EO 40-90B-2

ROYAL CANADIAN AIR FORCE

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

AN-MS ELECTRICAL CONNECTORS

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LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO
27 Jul 56	i		
27 Jul 56	ii		
27 Jul 56	35		
27 Jul 56	36		
27 Jul 56	37		
27 Jul 56	38		
27 Jul 56	39		
27 Jul 56	40		
27 Jul 56	41		
27 Jul 56	42		
27 Jul 56	43		
27 Jul 56	44		
3 Jul 59	Cover		
3 Jul 59	26		
3 Jul 59	28		
3 Feb 61	33		

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS (Cont'd)

LIST OF TABLES

PART 1

TABLE OF CONTENTS

INTRODUCTION

SCOPE

1 This EO covers the description selection, preparation, installation, and maintenance instructions for the AN connector types listed in Table 1 and illustrated in Figure 1-1.

TABLE 1

AN TYPE	NOMENCLATURE
AN3100	Wall Mounting Receptacles
AN3101	Cable Connecting Receptacles
AN3102	Box Mounting Receptacles
AN3106	Straight Plugs
AN3107	Quick Disconnect Plugs
AN3108	90-Degree Angle Plugs
AND10066	Integral Mounting Receptacles
AND10459	Integral Mounting Plugs

PURPOSE

2 AN connectors are designed to provide a detachable means of connection between electrical circuits in aircraft, and are constructed to withstand the extreme operating conditions imposed by this service. Connectors used in these critical electrical circuits must make and hold electrical circuits securely and without undue voltage drop despite extreme vibration, rapid shifts in temperature, and vast altitude differences.

MANUFACTURERS' DESIGNATIONS

3 As there are several manufacturers of these connectors, no list of manufacturers' part numbers is supplied. However, any manufacturer can supply the correct connector from the AN number. Connectors obtained from any manufacturer will engage properly with the mating connector of any other manufacturer.

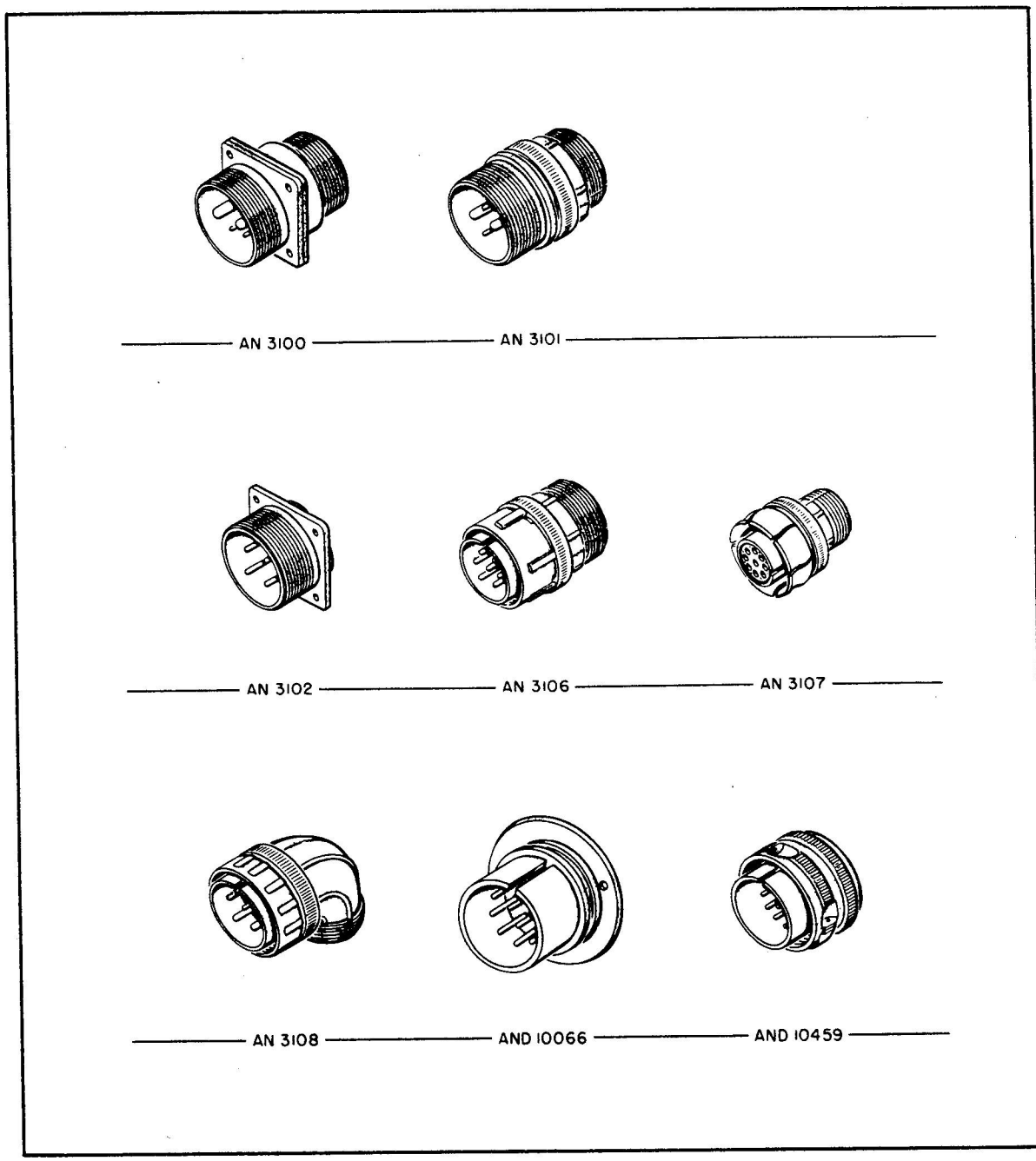


Figure 1-1 AN Connectors

PART 2

TABLE OF CONTENTS

DESCRIPTION

GENERAL

1 AN connectors covered in this handbook vary widely in their design and application. A simple connector consists of a plug assembly and a receptacle assembly which are coupled together by means of a coupling nut. Basically, the plug and receptacle assemblies each consist of an aluminum shell containing an insulating insert which holds the current-carrying contacts. This basic design allows wide variation in shell type, design, and size: contact layout, and insert style. The plug is the connector half that mounts the coupling nut and is the cable interconnection between receptacles. The receptacle is that half of the connector to which a plug is connected and is usually a mounted component.

SHELL TYPES

2 Eight shell types of AN connectors for general application are covered in this EO, see Figure 1-1. Descriptions of these connectors are as follows:-

AN3100, Wall Mounting Receptacle

(a) This connector is intended for use with conduit to eliminate the necessity of installing a conduit box to provide a means of connecting and disconnecting electrical circuits. It consists, normally, of a front shell, insert, insert retaining device, and a rear shell for conduit entrance.

AN3101, Cable Connecting Receptacle

(b) This connector is intended for use with cable or in other installations where mounting provisions are not required. It is normally of the same construction as AN3100 except that the front shell is constructed without a mounting flange.

AN3102, Box Mounting Receptacle

(c) This connector is intended for use where a detachable connection is required on a shielded box or unit of equipment. Its construction is substantially the same as that of AN3100 except that a rear shell is not provided since direct connections (without conduit) are made within the unit.

AN3106, Quick Disconnect Plug

(d) This connector is intended for use

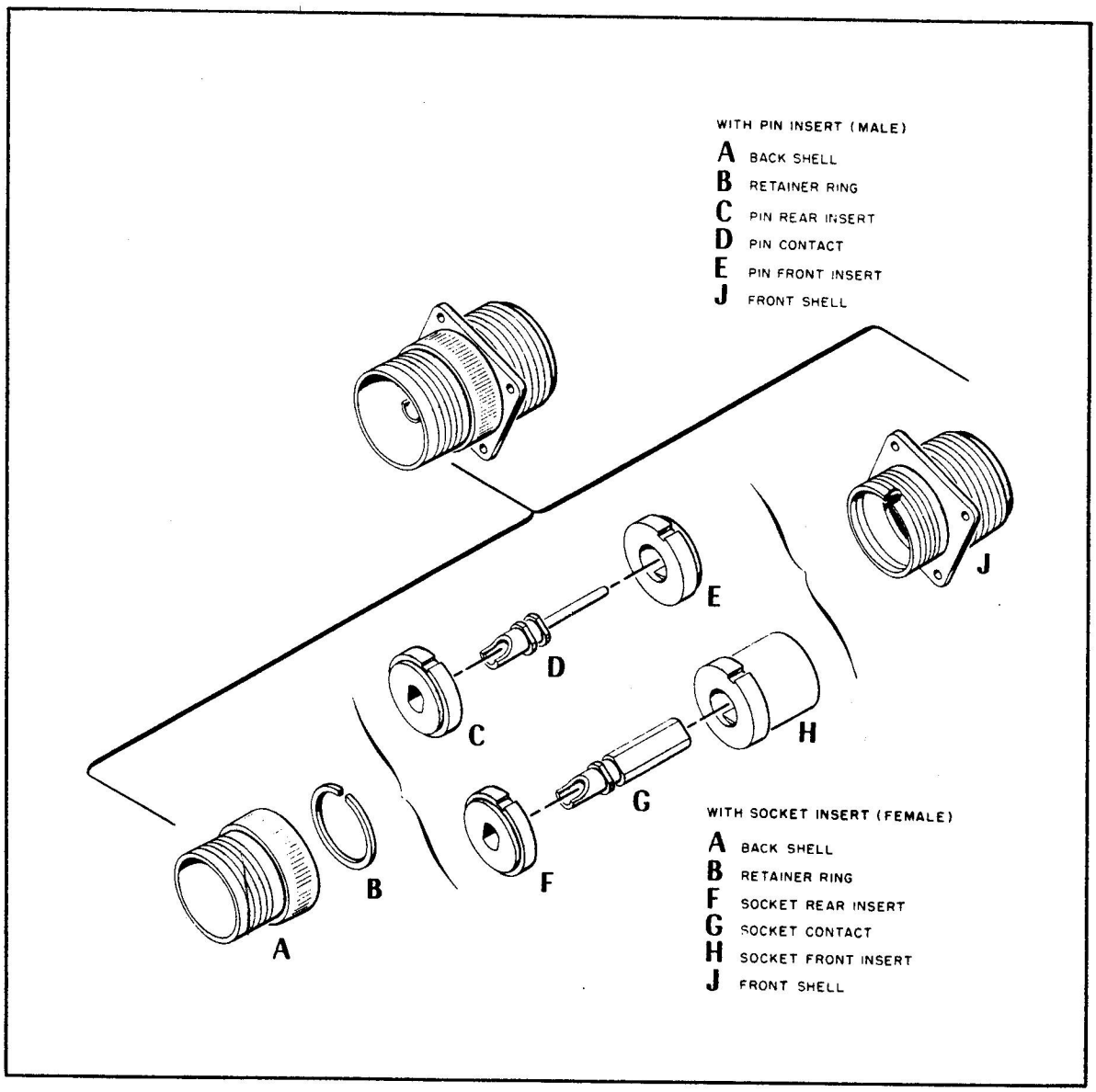


Figure 2-1 Exploded View - AN3100A

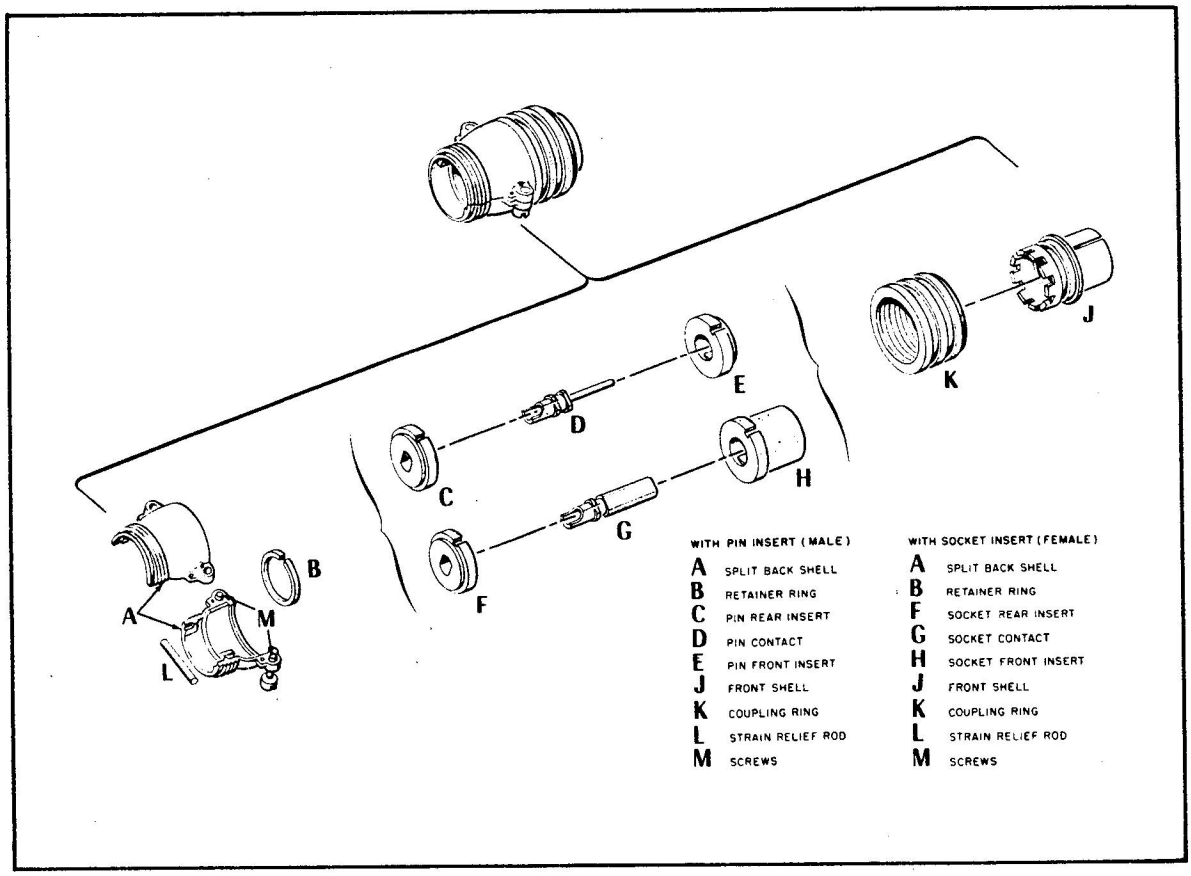


Figure 2-2 Exploded View - AN3106B

wherever circuits are to be connected with AN receptacles and where space limitations are not critical. It consists of a front shell, usually referred to as an "insert barrel", coupling ring, insert, insert retaining device, and a rear shell.

