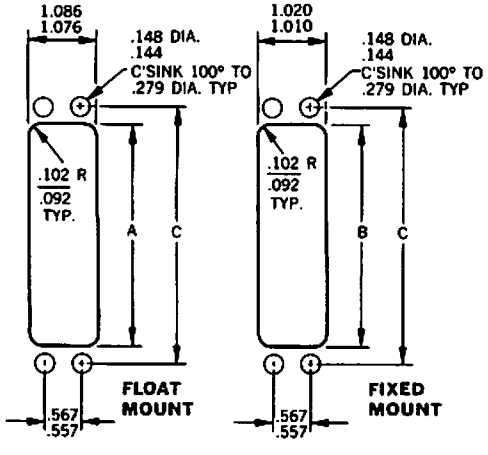
STYLE S (SOCKET INSERT) PLUGS



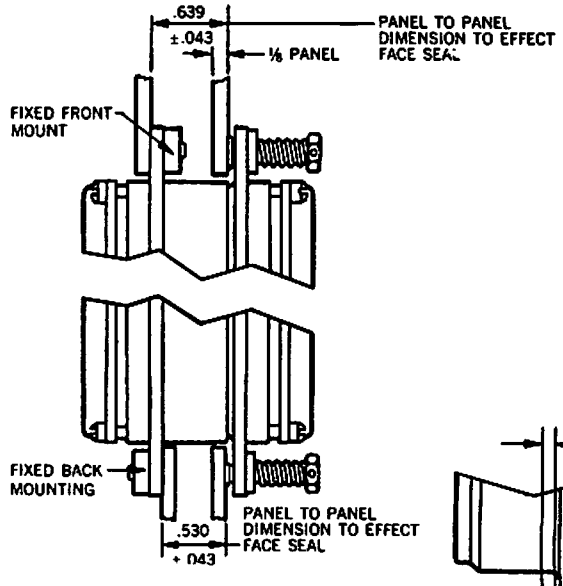
Shell Size	A ±.005	B ±.004	C ±.005
A	3.239	3.875	4.296
B	1.809	2.445	2.866
C	1.380	2.000	2.421

MOUNTING DIMENSIONS

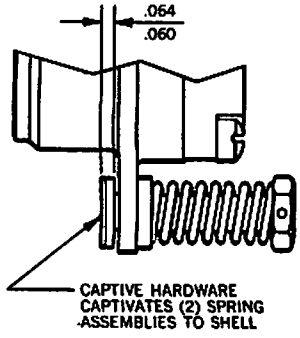
PANEL CUTOUT DIMENSIONS



Shell Size	Dimension A	B	C
A	3.459 3.449	3.393 3.383	3.880 3.870
B	2.030 2.020	1.964 1.954	2.450 2.440
C	1.585 1.575	1.533 1.523	2.005 1.995



THE PANEL TO PANEL DIMENSIONS SHOWN ABOVE WILL BE REDUCED BY .064 WHEN CAPTIVE HARDWARE IS USED.



217 SERIES How to Order 217 Series Connectors

The part numbering system has been set up to provide a complete and exact description through the part number. To find the AMPHENOL part number to order, put together the four groups of digits and letters that specify the particular 217 Series connector you want, as per the following example.

217 – 24C – A077S – 10

SERIES DESIGNATION
217–

SHELL AND CONTACT TYPE

Use number in appropriate column below. Socket Contacts (Plug)	Pin Contacts (Receptacle)	Number of Contacts
20	21	102
22	23	92
24	25	77
28	29	52
30	31	26
32	33	18
48	49	50
50	51	42
54	55	41

INSERT CONSTRUCTION
C—Closed Entry, Hard Dielectric, Ultra-Mate
R—Resilient Front

SHELL SIZE
A, B

TOTAL NUMBER OF CONTACTS

	#20	#16	#12	No. 1 Shielded	No. 2 Shielded
102	102				
092	82	10			
077	65		12		
052	52				
026		26			
018			18		
042	33				9
041	36	4		1	
050		50			

TYPE OF CONTACT
P—Pin
S—Socket

COMPONENTS INCLUDED

0 Plug or Receptacle Connector with contacts and spare sealing plugs.
1 Plug or Receptacle Connector without contacts.
2 Connector with captive retainer and spring mounting assemblies assembled to connector without contacts.
3 Same as 2 except with contacts included, packaged separately.
4 Connector, without contacts, with retainer nuts (MS* Fixed bushing) packaged separately.
5 Same as 4 except with contacts incuded, packaged separately.
6 Connector, without contacts, with spring loaded mounting assembly (MS**) packaged separately.
7 Same as 6 except with contacts included, packaged separately.
8 Connector without contacts, with retainer nuts (stainless) (MS* Fixed Bushing) packaged separately.
9 Same as 8 except with contacts included, packaged separately.