AN3107, Quick Disconnect Plug

(e) This connector is intended for use with receptacles where extremely rapid disconnection is essential. Its construction is identical with that of AN3106 except that in place of a coupling ring, it mounts a special coupling device which is engaged and disengaged by an application of pressure, rather than with threads. Quick disconnect plugs should not be used where vibratory or other shock conditions exist.

AN3108, 90-Degree Angle Plug

(f) This connector is intended for use where space limitations prevent the use of AN3106. Its construction is the same as that of AN3106 except that the rear shell provides a 90-degree bend to allow wire take-off where critical space limitations exist.

AND10066, Integral Mounting Receptacles

(g) This connector is intended for use where the shell of the receptacle is manufactured as an integral part of the electrical equipment housing. In every other way, its construction is identical with that of AN3102.

AND10459, Integral Mounting Plug

(h) This connector is intended for use where the shell of the plug can be manufactured as an integral part of the electrical equipment housing. Its construction corresponds to that of AN3106 although it does not have a rear shell.

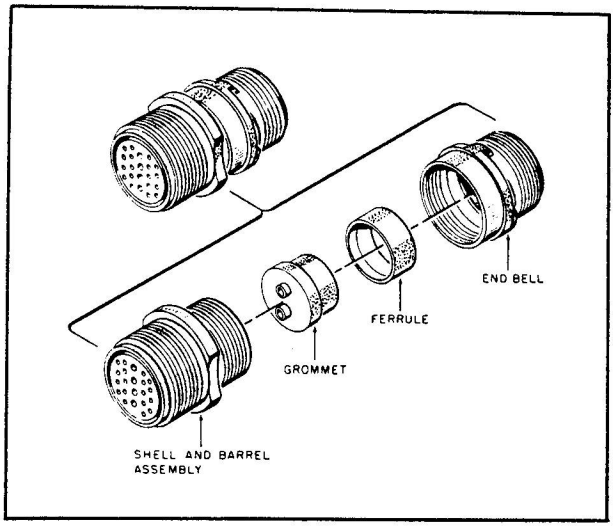


Figure 2-3 Exploded View - AN3101F

SHELL DESIGNS

3 AN connector shells are designed under eight different specifications for particular applications as follows:-

"A"	Solid Shell
"B"	Split Shell
"C"	Pressurized
"D"	Sealed
"F"	Vibration-Resistant
"H"	Flame Barrier
"K"	Fireproof
"M"	Moisture-Resistant

4 These letter designations appear in the AN number appended to the shell type(AN3106M: moisture-resistant straight plug, etc.). "A" and "B" designs are standard connectors and are used in many applications under widely variant conditions. Some types of connectors are manufactured under many of the different design specifications (AN3100, AN3106, etc.), while others may only be manufactured in one or two (AND10066, AND10459, etc.). Similarly, none of the designs are available under all connector types. Finally, designs will vary slightly from one type of connector to another and from one manufacturer to another. For these reasons, designs are covered in as broad and general a sense as possible.

"A", Solid Shell

(a) Connectors are manufactured with the rear shell die cast or machined from a single piece of aluminum, see Figure 2-1 for typical exploded view. No special features are incorporated into this design, and it should be used wherever no special requirements exist. Most specially designed connectors are solid shell, "A", designs into which other features have been incorporated.

"B", Split Shell

(b) Connectors have their rear shells manufactured in two halves, either of which may be removed by loosening the captive screws or assembly-nut, see Figure 2-2 for typical exploded view. They are normally used in conduit splicing operations where maximum accessibility to soldered connections is of prime importance.

"C", Pressurized

(c) Connectors have the same general dimensions as do "A" shells. However, in the "C" design, the insert assembly usually is not removable from the shell. In this design, the standard contacts, see Figure 2-5 are moulded into the insulator and the insulator is then pressed into the shell. The rear shell is spun over the rear of the insulator to further seal the bond. "C" connectors manufactured by another manufacturer, however, may have removable resilient rubber inserts. Pressurized receptacles are manufactured in AN3100, AN3102 and integral mounting types. They are intended to provide a pressure-tight feedthrough for electrical circuits that pass through walls or bulkheads of pressurized compartments of high altitude aircraft.

"D", Sealed

(d) Connectors may be manufactured with a glass-to-metal seal, polychloroprene rubber inserts, or in the manner of "C" connectors with sealing cement applied to the insert. These connectors are intended for use on equipment items that are completely sealed either at room conditions or purged and pressurized with a suitable gas.

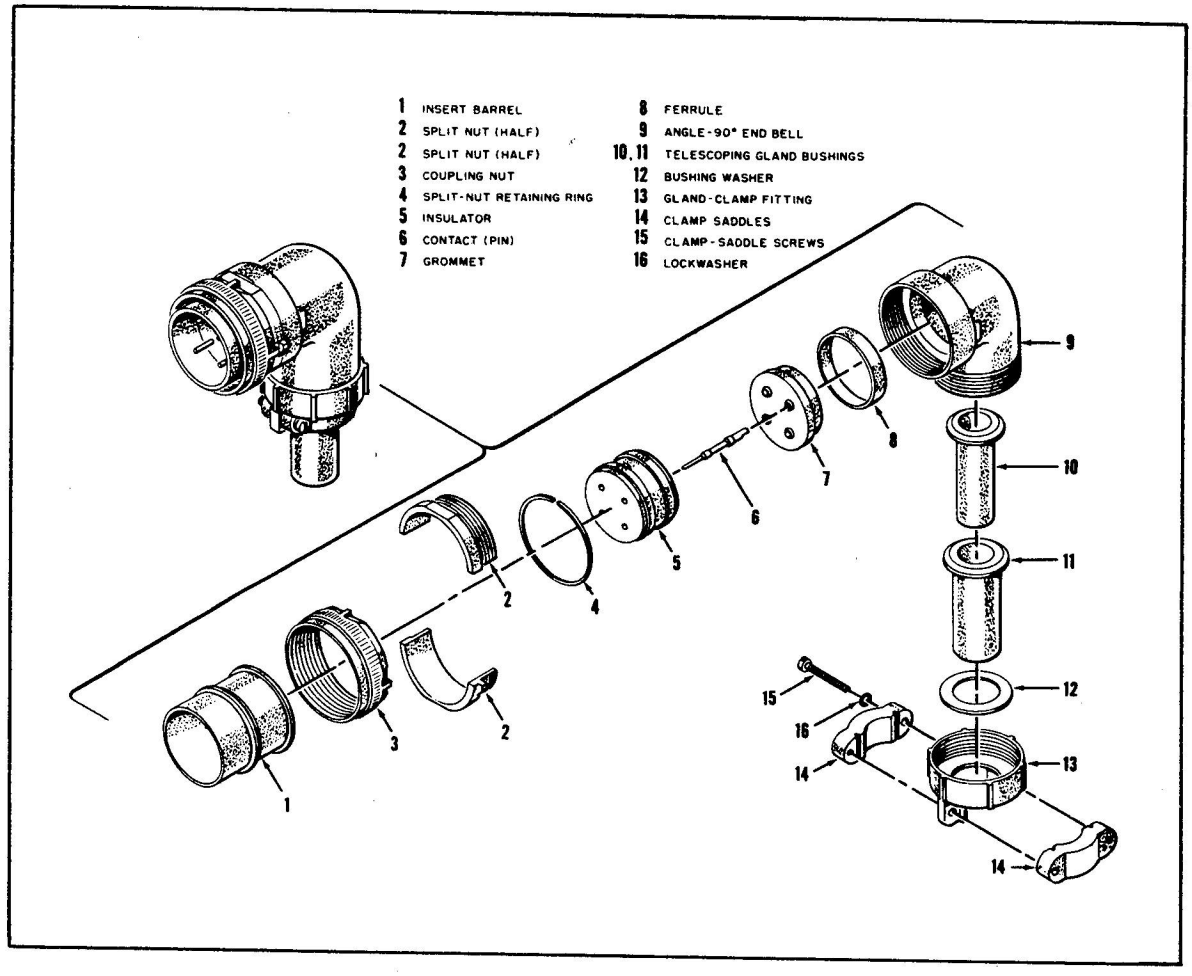


Figure 2-4 Exploded View - AN3108M

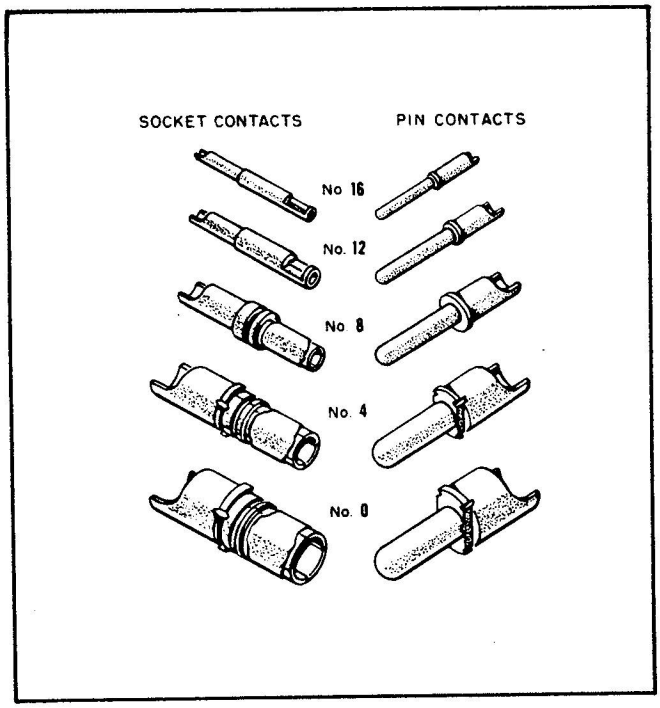


Figure 2-5 Standard Contacts for AN Connectors

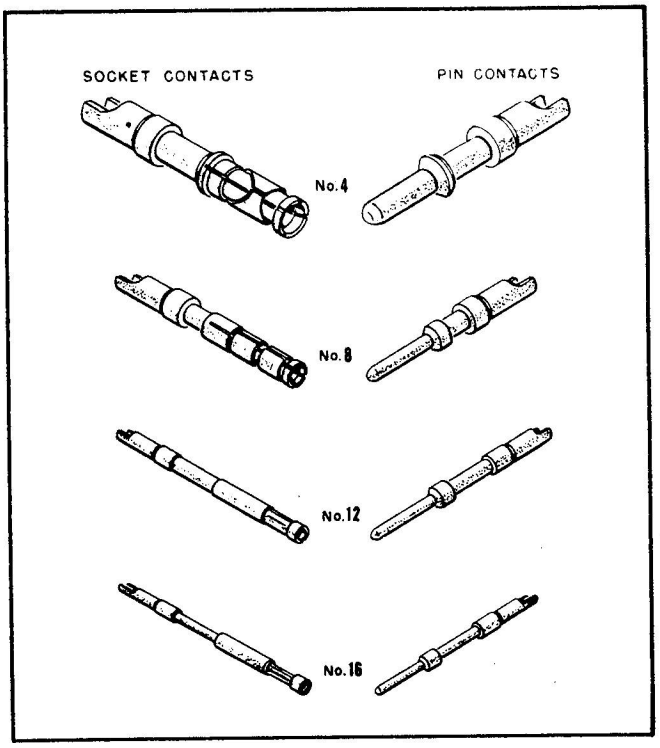


Figure 2-6 Contacts for AN-F and AN-M Connectors

"F", Vibration-Resistant

(e) Connectors contain a number of variations from standard connectors, see Figure 2-3 for typical exploded view. Among these differences are a resilient rubber insert, a different type of contact, see Figure 2-6, addition of a rubber grommet, and a grommet retaining ferrule. The rear shell is spun over the insert assembly to keep moisture from entering the insert. These connectors are intended for use on equipment subjected to high vibratory conditions such as installations on or near reciprocating engines.

"H", Flame Barrier, and "K", Fireproof

(f) Connectors are, ordinarily, both manufactured under the more exacting "K" specifications. Inserts are formed of a ceramic material; special "crimp" contacts are used, and a different retaining device, usually a spanner nut, is utilized. They are intended for use wherever it is necessary to maintain continuity of electrical service for a limited time, even though the connector is subject to continuing flame.

"M", Moisture-Resistant

(g) Connectors are the latest development in AN connectors. They consist of a combination of "A", "C" and "F" connector features, see Figure 2-4 for typical exploded view. In addition, bushings (AN3420) and special "saddle" clamps (AN3057A) are used in connection with the cable entry. "M" connectors are designed to operate under extreme humidity conditions without breakdown of the insulation resistance. These connectors are intended for use wherever electrical circuits must be maintained despite the effects of rain, oil spray, or atmospheric condensation.

STANDARD INSERTS, Figure 3-1

5 Table of Standard Inserts, illustrates all standard inserts in manufacture at this time. These views are of the pin engaging side of the male insert (socket inserts are exactly reverse) and are drawn approximately one-half size. The first line immediately beneath the insert drawing indicates the insert code number. This number is meaningless except as a form of identification. The next line lists the number of contacts and their sizes. Contacts are coded

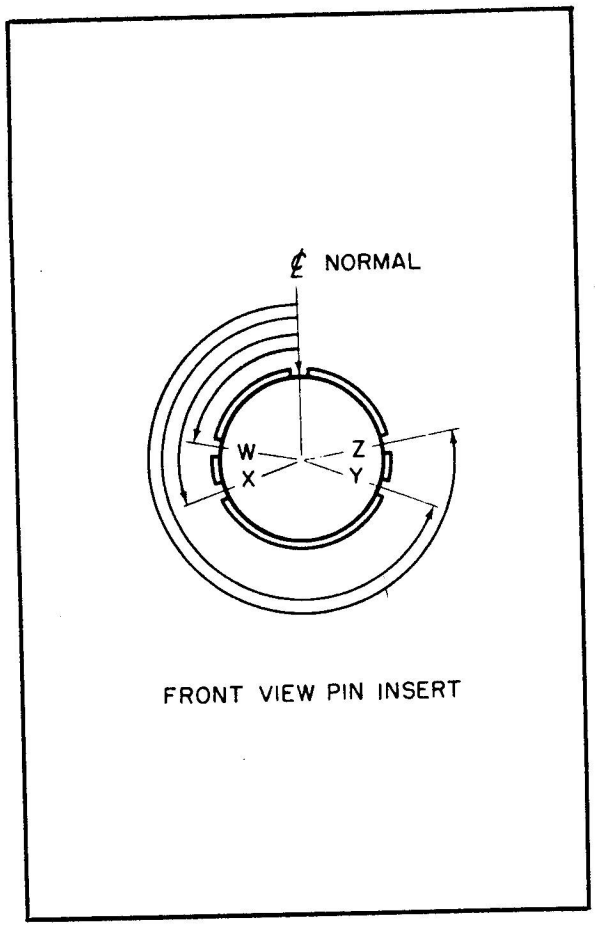


Figure 2-7 Alternate Insert Positions

in the illustrations to facilitate identification of contact sizes. The bottom line supplies the service rating of the connector as a whole, or of the individual contacts as specified. The service code, contact size code, and current ratings of contacts are supplied with this table. All standard inserts have their key or keyway in the normal position at zero degrees, see Figure 2-7.

INSERT STYLE

6 Inserts are manufactured in both P (pin, or male) and S (socket, or female) styles. A plug or receptacle may have either style insert, dependent upon its intended use.

SPECIAL CONNECTORS

7 Specially designed AN connectors are sometimes manufactured for a particular application. These connectors may have alternate insert positions. These variations are indicated in the AN number as can be seen in Figure 3-2. Alternate insert positions are not identical for all special connectors. Table 2 lists the alternate insert positions for all inserts that may be manufactured in an alternate position. Figure 2-7 illustrates these alternate positions. Unless the alternate insert position is indicated in the AN number of a connector, the connector is a standard AN connector and was manufactures under the normal specifications.

TABLE 2

ALTERNATE INSERT POSITIONS

INSERT NO	POSITION IN DEGREES			
	W	X	Y	Z
12S-3	70	145	215	290
14S-2	-	120	240	-
14S-5	-	110	-	-
14S-7	90	180	270	-
14S-9	70	145	215	290
16S-1	80	-	-	280
16S-3	-	170	265	-
16S-4	35	110	250	325
16S-5	70	145	215	290
16-7	80	110	250	280
16-9	35	110	250	325
16-10	90	180	270	-
16-11	35	110	250	325
16-13	35	110	250	325
18-1	70	145	215	290
18-3	35	110	250	325
18-4	35	110	250	325
18-5	80	110	250	280
18-8	70	-	-	290
18-9	80	110	250	280
18-10	-	120	240	-
18-11	-	170	265	-
18-12	80	-	-	280
18-13	80	110	250	280
18-14	80	110	250	280
18-15	-	120	240	-
18-20	90	180	270	-
18-22	70	145	215	290
18-29	90	180	270	-
20-3	70	145	215	290
20-4	45	110	250	-
20-5	35	110	250	325
20-6	70	145	215	290
20-7	80	110	250	280
20-8	80	110	250	280
20-9	80	110	250	280
20-12	80	110	250	280
20-14	80	110	250	280
20-15	80	-	-	280
20-16	80	110	250	280
20-17	90	180	270	-
20-18	35	110	250	325

INSERT NO	POSITION IN DEGREES			
	W	X	Y	Z
20-19	90	180	270	-
20-20	80	110	250	280
20-21	35	110	250	325
20-22	80	110	250	280
20-23	35	110	250	325
20-24	35	110	250	325
20-27	35	110	250	325
22-1	35	110	250	325
22-2	70	145	215	290
22-3	80	110	250	280
22-4	35	110	250	325
22-5	35	110	250	325
22-6	80	110	250	280
22-8	35	110	250	325
22-9	70	145	215	290
22-10	35	110	250	325
22-11	35	110	250	325
22-12	80	110	250	280
22-13	35	110	250	325
22-14	80	110	250	280
22-15	80	110	250	280
22-16	80	110	250	280
22-17	80	110	250	280
22-18	80	110	250	280
22-19	80	110	250	280
22-20	35	110	250	325
22-21	80	110	250	280
22-22	-	110	250	111
22-23	35	-	250	-
22-24	80	110	250	280
22-27	80	-	250	280
22-28	80	-	-	280
22-29	80	110	250	280
22-33	80	110	250	280
22-34	80	110	250	280
22-36	90	-	270	-
24-1	80	110	250	280
24-2	80	-	-	280
24-3	80	110	250	280
24-4	80	110	250	280
24-5	80	110	250	280
24-6	80	110	250	280

TABLE 2 (Cont'd)

INSERT NO	POSITION IN DEGREES			
	W	X	Y	Z
24-7	80	110	250	280
24-9	35	110	250	325
24-10	80	-	-	280
24-11	35	110	250	325
24-12	80	110	250	280
24-14	80	110	250	280
24-16	80	110	250	280
24-17	80	110	250	280
24-20	80	110	250	280
24-21	80	110	250	280
24-22	45	110	250	-
24-23	80	110	250	280
24-27	80	-	-	280
24-28	80	110	250	280
28-2	35	110	250	325
28-3	70	145	215	290
28-4	80	110	250	280
28-5	35	110	250	325
28-6	70	145	215	290
28-7	35	110	250	325
28-8	80	110	250	280
28-9	80	110	250	280
28-10	80	110	250	280
28-11	80	110	250	280
28-12	90	180	270	-
28-14	80	110	250	280
28-15	80	110	250	280
28-16	80	110	250	280
28-17	80	110	250	280
28-18	70	145	215	290
28-19	80	110	250	280
28-20	80	110	250	280
28-21	80	110	250	280
28-22	70	145	215	290
32-1	80	110	250	280
32-2	70	145	215	290
32-3	80	110	250	280
32-4	80	110	250	280
32-5	35	110	250	325

INSERT NO	POSITION IN DEGREES			
	W	X	Y	Z
32-6	80	110	250	280
32-7	80	125	235	280
32-8	80	125	235	280
32-9	80	110	250	280
32-10	80	110	250	280
32-12	80	110	250	280
32-13	80	110	250	280
32-15	35	110	250	280
32-17	45	110	250	-
32-101	65	125	225	310
32-102	65	125	225	310
36-1	80	110	250	280
36-3	70	145	215	290
36-4	70	145	215	290
36-5	-	120	240	-
36-6	35	110	250	325
36-7	80	110	250	280
36-8	80	110	250	280
36-9	80	125	235	280
36-10	80	125	235	280
36-13	80	110	250	280
36-14	90	180	270	-
36-15	60	125	245	305
40-1	65	130	235	300
40-2	80	110	250	280
40-3	80	110	250	280
40-4	80	110	250	280
40-5	80	110	250	280
40-6	80	110	250	280
40-7	80	110	250	280
40-9	65	125	225	310
40-10	65	125	225	310
40-11	80	110	250	280
44-1	65	125	225	310
44-2	65	125	225	310
44-3	65	125	225	310
44-4	65	125	225	310
48-1	65	125	225	310

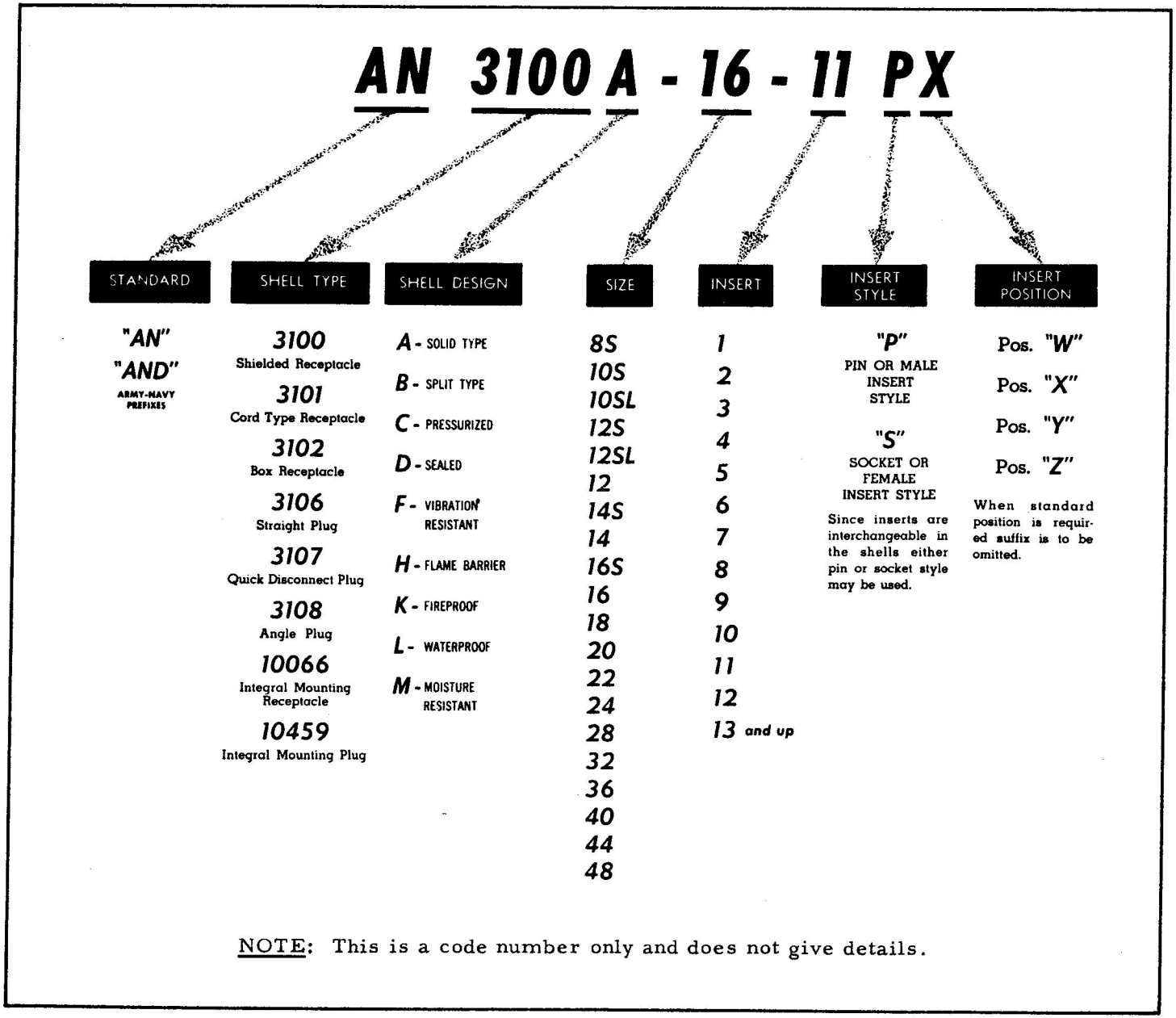


Figure 3-2 AN Numbering System

SELECTION OF SHELL SIZE

5 The shell size of an AN connector is automatically determined in the selection of an insert.

SELECTION OF SHELL DESIGN

6 AN connectors are manufactured in eight designs. "A", solid shell, and "B", split shell, connectors are standard designs and should be used where no special problems exist. When a special purpose design (pressurized, vibration-resistant, etc.) is required, it should be selected for its particular application by referring to paragraph 3 of Part 2 of this EO.

SELECTION OF SHELL TYPE

7 In selecting the type of shell required, refer to paragraph 2 of Part 2 of this EO which lists all shell types and their applications.

SPECIAL CONNECTORS

8 Variations from standard connectors are noted in paragraph 6 of Part 2 and Figure 3-2 of this EO. These variations must be included in the AN number in ordering special connectors. Unless specified, inserts will be supplied in the normal position.

FORMING AN AN NUMBER

9 Refer to Figure 3-2 in forming an AN number for ordering a connector. This number will include all the information that is necessary for the selection of a specific connector; for instance, a plug and receptacle are needed to connect a single conductor carrying 500 volts dc at 45 amperes from a generator through a fuselage bulkhead. Referring to Figure 3-1, it is seen that insert number 14-3 is the smallest insert capable of handling the voltage and current required. Since the plug will be "hot", coming from the generator, the insert will be S (socket) style and the receptacle must be of the P (pin) style. Both connectors may be of solid shell ("A") design. Unless space is limited, a straight plug, AN3106, and AN3100, wall mounting receptacle should be used. Thus the AN number for the plug would be AN3106A-14-3S, and that of the receptacle AN3100A-14-3P.