*Fixed Bushing:

MS No.	AMPHENOL No.
MS 24700-1	217-537 (Set of 4) Aluminum
MS 24700-2	217-955 (Set of 4) Stainless

**Spring Loaded Mounting Assembly:

MS 24695-1	217-678 (A Size) (Set of 4)
MS 24695-2	217-679 (B Size) (Set of 4)

SHELL FINISH

1 MIL-C-26518 hard coat anodize on front of shell, gold iridite on flange and on grommet ferrule
5 Gold Iridite
6 Black Anodize

Contact Data

Contact Size	Max. Current Rating	Wire Size	AMPHENOL Part No.		MS Part No.	
			Pin	Socket	Pin	Socket
No. 20	7.5 amps	24-22-20 AWG	48-1595-02	248-136-2001S-02	MS24254-20P	MS24255-20S
No. 16	22 amps	18-16 AWG	48-1825-02	248-136-1600S-02	MS24254-16P	MS24255-16S
No. 12	41 amps	14-12 AWG	48-1827-02	248-136-1200S-02	MS24254-12P	MS24255-12S
No. 1 (shielded)*						
Resilient	3 amps	* *	48-1226-02	48-1227-02	MS27184-22P	MS27185-22S
Hard Front	3 amps	* *	–	48-1227-50	–	MS27450-22S
No. 2 (shielded)						
Resilient	7.5 amps	* * *	48-2187-02	48-2188-02	MS27184-20P	MS27185-20S
Hard Front	1 amp	RG-195/U	48-2187-50	48-2188-50	–	–

*Replaces No. 12 power contact.
Can accommodate cables RG179/U, RG179A/U, RG187/U, RG188/U and RG161/U as well as shielded contacts.
Cables RG195/U, RG178/U, RG178A/U and RG196/U can also be accommodated with modification to shielded contacts.

**Cable MIL-C-27500-22KIN6 (Extruded) or 22 AWG per MIL-C-7078 type II.

***Cable MIL-C-27500-22KIN6; 20KIN6; 18KIN6 (Extruded) or 22, 20, 18 AWG per MIL-C-7078 type II.

CONTACTS

When you order 217 Series connectors with contacts, the contact package contains enough contacts to complete the insert arrangement and have at least 2 spares left. The package also includes enough sealing plugs for at least 15% of the contacts in the insert, in any case a minimum of 3 sealing plugs. To provide proper sealing, insert unwired contacts and sealing plugs in all unused holes. (Use a #12 contact for a /1 shielded hole.) To order contacts and sealing plugs separately use the part numbers in the table below. Contacts may also be ordered in reels for use with automatic crimping tools.

GROMMET SEALING PLUGS

Color Code	Size	AMPHENOL Part No.	MS Part Number
Yellow	12 & #1 Shielded	48-2221-12	MS27187-2
Blue	16	48-2221-16	MS27187-1
Red	20	48-2221-20	MS27186-1
White	#2 Shielded	48-1458-01	–

TOOLS

Note that various tools are available for crimping, inserting, and removing each size contact.