PART 4

TABLE OF CONTENTS

PREPARATION OF CABLE ENDINGS AND MOUNTING OF RECEPTACLES

SERVICE TOOLS

1 Table 3 lists the standard service tools and test equipment required for the procedures outlined in this section.

MOUNTING OF RECEPTACLES

2 In order to mount either AN3100 or AN3102 receptacles, five holes must be provided through the panel or bulkhead where the connector is to be mounted - one large hole to pass the barrel of the receptacle and four to pass the mounting bolts. The receptacle is then put in place and secured with four mounting bolts, washers and nuts; it is then ready for connection as outlined in the following paragraphs. Only those paragraphs which are applicable to receptacles should be followed. AN3101, cable connecting receptacle, requires no mounting and is connected in the same manner as are plugs. AND10066 receptacles will vary in their mounting provisions and no specific instructions can be included in this handbook.

PREPARATION OF CABLE ENDINGS

Stripping Conductors

3 Strip conductors as follows:-

(a) Strip the conductors back far enough so that the bare wires will just fill the solder cup of the contact. If a stripper is not available, use a knife, but be careful not to nick or cut strands of the conductors.

(b) To avoid fraying of large conductors, serve the exposed conductors with fine copper wire, see Figure 4-1.

(c) If the bared portion of a wire is dull looking, scrape it clean with a knife and re-twist between finger and thumb.

TABLE 3

NOMENCLATURE	APPLICATION
Strap Wrench	To tighten coupling rings and assembly nuts.
Wire Stripper	To strip insulation from conductors.
Knife	To remove outer insulation and shielding from conductors.
Soldering Coppers	All soldering operations.
Soldering Jigs	To hold connectors and inserts while soldering.
Solder Pot	To tin conductors and large contacts.
Continuity Tester	To test continuity of assembled connectors

Tinning Conductors

4 Tin conductors as follows:-

(a) Small conductors should be held together loosely when dipping the bare ends into a small container of flux, see Figure 4-2. Large conductors should be fluxed individually.

CAUTION

Under no circumstances should any flux other than rosin be used.

(b) Remove any excess flux by shaking, then dip the conductor ends into molten solder in a solder pot, see Figure 4-3. Large conductors should be tinned individually, see Figure 4-4. Remove excess solder by lightly shaking the group of wires, or the individual large conductors, while solder is still molten.

NOTE

If coding bands are to be used, and it is advisable to do so, they should be applied to the insulation approximately 3/16" behind the bared portion of the conductor, see Figure 4-5.

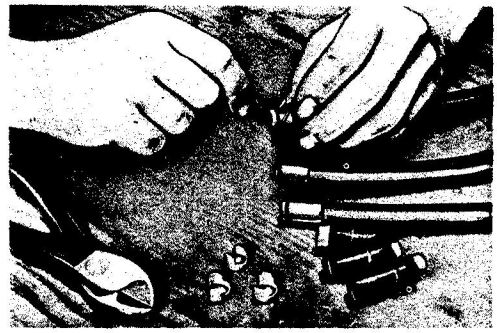


Figure 4-1 Servicing Large Conductors

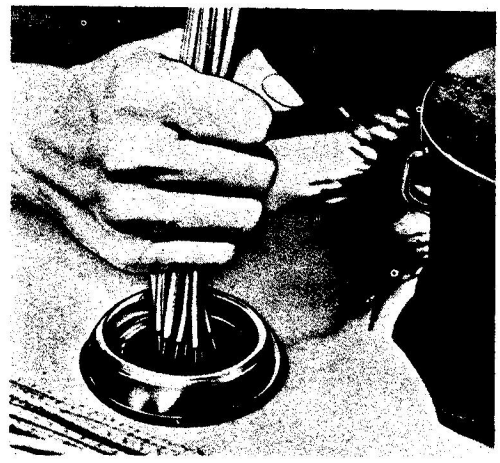


Figure 4-2 Fluxing Small Conductors

DISASSEMBLY OF AN CONNECTORS

General

5 AN3102, AND10066, and AND10459 plugs and receptacles need not be disassembled for soldering unless they contain contacts larger than #12. These connectors are not equipped with rear shells, and solder pots extend far enough for easy soldering. All other connectors except those of "F" and "M" design need only have their rear shells removed for soldering unless they contain contacts larger than #12. All connectors having contacts larger than #12

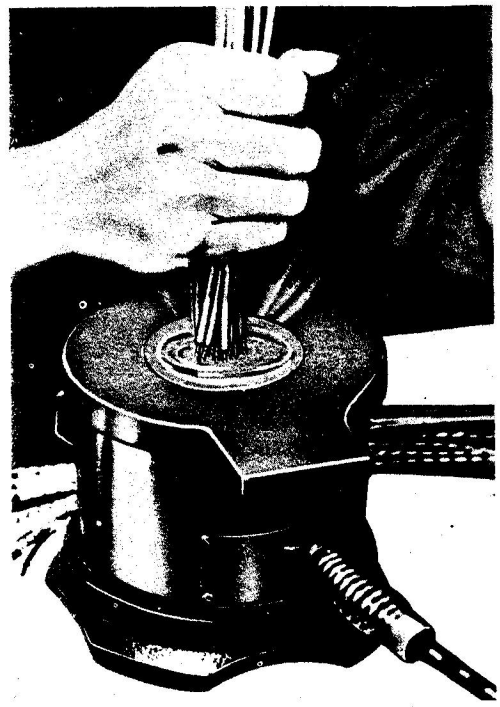


Figure 4-3 Tinning Small Conductors

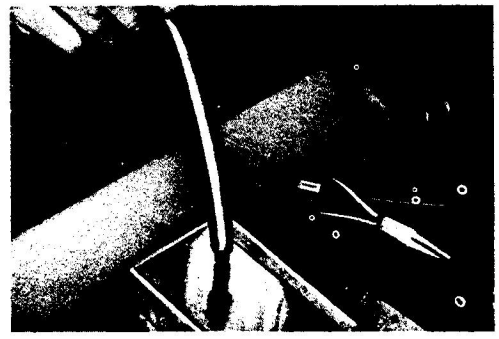


Figure 4-4 Tinning Large Conductors

that are secured in the insert by the use of spring clips, see Figure 4-2, need only have these clips removed and the large contacts extracted to be ready for soldering. All other connectors must be fully disassembled.

DISASSEMBLY OF "A", "B", "C", "D", "H", AND "K" CONNECTORS

6 Disassemble connectors as follows:-

(a) If the rear shell is of solid shell construction, remove it by unscrewing from the connector body. If it is of the split shell variety, remove the assembly nut or two screws, whichever is applicable, securing the two halves of the rear shell, see Figure 4-6. Remove the two halves of the split rear shell to expose the solder cups for soldering.

(b) If contacts larger than #12 are present, and they are secured by spring clips, pry them off with a small screwdriver, see Figure 4-7. The large contacts should then be given a quarter turn and be lifted out of the insulator, see Figure 4-8. Small contacts will remain in the insulator body. If large contacts are not secured with snap rings, the insert retaining ring must be removed, see Figure 4-9. The entire assembly will then come apart, see Figure 4-10.

DISASSEMBLY OF "F" AND "M" CONNECTORS, see Figures 2-3 and 2-4

7 Disassemble as follows:-

(a) Loosen the grounding shield screw and the two screws on the gland-clamp saddles of "M" connectors, and remove the saddles, so that the gland-clamp fitting is free to turn about the telescoping gland bushing.

(b) Hold the rear shell securely on "M" connectors and loosen the gland-clamp fitting, using a strap wrench if necessary. Remove the gland-clamp fitting by hand.

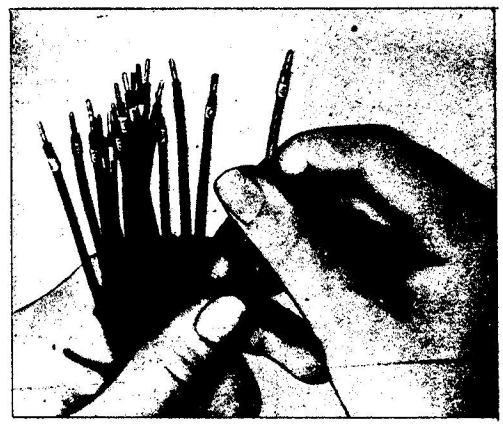


Figure 4-5 Coded Conductors

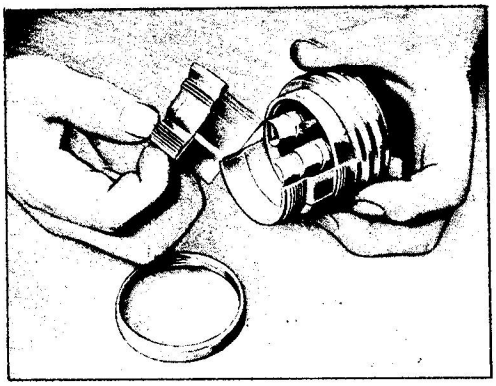


Figure 4-6 Removing Split Shells

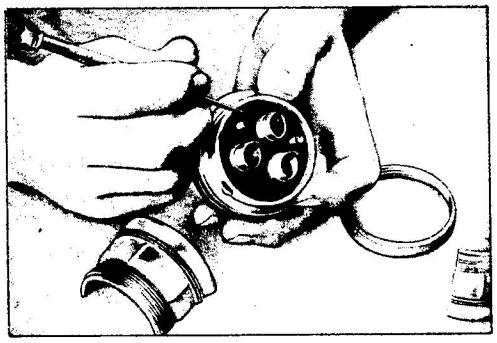


Figure 4-7 Removing Spring Clips

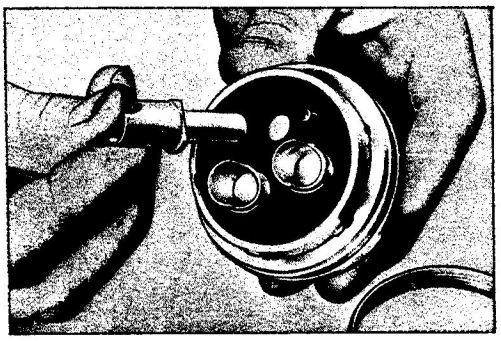


Figure 4-8 Removing Large Contacts

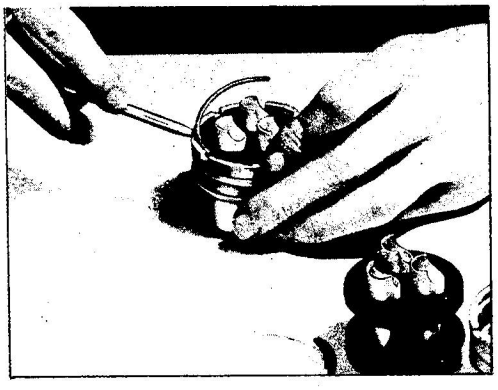


Figure 4-9 Removing Snap Ring

(c) Remove the telescoping gland bushings of "M" connectors.

(d) Loosen the rear shell on "F" and "M" connectors,.and remove it.

(e) Remove the grommet retaining ferrule in both connectors and lift out the grommet.

(f) If contacts larger than #12 are used, place the insert barrel over a hole slightly larger than the contact, with the solder pot end of the contacts upward. Insert a dowel of wood or plastic, small enough to fit into the solder pot, and then push out the contact with a steady pressure.

CAUTION

Do not remove smaller contacts except for emergency repair or replacement, as damage may be done to the insert.

(g) "F" and "M" connectors are now ready for soldering.

TINNING CONTACTS

8 Tin contacts as follows:-

NOTE

New contacts need not be tinned as they are pre-tinned during manufacture. It is advisable, however, to tin contacts that have been used in prior service.

(a) When tinning small contacts, place the connector body in a jig or fixture so that the solder cups are tilted back at a slight angle, see Figure 4-11. Apply a slight amount of rosin flux to the inside of each cup. Hold a soldering

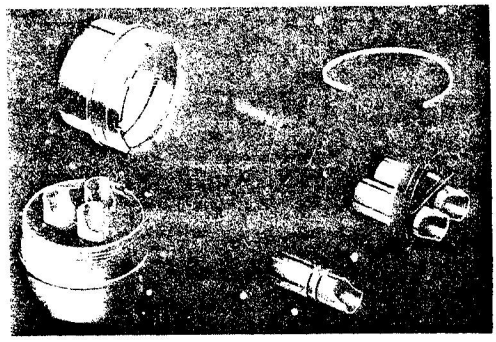


Figure 4-10 Disassembled Plug

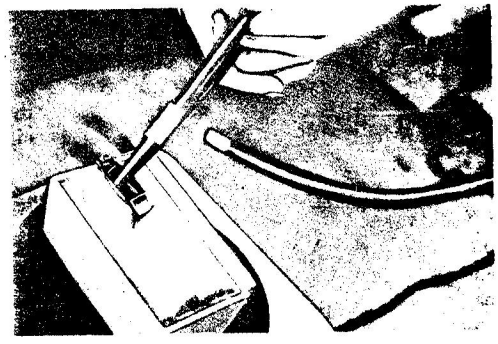


Figure 4-12 Tinning Masked Contacts

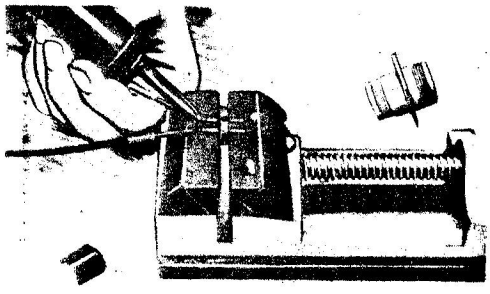


Figure 4-11 Typical Holding Fixture

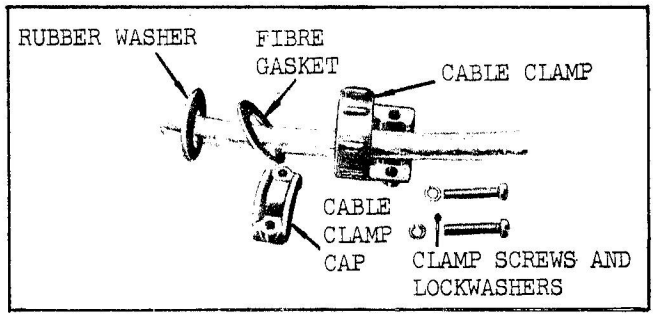


Figure 4-13 Cable Clamp Parts on Cable

copper against the back of each cup and apply wire solder to the inside until it flows into the cup.