*** Automatic Equipment Available; Consult Factory**

Contact Size	Wire Size AWG	Max. Current Rating Amps.	AMPHENOL Part No.		MS Part No.		Crimping Tool	Positioner or Turret Head	Crimp Jaw Setting Dia.	Insertion Tool	Removal Tool	
			Pin	Socket	Pin	Socket					Standard Connector	Ultra-Mate Connector
No. 20	24 22 20	3.0 5.0 7.5	48-1595-02	248-136-2001S-02	MS24254-20P	MS24255-20S	•294-126 294-506 ••294-542	Included Automatic 294-1889-01	.031-041 SEE DATA PLATE	294-88 (MS24256A20) or 294-213	294-89 (MS 24256R20)	294-203, (MS24256RH20)
No. 16	18 16	16 22	48-1825-02		MS24254-16P	MS24255-16S	• 294-126 294-506 ••294-542	Included Automatic 294-1889-01	.041-053 SEE DATA PLATE	294-96 (MS24256A16)	294-97 (MS24256R16)	294-180, (MS24256RH16)
No. 12	14 12	32 41	48-1827-02		MS24254-12P	MS24255-12S	•294-126 294-506 ••294-542	Included Automatic 294-1889-01	.062-072 SEE DATA PLATE	294-72 (MS24256A12)	294-73 (MS24256R12)	294-183, (MS24256RH12)
No. 1 (shielded)*	** **** *****	3 1 1	48-1226-02 48-1226-54 48-1226-55	48-1227-02 48-1227-54 48-1227-55	MS27184-22P – –	MS27185-22S – –	294-268	294-1631	SEE DATA PLATE	294-72† (MS24256A12)	294-73† (MS 24256R12)	294-264
No. 2 (shielded)	***	7.5	48-2187-02	48-2188-02	MS27184-20P	MS27185-20S MS27450-20S	294-268	294-1630	SEE DATA PLATE	294-128†	294-127†	294-184†

*Replaces No. 12 power contact.

**Accommodates cables, RG174/U, RG179/U, RG179A/U, RG187/U, RG188/U and RG161/U as well as shielded wire. Can also accommodate Cable MIL-C-27500-22KIN6 (Extruded) or 22 AWG per MIL-C-7078 type II.

***Accommodates Cable MIL-C-27500-22KIN6; 20KIN6; 18KIN6 (Extruded) or 22, 20, 18 AWG, per MIL-C-7078 Type II.

****For use with RG195/U and RG180/U, RG180A/U and RG180B/U.

*****Accommodates Cables RG178/U, RG178A/U, RG178B/U and RG196/U.

†These tools are applicable to all #1 or #2 shielded contacts, respectively, not just contacts listed here.

•294-126 (MS3191-1) Tools are inactive for new procurement, but can be used if available.

••294-542 Crimping tools comply with MIL-C-22520 specification.

POKE HOME How To Use Hand Crimping Tools

Setting Up the MS3191-1 Tool

1. Put tool in "open" position by squeezing handles to their maximum position to trip ratchet, then releasing them.
2. Loosen latch locking screw and pull latch to "open" position.
3. Pull positioner release all the way down against force of spring and insert or remove positioner.
4. Select proper positioner for contact size. Positioners are color coded and stamped for size. Be sure flat on flange mates with the flat in handle. Positioner flange must be flush with handle before positioner latch assembly and locking screw can be fully closed and locked.
5. After positioner is in place, push latch to closed position and tighten latch locking screw. Tool is now ready to crimp.

Setting Up the MS22520/1-01 Tool and Turret Head

1. Put tool in "open" position by squeezing handles to their maximum position to trip ratchet, then releasing them.
2. Depress side lever to release locked turret.
3. Dial turret for proper positioner.
4. Depress turret barrel until it snaps in locked position.
5. Set tool adjustment to proper selector number for wire size being used. Lock in place. Tool is now ready to crimp.

Crimping

1. Insert prepared contact and wire through the indenter opening into positioner.
2. Squeeze handles together until positive stop is reached. Tool will then release and return to fully "open" position. Remove crimped contact and wire.

Procedures for the other crimping tools are similar.

Contact Insertion and Removal With Ease and Consistent Reliability

Properly designed contact insertion and removal tools are available for the connectors in this catalog. Find the proper tool numbers on the pages covering the specific connectors.

INSERT OR REMOVE INDIVIDUAL CONTACTS AT WILL

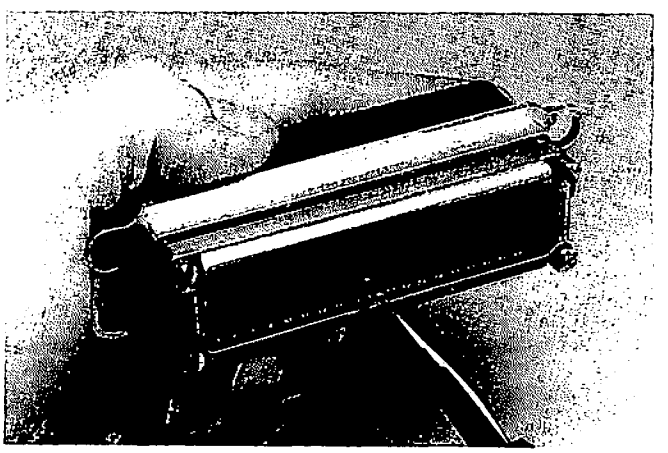
Insertion

1. Cradle the crimp end of contact in round end of tool, making sure tip of tool rests against contact shoulder at base of crimp.
2. Carefully direct mating end of contact into appropriate wire hole in grommet assembly.
3. Push contact into grommet assembly until contact is seated with a positive stop. When shoulder on insertion bit reaches grommet face, insertion is complete.
4. Withdraw tool, keeping it at right angles to grommet face during withdrawal.

Removal

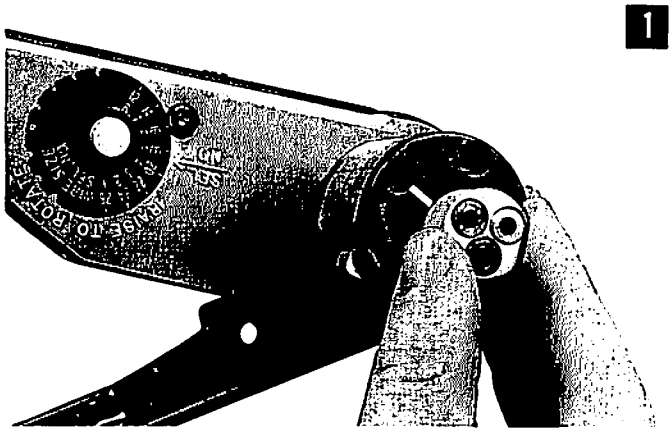
1. Select proper removal tool for size of contact.
2. Insert bit (*into* mating end of female contacts, *over* mating end of male contacts) and push the contact out.

REMOVING CONTACT



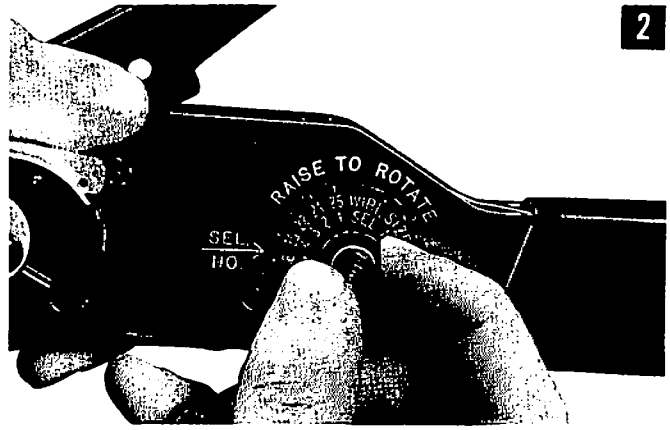
INSERTING CONTACT

1



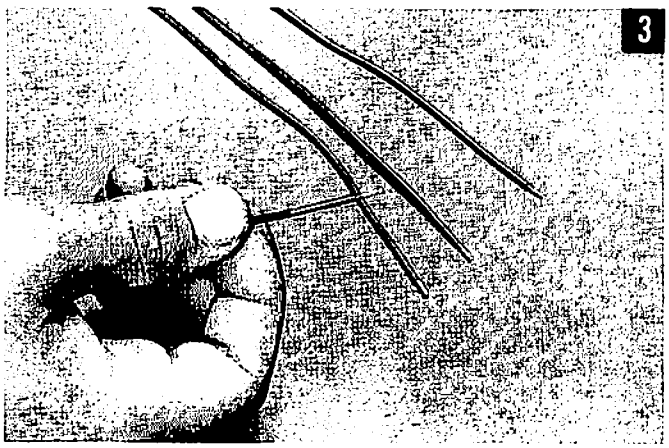
Select proper positioner in turret head.

2



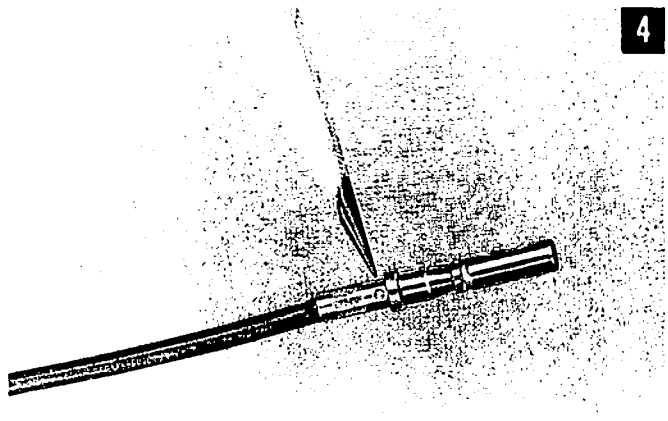
Set selector knob for wire size being used.