CAUTION

Never hold soldering copper against a solder cup longer than necessary. The heat will be conducted to the insulator and cause it to buckle, crack, or warp.

(b) Large contacts should be wrapped carefully on the outside with friction tape and tinned in a solder pot, see Figure 4-12. This wrapping keeps any solder from adhering to the outer portion of the contact.

USE OF CABLE CLAMPS

9 If an AN3057 cable clamp is to be used, disassemble it by removing two screws and removing the top half of the saddle portion.

10 The cable clamp with its two gaskets should be slipped over the cable or group of conductors, see Figure 4-13. Be sure to have the threaded portion facing the end of the cable that is to be attached to the plug or receptable.

POSITIONING PARTS ON CABLE OR CONDUCTORS

11 Position as follows:-

(a) When preparing "A", "B", "C", "D", "F", "H", or "K" connectors for soldering, if an AN3057 cable clamp is to be used, it should be positioned on the cable or group of conductors as outlined in paragraphs 9 and 10. When preparing "M" connectors, the gland-clamp fitting, bushing washer, and telescoping gland bushings should be placed on the cable in the order above.

(b) Rear shells, grommet retaining ferrules, and split nut retaining rings (in the case of some "F" connectors), whichever are applicable, should then be placed on the cable.

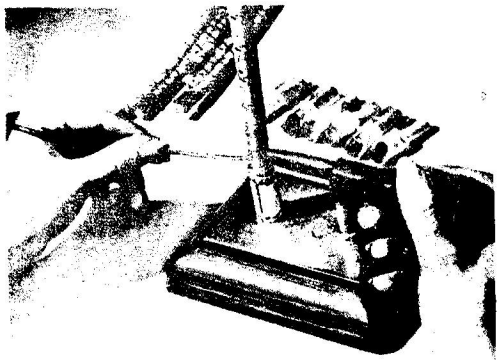


Figure 4-14 Contact Holding Fixture

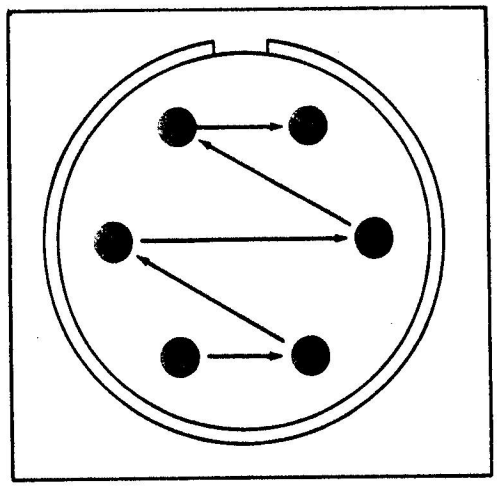


Figure 4-16 Sequence of Soldering

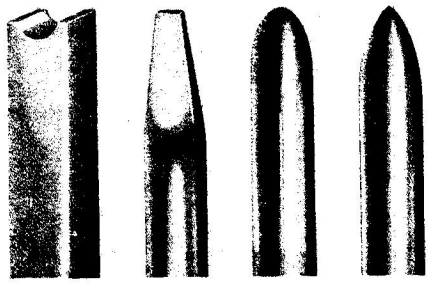


Figure 4-15 Soldering Coppers

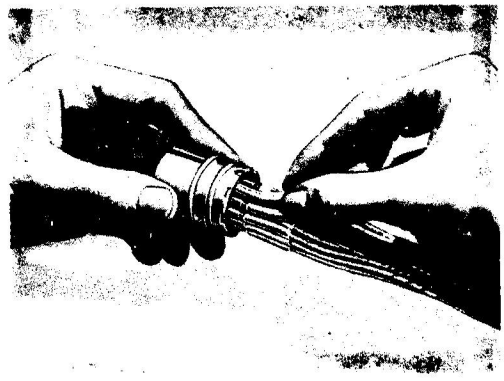


Figure 4-17 Insulating Soldered Joints

(c) When using "F" or "M" connectors, the rubber grommet should have all the individual leads to be connected threaded through their respective holes.

Use of Insulating Sleeves

12 On all connectors except "F" and "M" designs, a clear insulating sleeve is to be slid over each conductor. If available, use the transparent type as it is easier to identify either number, or colour, coding of wires through a transparent sleeve. This insulating sleeve should be just long enough to cover the soldered joint when it is slid down over the completed connection.

SOLDERING CONDUCTORS TO CONTACTS

13 Large contacts should be inserted in a contact holding fixture, see Figure 4-14. Heat the contact with a large parabolic soldering copper, see Figure 4-15, until solder melts, then insert the tinned conductor into the contact. Allow a good joint to be made, then remove the soldering copper and allow the joint to cool. When the joint has cooled, the masking tape should be removed from the large contact.

14 With the connector in a holding jig or fixture, small contacts should be heated by holding a soldering copper against the back of the solder cup. When the solder melts, insert the tinned conductor into the cup. If necessary,

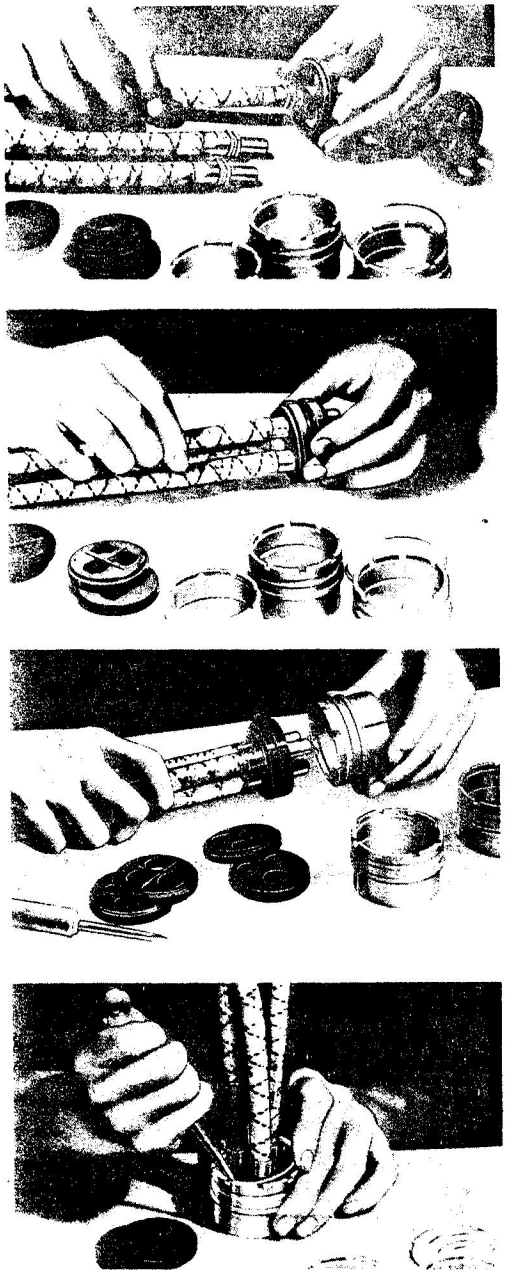


Figure 4-18 Progressive Assembly of Snap Ring Held Connectors

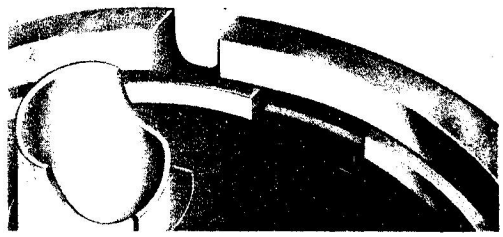


Figure 4-19 Proper Positioning of Snap Ring

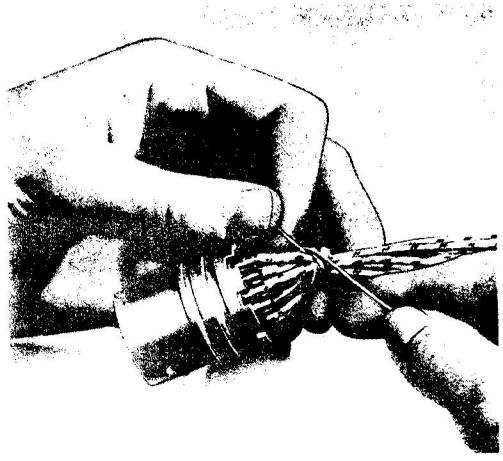


Figure 4-20 Tying Conductors

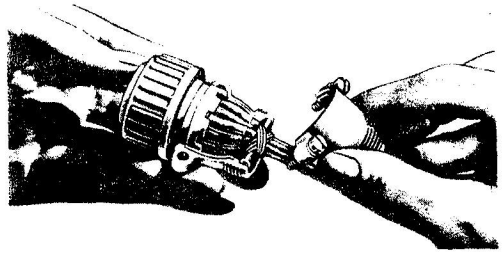


Figure 4-21 Use of Strain Relief Bar

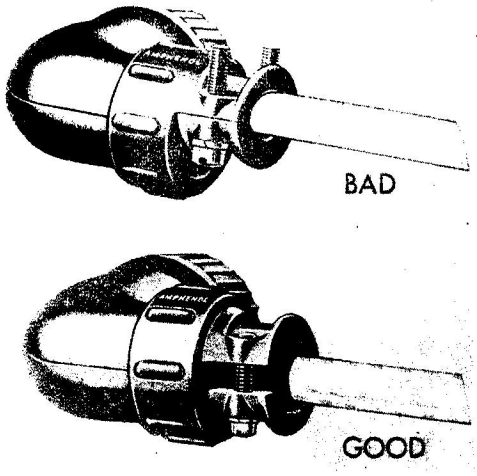


Figure 4-22 Good and Bad Cable Clamps

run more solder into the cup around the conductor.

15 It is important to hold the conductors steady in the cup after removing the soldering copper. If the conductor is moved before the solder solidifies, the joint will crack or turn grey and be unacceptable. This is commonly called a "cold joint".

16 In working on cables composed of a large number of small conductors, it is especially important to follow a pre-arranged sequence in soldering the conductors, As a general rule, when using a jig or holding fixture it will be best to start from the bottom connection and work up from left to right, see Figure 4-16. If the work is being done without the benefit of a holding fixture, the best sequence will probably be to work from the centre out.

17 Clean off all excess flux from contacts with alcohol.

18 After all connections have been made, they should be inspected for bad joints. Check continuity of each circuit by means of an ohmmeter, lamp, or bell.

Insulating Soldered Joints

When all circuits and soldered joints have been found to operate properly, slide the clear insulating tubing down over the soldered joints, see Figure 4-17. This protects the cable from possible shorts due to frayed conductors touching each other or the shell.

RE-ASSEMBLY

20 Re-assemble connectors as follows:-

(a) If large contacts are present, and are secured by spring clips, replace the contacts in their correct positions in the insulator and secure them with spring clips.

(b) If large contacts are snap ring held, they must be assembled with the insulators and returned to the plug or receptacle body, see Figure 4-18.

(c) If a snap ring is used, be careful to replace it so that one end projects slightly past the nick in the plug body, see Figure 4-19. This will facilitate any possible removal for service repairs.

(d) Individual conductors should be laced together with string just behind the sleeve endings, see Figure 4-20. This will help to prevent undue strain on conductor joints when the plug is attached to, or detached from, its mating receptacle.

(e) An alternate method of manufacture allows the use of a strain relief bar at this point, see Figure 4-21. The bar is placed in the centre of the bunched conductors and firmly laced into place. The shell of the plug is grooved to support this bar.

NOTE

"F" and "M" connectors are not to be laced, and strain relief bars are not provided.

(f) If the connector is a plug, the coupling ring or nut should be brought forward into its position.

(g) If the connector is a split ring-nut, "F" design, plug, the two halves of the split ring-nut

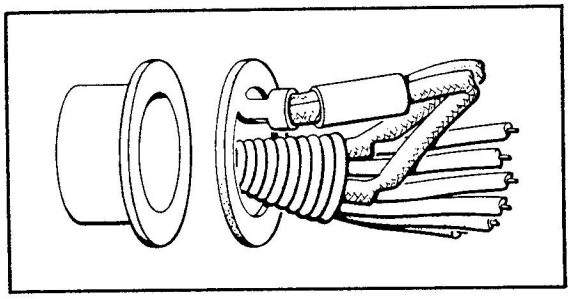


Figure 4-23 Use of Bonding Ring

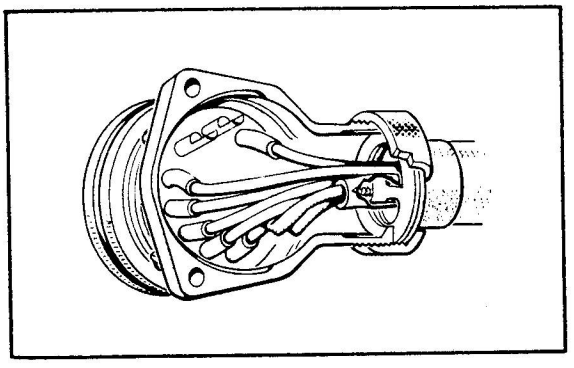


Figure 4-24 Bonding Ring in Assembly

should be fitted over the insert barrel, see Figure 2-3, and secured by pressing the split ring-nut retaining ring into its position over the two halves.