3



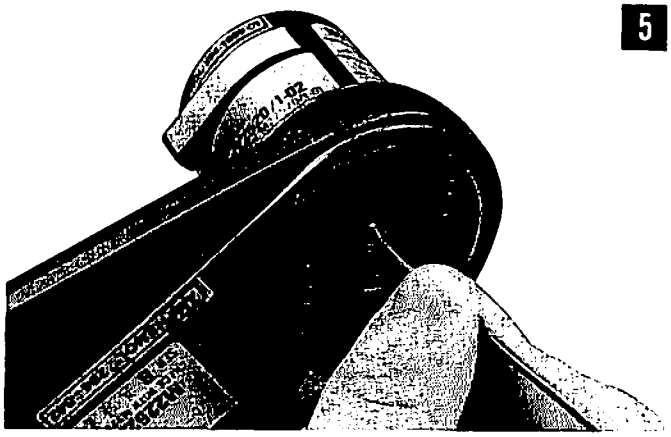
Strip wires to lengths shown in table, below. Be careful not to cut or gall wire strands or insulation. If ends fray, twist them back to their original lay.

4



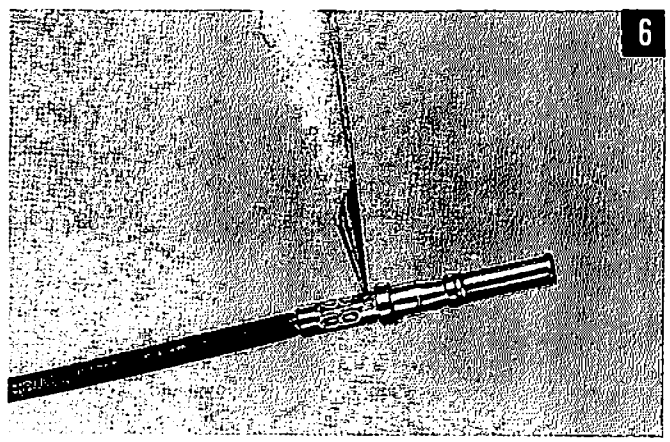
Insert stripped wire into contact pocket until it is visible through inspection hole.

5



Fully seat contact in crimping tool. Crimp in one full stroke. (The ratchet will not release jaws until tool has completed stroke.)

6



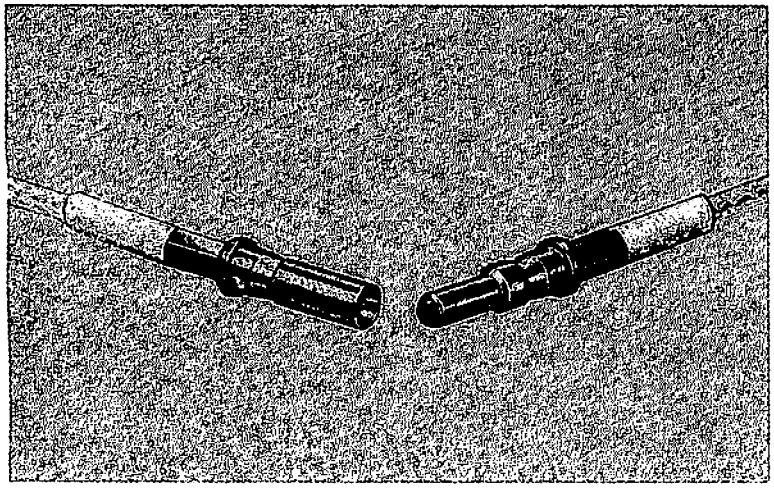
Visibility of the wire in the contact inspection hole indicates that the wire is crimped at the proper depth.