(h) Grommets of "F" and "M" designed connectors should then be brought down to meet the insulator body, and grommet ferrules should be fitted over the grommets.

(j) Rear shells may then be returned to the connector body. Solid shells should be screwed into place, while split rear shells should be fitted over the connector body and shell screws, or the assembly nut, returned to their positions and tightened.

(k) Telescoping gland bushings of "M" designed connectors should be pushed down to meet the rear shell and the bushing washer

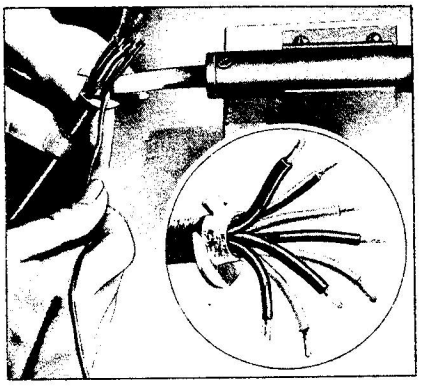


Figure 4-25 Use of Soldering Ferrule

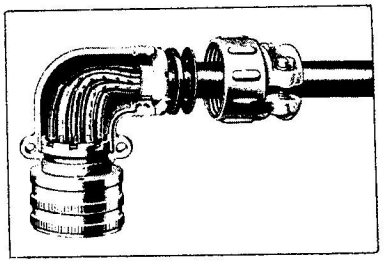


Figure 4-26 Soldering Ferrule in Assembly

pressed up behind them. The gland-clamp fitting should then be brought down and screwed onto the rear shell, and the gland-clamp saddles and screws returned to their positions. Tighten the screws to form a moisture-resistant seal.

(l) When AN3057 cable clamps are used on connectors of other than "M" design, the rubber and fibre washers should be pressed down to meet the rear shell. Screw the cable clamp onto the rear shell and return the clamp saddle and screws to their positions and tighten..

NOTE

If the group of conductors is too small to obtain a good clamp grip with the clamping screws tightened all the way, wrap the group of conductors with rubber tape until it is built up enough to obtain a good clamp, see Figure 4-22.

USE OF SHIELD CONDUIT GROUNDING METHODS

21 When multi-conductor shielded cables are used, provision must be made to make a good contact between the shield and the plug or receptacle body. There are three methods in common practice:-

(a) Figure 4-23 shows a bonding ring soldered to the shield and the solder joint covered with "spaghetti" tubing to prevent shorts from frayed shields. Figure 4-24 shows this ring assembled and held tightly against the end of the shell by a conduit coupling nut. If a cable clamp is used, it will contact the bonding ring in the same manner.

(b) Figure 4-25 shows the correct procedure for using a split type soldering ferrule to accomplish good grounding of the cable shield to the connector. Figure 4-26 is a cutaway drawing showing the ferrule in position against the plug or receptacle shell.

(c) A third method should be used on "M" connectors in which a hole is made in the shield just behind the grommet. Then all conductors should be pulled out through this hole and the empty shield should be pulled out to form a long thin conductor. A piece of "spaghetti" or vinylite sleeving should be pushed over this shield-lead. In re-assembling the connector, the shield should be bent back in the reverse direction just behind the grommet and fed out through the telescoping bushings with the conductors. When the gland-clamp fitting is re-assembled to the rear shell, a lug should be soldered to the end of this lead, and the lug should be fitted onto one of the gland-clamp fitting screws with a lockwasher.

FINAL INSPECTION

22 Test all conductors again for continuity to make sure that all connections are free from short circuits.

23 If the cable specifications call for an insulation resistance test, use a Navy Type G Insulation Resistance Test Set or other tester which will indicate resistance at the specified potential. For detailed information, see TO 08-45-24. If the cable passes these tests, it is ready for installation.

PART 5

TABLE OF CONTENTS

INSTALLATION

CONNECTING AND DISCONNECTING PLUGS

1 Cables fitted with AN connectors are easily installed. It is not necessary to force the plug into the receptacle; locate the proper position of the plug in relation to the receptacle by lining the boss or key of one part up with the groove or keyway of the other part. Start the plug into the socket with a light forward pressure and engage the threads of the coupling ring on the plug with those of the receptacle. Tightening the coupling ring exerts enough pressure to force the pin contacts into the socket contacts. Unscrewing the coupling ring pulls the pins out of the sockets and allows the plug to be removed easily by hand. A simple

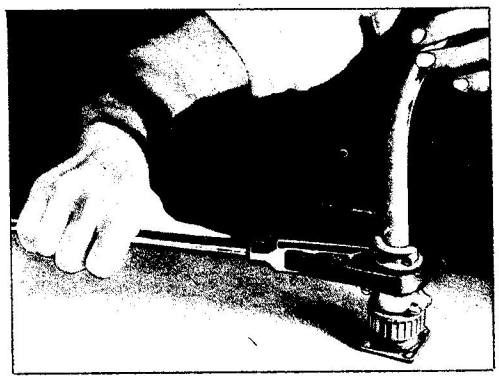
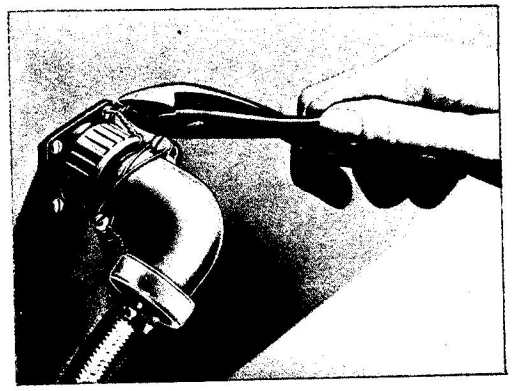


Figure 5-1 Strap Wrench in Use



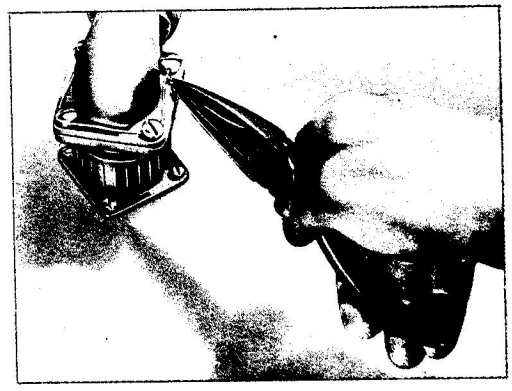


Figure 5-2 Safety Wiring

strap wrench for additional tightening may be used as shown in Figure 5-1.

SAFETY WIRING AN CONNECTORS

2 "B", split shell, connectors will usually have cross drilled screwheads. In such cases, these screws should be safety wired as shown in Figure 5-2. The coupling nuts of all AN plugs (with the exception of AN3107, quick disconnect plugs) should be safety wired to the cross drilled screws of the receptacle they join, see Figure 5-2. Stainless steel wire is recommended for all safety wiring because of its corrosion-resistant properties. When a safety wired plug is disconnected, the wire securing the coupling ring should be cut away with wire cutters. Use new wire for safety wiring of the coupling ring when the plug is returned to the receptacle.

PART 6

TABLE OF CONTENTS

SERVICE, INSPECTION, MAINTENANCE AND LUBRICATION

SERVICE TOOLS REQUIRED

1 Service tools required for the procedures outlined in this Part are listed in Table 3.

SERVICE INSPECTION

2 As AN connectors are either a part of, or used in conjunction with, major equipment units, no suggested periodic maintenance inspection table is supplied. When performing periodic inspection on the major unit, inspect all AN connectors used in conjunction with the unit.

INSPECTION AND MAINTENANCE PROCEDURE

3 Inspect and maintain connectors as follows:-

(a) Part the mating connectors and inspect the contacts for evidence of corrosion. If corrosion is present, clean the surfaces with a brush or clean rag. Finish cleaning with 1-1-1 Trichloroethane, Specification 31-GP-213.

CAUTION

Although Trichloroethane has an odor similar to ether it does not have the same effect. Like most volatile liquids, using in a confined unventilated space is to be curtailed and smoking is to be prohibited.

(b) Inspect the coupling ring for battered threads. If threads are not in good condition, replace the coupling ring. This will necessitate complete disassembly of the cable ending. Proceed as outlined in Part 4 of this handbook.

NOTE

When attaching or detaching AN connectors, be careful to avoid damaging the coupling ring. Stripped threads or a battered or bent coupling ring will require disassembly for replacement of the coupling ring.

(c) Test all cable conductors for continuity as outlined in paragraphs 22 and 23 of Part 4. If defects are found, treat as follows:-

(1) If an open circuit is found, it will probably be at a conductor termination. If the "open" is not at a conductor ending, the conductor must be replaced. If the cable is of the multi-conductor overall insulated type, replace the entire cable or, if feasible, run one conductor outside of the cable, parallel to the defective one. When it is found necessary to resolder a broken conductor or to replace a defective lead, it will probably be necessary to unsolder other conductors to get to the contact that requires attention. The easiest way to do this work is to unsolder the blocking conductors in a "vee" down to the defective connection. Re-soldering should follow the reverse procedure.

(2) A short circuit will usually be caused by a frayed strand of one conductor touching the solder cup of another conductor at a cable ending. If this is the case, clip the frayed strand. If the short is between two conductors they should both be replaced.

(d) If the specification covering the cable calls for specific insulation resistance, test conductors with a type G test set as outlined in paragraphs 22 and 23 of Part 4. If the insulation is not up to specification, and it is possible to remove the entire cable unit, do so, and bake the cable assembly at a low temperature. Retest, and if found to meet the specification, put the cable back into service. If the insulation is still not up to requirement, the entire assembly must be replaced.

LUBRICATION

4 AN connectors do not require any lubrication; however, the coupling ring threads should be given a coat of anti-seize compound when they are replaced after inspection. This compound is as specified in AN-P-51. If necessary, Dow-Corning #4 compound as specified in AN-C-128 may be used for thread lubrication.

PART 7

INSTRUCTIONS FOR POTTING AN ELECTRICAL CONNECTORS

POTTING AN ELECTRICAL CONNECTORS

1 Potted AN electrical connectors are being installed in various locations on different types of aircraft.

2 When potted connectors fail and potting of the replacement connectors is required, the ensuing instructions should be followed.

NOTE

To determine which AN connectors shall be potted, refer to the appropriate aircraft handbook.

(a) New Electrical Connectors.

(1) Solder wiring to connector pins as required for intended use and, in addition, add spare wires as necessary.

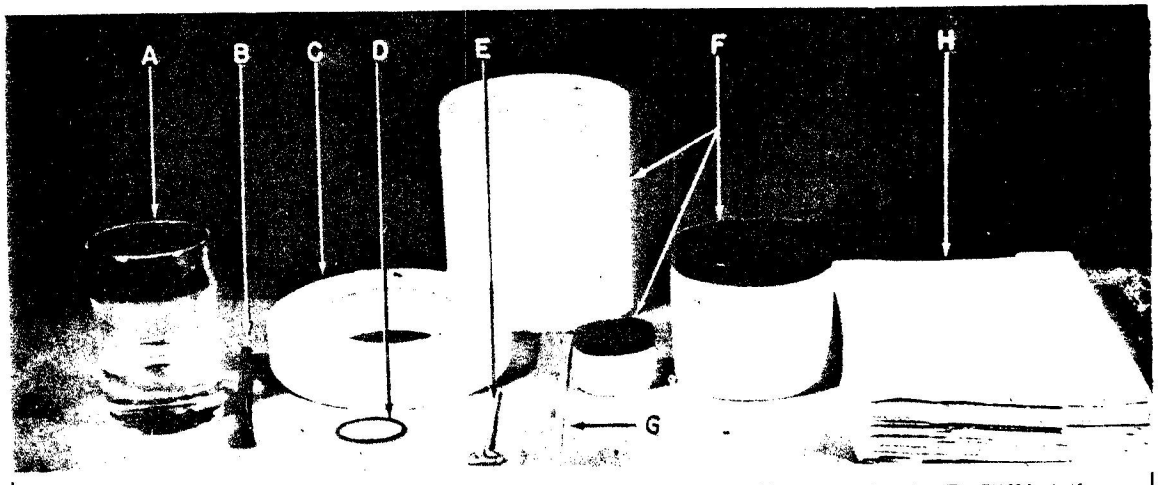
(2) Scrape excess rosin from insert and pins. Flush the area to be sealed using one of the solvents listed in paragraph 2(b). This will insure removal of any foreign matter and oil film.

(3) In preparation for application of the sealing compound, separate wires evenly.

(4) Subsequent to potting of connectors, a light film of lubricating oil shall be applied to all exterior metal surfaces. Anti-seize compound should be used on connector threads.

NOTE

Insulating material should not be placed over the leads as has been required in the past. The compound will provide a better seal around the wires without it. Proper soldering and careful inspection prior to sealing is essential.



For adequately moisture-proofing a connector you should have: A. Cleaning solvent. B. Stiff bristle brush. C. Masking tape. D. Rubber "O" ring, if required. E. Welding rod or equivalent in the length shown. (It may be used to aid in mixing if placed in a hand drill and used like an egg beater.) F. Kit of electrical connector sealant. G. Spatula. H. Paper towels.

Figure 7-1

Foreign matter is removed from the wire, pins, insert material and back shell to insure proper adhesion.

Figure 7-2

Mix the accelerator, using a clean piece of welding rod or small stick.

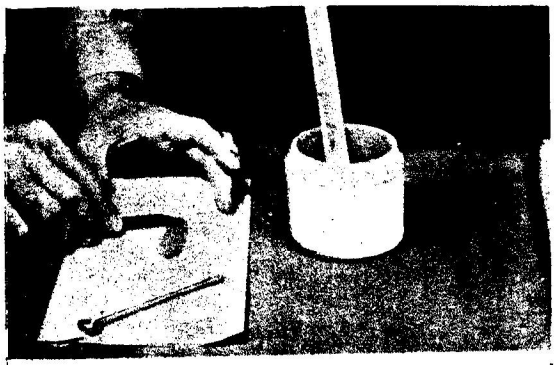
Figure 7-3

Mix the base compound and accelerator thoroughly.

Figure 7-5

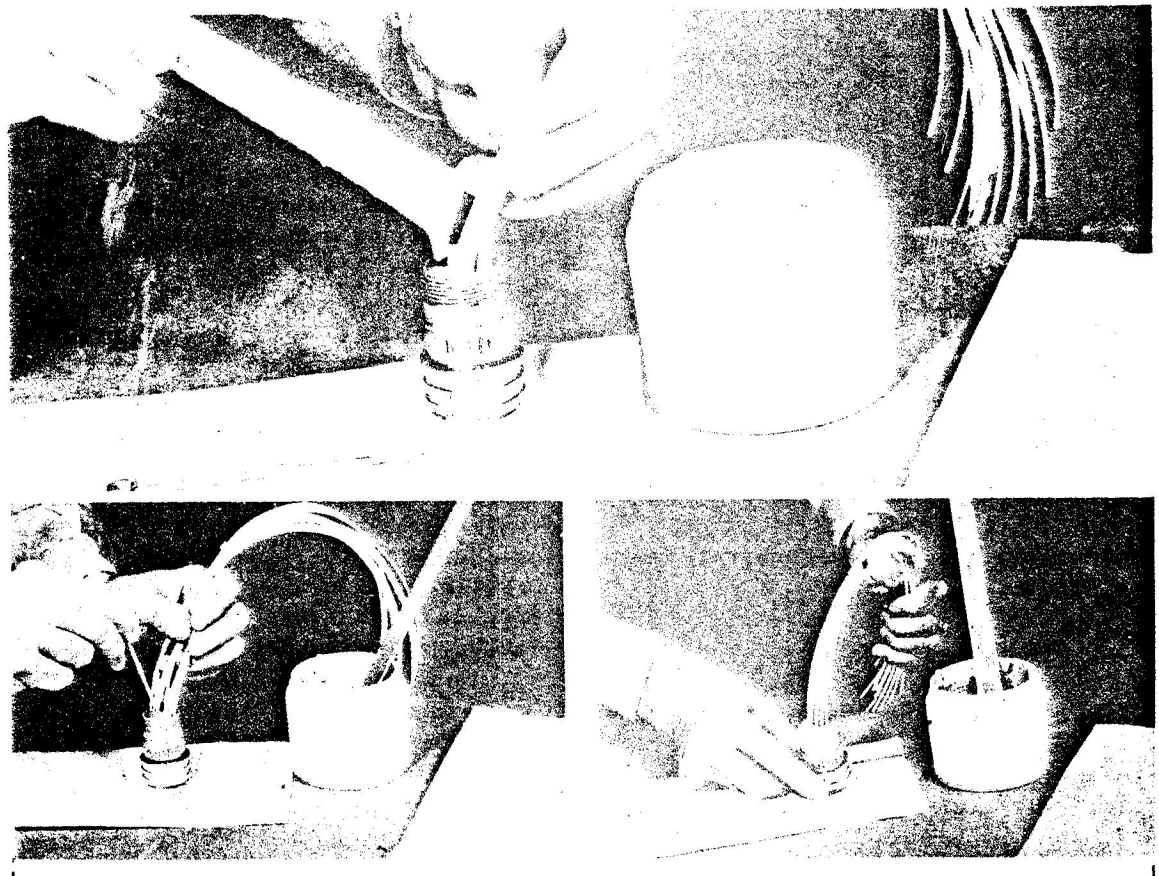
Combine accelerator with base compound.

Figure 7-4



A very thin smear of the compound on a piece of paper will reveal whether the compound is completely blended.

Figure 7-6



The application of sealant to a plug with a straight back shell.

Figure 7-7

(5) Spare wires, approximately nine inches long, should be installed in all spare pins, size 8 and smaller. The size of the wire should be the same as the size of the pin. The only exception to this is that connectors normally attached to equipment where additional wiring growth will not be required need not be so equipped. All spare wires shall be identified by their applicable insert pin letter and wire gage number. When a small or lower case letter appears on the insulation insert face, this letter shall be stamped on the wire as a double prefix to the wire gage number, for example, pp-12, aa-16, bb-20. When a capital or upper case letter appears on the insulation insert face, this letter shall be stamped on the wire as a single prefix to the wire gage number, for example, P-12, A-16, B-20. Exposed terminations of spare wires shall be sealed by dipping in either connector sealant or other such acceptable material.

(b) Old Electrical Connectors.

(1) Connectors without wires attached shall be cleaned prior to assembly by methods specified either in paragraph 2(b)(1) a. or b.

a. Connectors having hard plastic inserts may be tumbled in Turco High Flash Penetrox for not less than forty minutes, followed by a thorough rinse in dry cleaning solvent, safety solvent, naphtha or mineral spirits. The connectors shall then be vapor degreased. Under no circumstances shall con-

nectors with rubber inserts or assembled cables and bundles be cleaned by this procedure.

b. Connectors having rubber inserts SHALL and connectors having hard plastic inserts MAY be cleaned by hand by the procedure outlined in para 2(b)(2) a. b. and c. Prolonged soaking in solvent should be avoided.

(2) Connector assemblies with wires attached shall be cleaned prior to potting as follows:

a. Remove sleeving, if present, from wires and bundles.

b. Remove all loose rosin and flux. Using a small varnish or striping brush, work around all wires, lugs, pins and internal surfaces of the shells with one of the following solvents: safety solvent, mineral spirits, naphtha or dry cleaning solvent. Repeat this operation at least twice to insure a clean silicone-free back shell area.

c. Rinse the area to be potted with a small volume of methylene chloride and allow to dry. The methylene chloride should be applied by means of a hand-operated laboratory wash bottle, atomizer or similar device.

CAUTION

Health Hazard - Do not breathe methylene chloride fumes. Use only in a well ventilated area.

(3) Resolder any loose or poorly soldered connections and add spare wires as necessary.

(4) Clean as described in para 2(b)(2)c.

(5) Separate wires evenly in preparation for the application of the sealing compound.

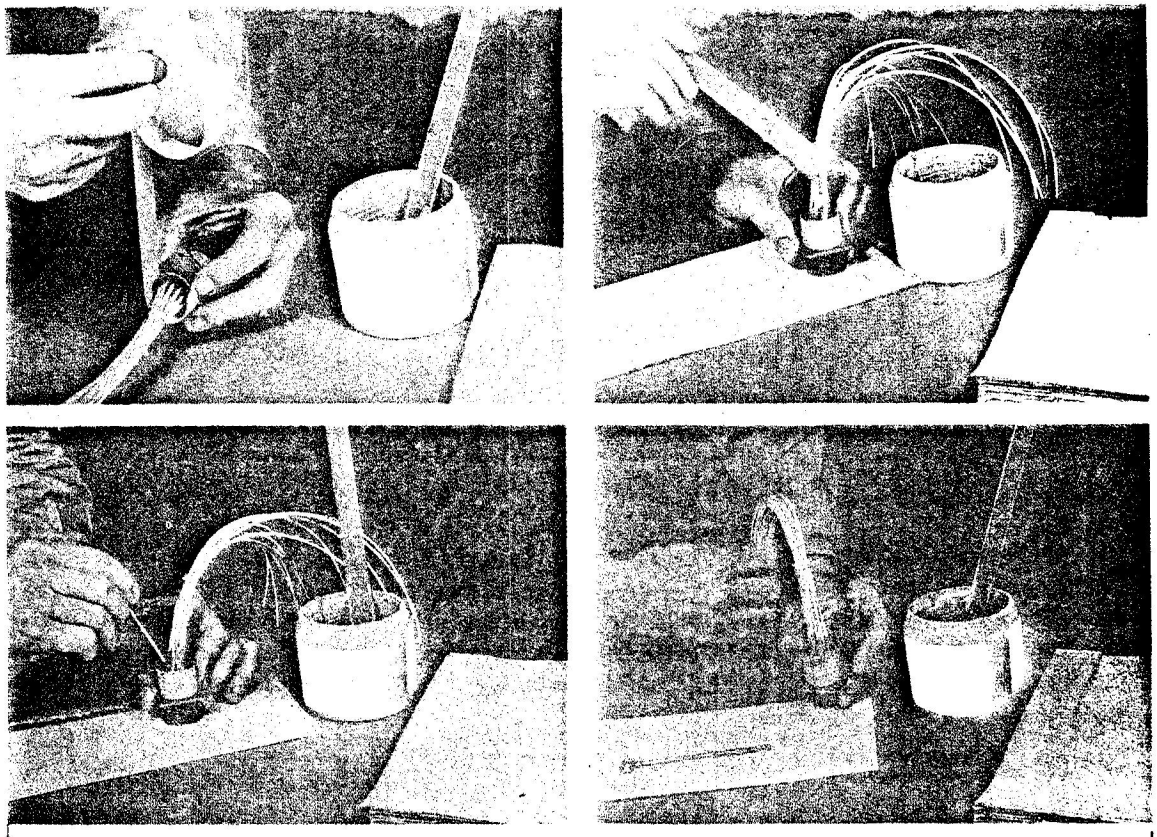
(6) Subsequent to potting of connectors, a light film of lubrication oil shall be applied to all exterior metal surfaces.

General

3 Place the plug(s) and/or receptacle(s) on a table and arrange so that gravity will draw sealer to the bottom of the plug. Box receptacle(s) or plug(s) without back shells may be fitted with a mold formed from masking or cellophane tape, vinyl tubing, or equivalent, to retain the potting compound during the curing process. If it is desired that the back shell be easily removed after sealing (to facilitate inspection and repairs), a very slight amount of petroleum base oil or grease can be applied to the inner surfaces of the shell to act as a parting compound. THE QUANTITY OF OIL APPLIED SHOULD BE SO SLIGHT THAT IT DOES NOT COME IN CONTACT WITH THE INSERT, PINS OR WIRES. AN-3057 adapter cable clamps and AN bushings should be omitted from potted connectors. All connectors concerning the safety of the aircraft should be pressure tested by using 10 pounds air pressure to insure the quality of the seal. All other connectors should be spot pressure checked to assure quality control. No air bubbles should be visible from a connector submerged in water.

PREAPPLICATION HANDLING AND STORAGE

4 The sealing compound used shall conform with requirements of Specification MIL-S-8516-A. If for any reason the mixed sealant is not used before its work life expires, it may be stored in a refrigerator or deep freeze. If stored at -20°F the work life is extended to as much as 36 hours. At a room temperature of 75 degrees and 50 percent relative humidity



The back of a receptacle may be sealed by making a form or mold from masking or scotch tape, and applying the sealant as indicated.

Figure 7-8

In potting a connector with a 90-degree back shell it may be necessary to fill each hole individually before the temporary mold is attached.

Figure 7-9

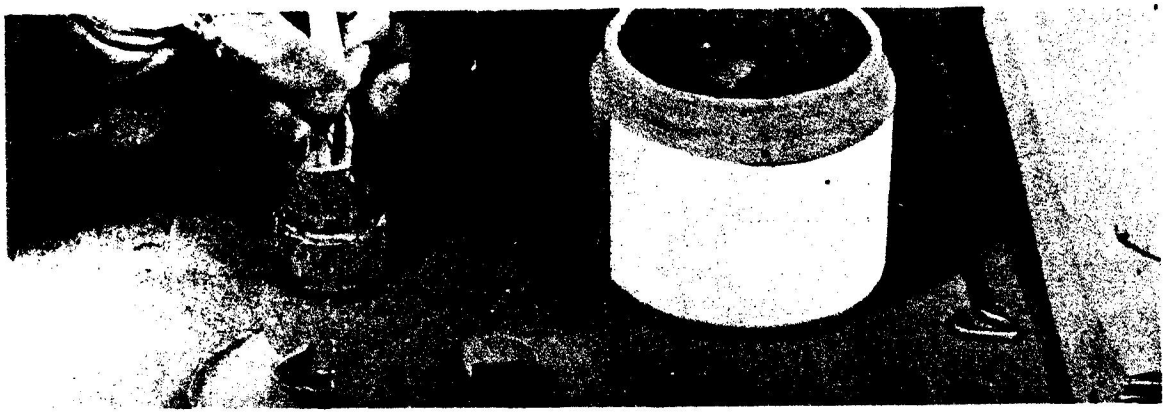


Figure 7-10

the work life will expire after 90 minutes. For each 10°F increase in temperature the work life will be reduced approximately 50 percent. Conversely, each 10°F reduction in temperature will double the work life.