COLOR CODING

Contact Size	Contact and Positioner Color Code	Wire Size	Insulation O. D.	Stripping Lengths
20	Red	20-22-24 AWG	.040/.090"	.187/.234"
16	Blue	16-18-20 AWG	.068/.130"	.220/.260"
12	Yellow	12-14 AWG	.106/.170"	.220/.260"

ASSEMBLY PROCEDURES

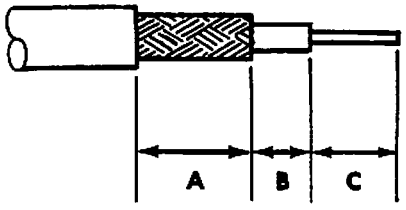
Crimping and Inserting Shielded Contacts

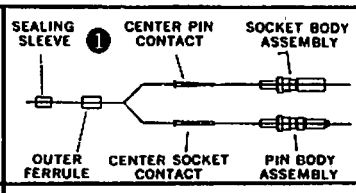
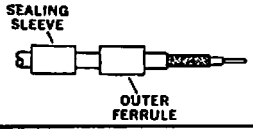
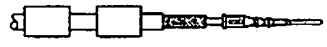
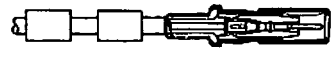
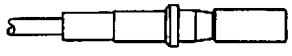
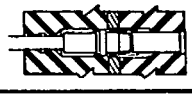


Shielded Contacts
After Crimping

CABLE STRIPPING

Strip cable jacket, braid, and dielectric to the dimensions shown in the table on page 17. Make all cuts square and sharp, being careful not to nick braid, dielectric, or center conductor when cutting. If conductor ends fray, twist them to their normal lay.



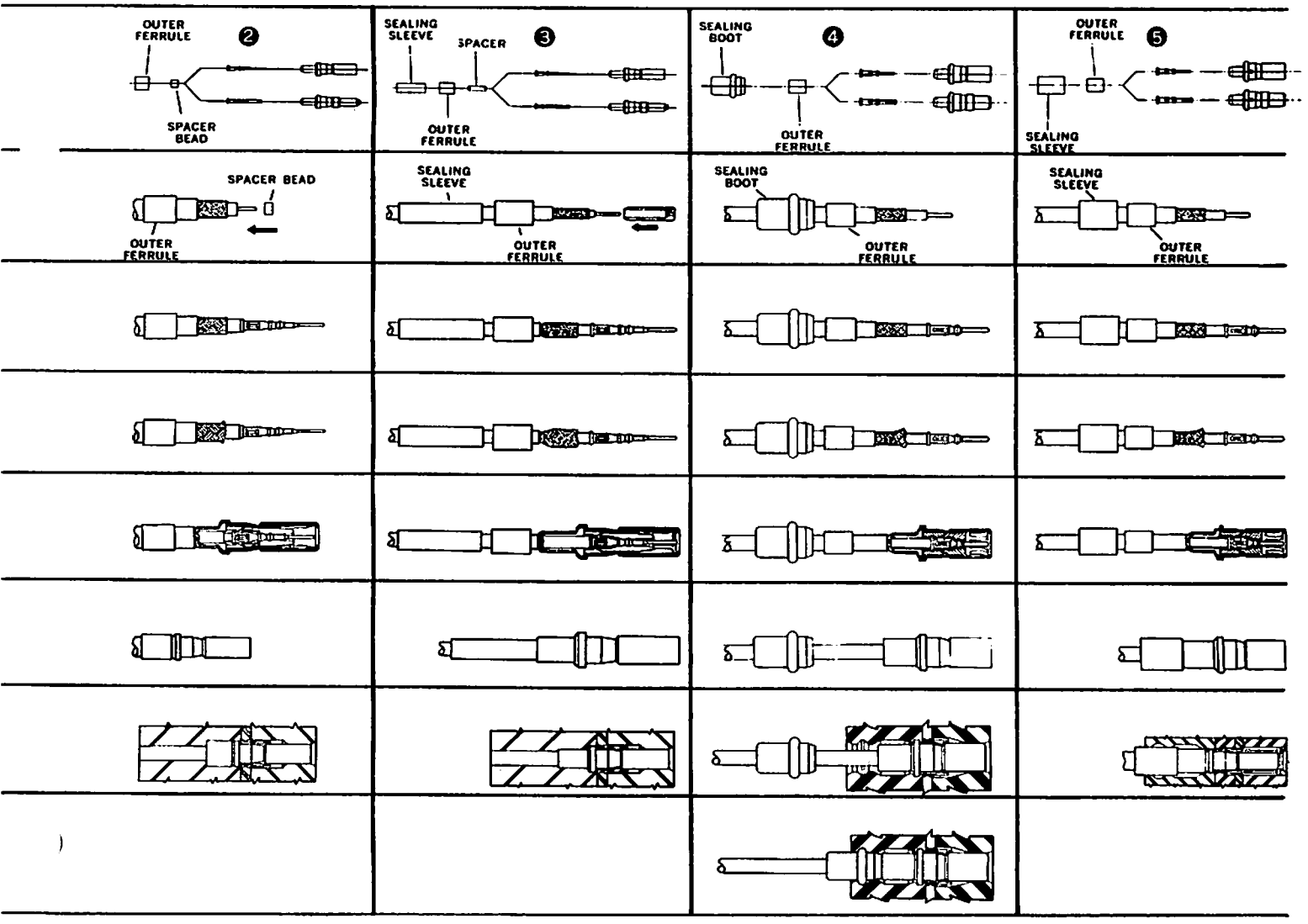
	Exploded Views of Shielded Contact Types
	