NOTE

The time required to cool the sealant plus the time required to bring it back to application temperatures must be subtracted from the work lifetime. If the sealant is to be stored, it should be cooled immediately after acceleration. The sealant may be warmed by using compressed air on the outside of the container. Never use heat to raise the sealant temperature.

5 The compound can be applied by a spatula or by using a sealant pressure gun. A small piece of clean wooden dowel or metal, such as welding rod, may be used to tamp or pack the compound around the base of the pins to eliminate voids due to air bubbles. Several sharp taps on a block of wood or resilient surface or mechanical vibration will further facilitate the flow of the sealant into the small recesses thereby expelling the air bubbles.

6 Fill to the brim the part of the connector being sealed, or to a point which will cover at least 1/4-inch wire insulation. Group the wires in a desired manner and place in a position which will not allow the compound to pour or spill, and allow to cure as indicated in paragraph 7.

WORK LIFE AND CURE

7 The viscosity of the mixed compound increases with time and temperature. A satisfactory cure is obtained after 24 hours at room temperature (75°F). A more rapid rate of cure will result if, after a minimum air drying time of one hour, the material is heated to temperature of 135° F or less, see following paragraph 8 (e). During cold weather sufficient heat should be applied to obtain a satisfactory cure in the time allowed for the work. The useful work life of the sealant can be extended appreciably by chilling in ice water or refrigerator (approximately 10 hours) prior to mixing.

PRECAUTIONS TO BE OBSERVED

8 The following precautions shall be observed:

(a) Thoroughly mix the base compound before adding the accelerator. This will insure more uniform work life and flow characteristics.

(b) Thoroughly mix accelerator into base compound. Due to the heat generated in the compound during the mixing process, it is suggested that it be mixed slowly and not beyond the point where tests show the accelerator to be thoroughly blended. This may take from five to ten minutes. Fast mixing may also cause excessive amounts of air to become trapped in the sealant.

(c) Certain electrical properties of the sealant are greatly affected by any change in the ratio of accelerator to base material. The work life, rate of cure, and hardness may also be affected to a lesser degree. It is very important that the entire amount of accelerator be mixed in the base material. Therefore, DO NOT REMOVE THE ACCELERATOR AND BASE MATERIAL CONTAINERS FROM THE CARTON FOR THE PURPOSE OF STORING SEPARATELY. A switching of accelerators and base material containers may produce a sealant with substandard ELECTRICAL properties.

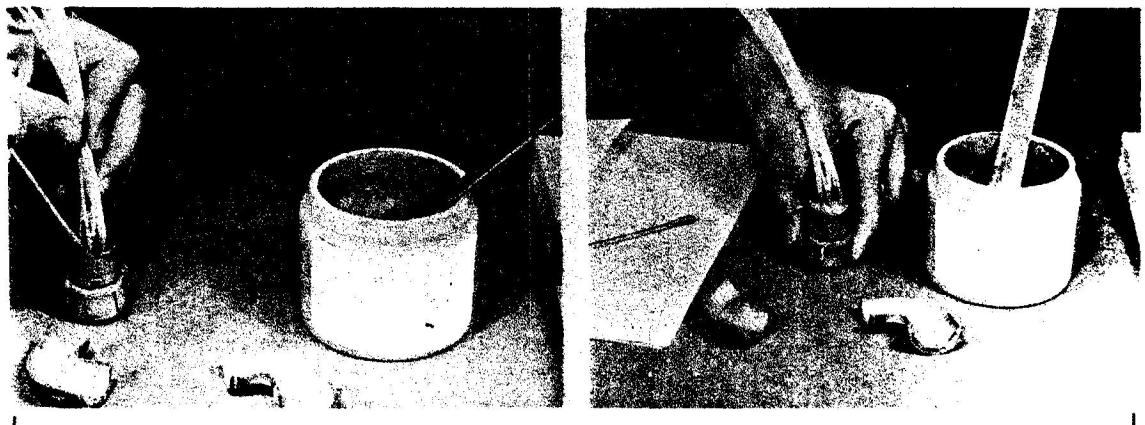
(d) Insure that no foreign matter such as water, grease, rosin, dirt, or especially Dow Corning #4 (A-C-128) grease is present in the part of the plug to be sealed. The smallest amount will prevent the sealant from adhering to the connector parts.

(e) Do not apply heat in excess of 135° F to accelerate curing. The compound may expand excessively. The texture will become quite porous.

(f) MIL-S-8516-A sealant contains a small quantity of volatile, inflammable solvent, and has a TCC flash point of 40° F. Although this does not present an extreme fire hazard, adequate ventilation and fire precautions should be taken during mixing and storage. It has an ICC shipping classification of "Rubber Cement".

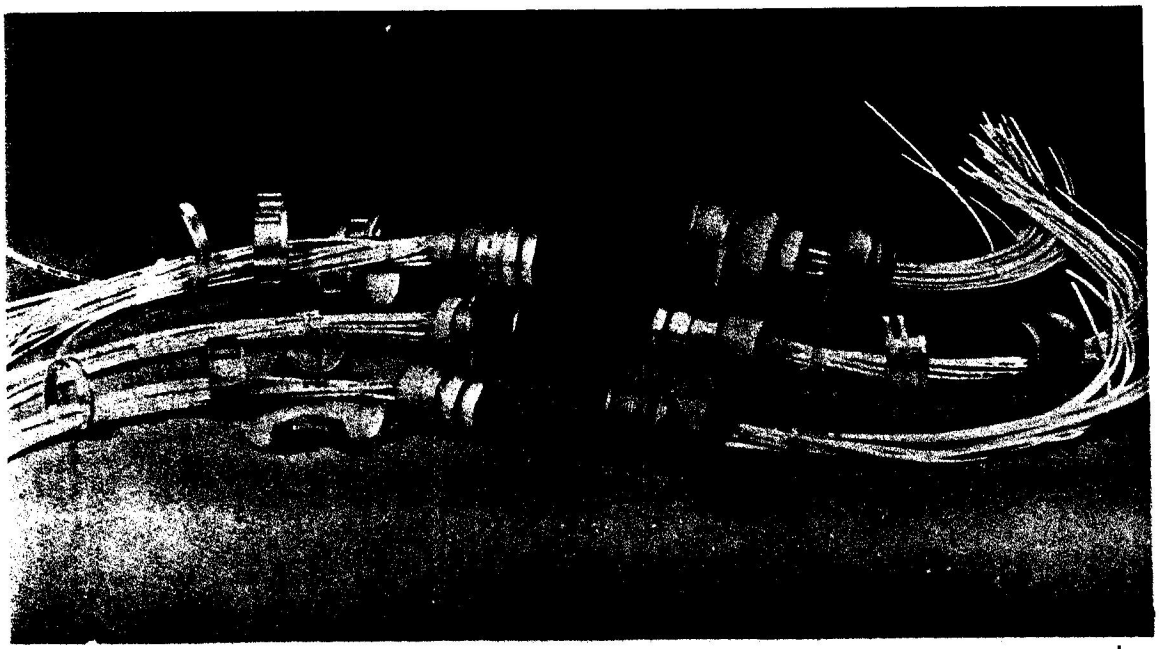
(g) THE ACCELERATOR CONTAINS A LEAD COMPOUND, AVOID EXCESSIVE SKIN CONTACT AND CLEAN HANDS THOROUGHLY AFTER USING. Use gloves.

(h) Dry cleaning solvent is inflammable. Solvents should not be mixed and used in closed spaces except where adequate ventilation is assured.



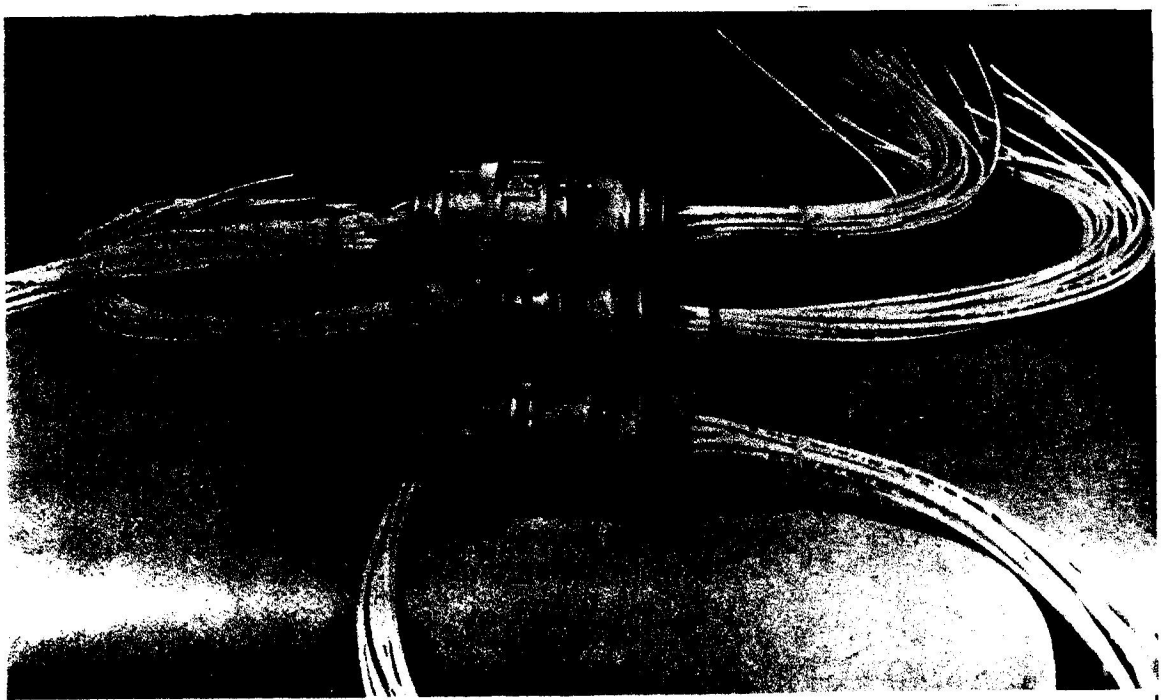
Compound is packed around the pins and insert and the temporary mold filled.

Figure 7-11



Three typical electrical connector assemblies disassembled, showing the sealant and rubber "O" rings in place.

Figure 7-12



These three completed connector assemblies are potted with sealant and sealed against moisture or aircraft fluid.

Figure 7-13

HAND MIXING PROCEDURE

9 Proceed as follows:

(a) Remove accelerator lid and with a clean spatula, wood tongue depressor, or putty knife stir contents slowly into a smooth creamy paste.

(b) Cut top from base compound can and stir until material has a smooth texture. This is necessary to recombine any material which may have settled out.

(c) Combine accelerator and the base material and thoroughly agitate or mix until no accelerator streaks or traces of unmixed material are visible. This normally requires approximately five minutes. Continued scraping of the sides and corner of the bottom of the container will insure complete mixing. (See figures 7-3 and 7-4).

(d) Determine if mixing is complete by very thinly spreading a drop of the mixture on a piece of white paper using a knife blade or similar instrument. (See figure 7-6). Very close examination should not reveal any specks or streaks.

(e) After preceding steps have been carefully followed, the sealant is ready for use and may be poured directly into the connector to be sealed in accordance with preceding paragraph 8 (d).

MECHANICAL MIXING PROCEDURE

10 Proceed as follows:

(a) Hand mix the accelerator as prescribed in paragraph 9. A paint shaker vibrating machine may be used if available. Shake for five to seven minutes.

(b) If the base material is packaged in a metal can, cut off the top of the container using a mechanical can opener. This should leave a smooth wall without any burr at the top of the can.

(c) Clamp base material container securely to a drill press geared to 50 RPM minimum to 90 RPM maximum. Insert a mixing paddle fashioned from a drill rod or wire.

(d) Start drill press motor and slowly lower mixing paddle into the base compound to recombine any material which may have settled out.

(e) Scrape all accelerator from its container and place it in the base material. Start drill press motor again and slowly mix for approximately two minutes. Stop machine, raise paddle and scrape container walls and paddle as clean as possible. Start the drill press and lower the mixing paddle again and continue mixing for an additional three minutes.

(f) Make thin spread of sealant on white paper as described in preceding paragraphs 9(c) and (d). If necessary, continue mixing in two minute cycles followed by paper test until no traces of unmixed material are visible. The sealant is then ready for use.

SINGLE WIRE MAINTENANCE

11 A short length of wire is soldered to spare pins for the following purposes:

(a) To provide for addition of circuits which may be required during the life of the connector.

(b) To serve as a temporary fix for wires that may fail within the connector. In event a spare wire is not available in the connector

and a single wire must be replaced, the back shell may be removed after first sliding a thin knife blade around the outside edge of the sealer and unscrewing the shell. (This may require considerable force depending on how well the sealant adheres). Access to the desired lead and solder cup may be obtained by cutting away the compound with a knife. If in a large connector a center wire is defective beyond easy reach from the side, it may be better to cut and/or pull the sealant from the center (using long nose pliers) until sufficient area is exposed to allow the defective lead to be repaired. A small soldering iron or soldering gun is required in such confined places. Complete removal of the compound should be unnecessary. The plug may be returned to its original condition by applying sealant to the connector in the manner previously described. The new compound will seal or vulcanize satisfactorily to any old compound remaining in the plug.

MOISTURE-PROOFING OF PLUG ASSEMBLY

12 It is desired that the entire connector assembly (plug and receptacle) be sealed against fluid entering or collecting in the void between the two parts; therefore a rubber "O" ring should be fitted over the barrel of the plug to provide a seal when the two parts are engaged securely. If properly installed, this seal will withstand air pressure in excess of 15 PSI, thereby preventing moist air from entering due to variations in temperature, altitude, or barometric pressure on the ground.