1 Slide sealing boot or sleeve and outer ferrule onto cable and strip cable as shown at right. After stripping, slide spacer over center conductor as shown for ❷ and ❸; for ❸ slide spacer under wire braid.	
2 Insert stripped center conductor into contact until wire shows through inspection hole and dielectric(❶, ❹, ❺) or spacer(❷, ❸) butts against contact. Fully seat contact in nest bushing of crimp tool and crimp in one full stroke. (Follow same crimping procedures shown on page 15 except use nest bushing crimping tool from table on page 17.)	
3 Slightly flare out ends of wire braid to facilitate insertion of inner ferrule of body assembly. (Do not comb braid.)	
4 Install center contact in body assembly and slide inner ferrule underneath wire braid as shown. Push center contact until it is locked in place in the body assembly. Pull lightly on cable to make sure that contact is securely locked in place.	
5 Slide outer ferrule over braid and up against body as shown. There should be no slack in the wire braid. Crimp the outer ferrule with proper tool from table on page 17. Then, for ❶, ❸ and ❺, slide sealing sleeve toward contact until sleeve touches outer ferrule.	
6 Insert the assembled shielded contact into the connector in the same way as the standard Poke Home contact, with applicable insertion tool (see page 14). This completes assembly for ❶, ❷, ❸, and ❺.	
7 To complete assembly for ❹, push sealing boot into connector grommet until O-ring riser of boot snaps into place and seals the assembly.	

SHIELDED CONTACT CRIMPING

Drawing	Shielded Contact	Contact Pin (P) or Sockets	Cable Stripping Dimensions +1/64, −.000 inch A	B	C	Crimp Tools Center Contact (Amphenol Nos.) Tool	Nest Bushing	Crimp Setting	Outer Ferrule Crimping ▲ Tool	Cable Application
❶ #1 Shielded	48-1226-02 48-1227-02, 48-1227-50	P S S	7/32	5/64	7/64	294-268*	294-1631	#3	294-529	#22 AWG per MIL-C-7078, Type II and MIL-C-27500-22 KIN6 RG-174/U, -188/U
								#1	294-529	RG-161/U, -179/U, -179A/U, -187/U
	48-1226-57 48-1227-57	P S	7/32	5/64	7/64	294-268*	294-1631	#1	294-529	Raychem 9530A11
❷ #1 Shielded	48-1226-51, -54 48-1227-51, -54, -56	P S	7/32	1/32	5/32	294-268*	294-1631	#1	294-528	RG-180/U, -180A/U, -180B/U, -195/U
❸ #1 Shielded	48-1226-55 48-1227-55	P S	15/64	1/32	5/32	294-268*	294-1631	#1	294-529	RG-178/U, -178A/U, -178B/U, -196-U
❹ #2 Shielded	48-2187-02 48-2188-02	P S	7/32	7/64	9/64	294-126** 294-268*	294-1014 294-1630	SEE DATA PLATE	294-528	#18, 20, 22 AWG per MIL-C-7078, Type II and MIL-C-27500-18, -20, -22 KIN6 Extruded Jacket
	48-2187-50, -51 48-2188-50, -51, -53, -54	P S	7/32	7/64	9/64	294-1166** 294-268*	294-1014 294-1630	— #3	294-528	RG-180/U, -180A/U, -180B/U, -195/U
❺ #2 Shielded	48-2187-52 48-2188-52	P S	5/16	7/64	9/64	294-268*	294-1630	#7	294-530	RG-59/U and 21-541

*294-268 Conforms to MIL-C-22520/2 specification.
**MS3191-1 Tools are inactive for new procurement, but can be used if available.

▲ Including Hex Die Set



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AMPHENOL

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