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CONNECTORS
HUGHES C21 SERIES

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

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EMER Aircraft A040 (ARMY)
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AMENDMENT RECORD

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TECHNICAL ENQUIRIES

R.A.F.

Technical enquiries concerning these connectors should be directed to the Delegated Engineering Authority for Electrical Connectors, ESS, EEW, CSDE, RAF Swanton Morley. Telephone RAF Swanton Morley (894), extension 290 for urgent enquiries only.

Technical enquiries concerning tooling for these connectors should be directed to the Delegated Engineering Authority for Electrical Hand Tools, OC, GSS, RAF Swanton Morley. Telephone RAF Swanton Morley (894), extension 286 for urgent enquiries only.

R.N.

Technical enquiries concerning these connectors or tooling for these connectors should be directed to O.C. NATEC, HMS DAEDALUS, Lee-on-the-Solent, Hants.

Chapter 1

DESCRIPTION

CONTENTS

Introduction

1 Hughes C-21 connectors are a range of high density, fully environmental, centre jackscrew coupling, rectangular connectors manufactured by Hughes Microelectronics Ltd. and Hughes Aircraft Corporation.

DESCRIPTION

Specifications

2 The C-21 connectors meet the requirements of specifications MIL-C-85028/1 to /6. The contacts meet the requirements of specifications MIL-C-39029/69 and /70.

Intermountability and intermateability

3 The C-21 connectors are intermountable and intermateable with Hughes MRS non-environmental connectors. The MRS connectors comply with specification MIL-C-28748.

Connector identification

4 C-21 connectors are identified by the manufacturer's part number. A typical part number is C21-0-052P02BN000. The significance of the part number is as follows:-

C21 0 0522 P 02 BN 000

- 000 — Variants
  - 018 - less pin protector
  - 027 - centre hardware extension
  - 044 - straight-sided pin protector
- BN — Polarization, refer to para. 9.
- 02 — Centre hardware
  - 00 - Boss only, mates with jackscrew
  - 01 - Guide pin
  - 02 - Extended jackscrew (52-212 way only)
  - 03 - Recessed jackscrew
  - 09 - Boss only, mates with guide pin (52-212 way only)
  - A0 - Actuating boss (socket body only 52-212 way)
  - A3 - Stationary jackscrew (pin body only 52-212 way)
- P — Body style, refer to para. 5.
  - P - pin body
  - S - socket body
- 0522 — Insert arrangement, refer to para.6
- 0 — Insulator material
  - 0 - Diallyl Phthalate
- C21 — Connector series

Connector styles

5 The connector is available in two body styles; pin body and socket body. The two styles are shown in fig. 1.

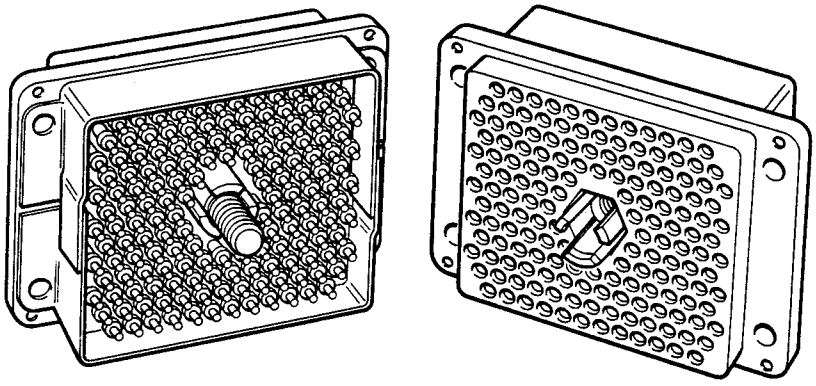

Fig. 1 Typical pin and socket connectors

Insert arrangement

6 The insert arrangements are shown in fig. 2.

Contacts

Standard range

7 Contact pins or contact sockets are only available in size 16. Table 1 details the contact accommodation data by wire size.

Shielded range

8 Shielded contact pins or contact sockets can be specified and are only available in size 16. Table 2 details the contact accommodation data by wire size. These contacts are for use in terminating twisted pairs of wires.

Orientation

9 To prevent the cross-mating of identical connectors in the vicinity of each other, the connector is supplied with a polarizing boss. To polarize the connector, the boss is mounted in the insert with the largest opening adjacent to the desired position. Three sizes of angle, for the largest opening, and orientation position are identified by letters, as follows:-

9.1 BV, BW and BN (normal) - 90 deg.

9.2 DX, DY and DZ - 80 deg.

9.3 JV, JW and JN (normal) - 70 deg, guide pin (01 and 09) centre hardware only.

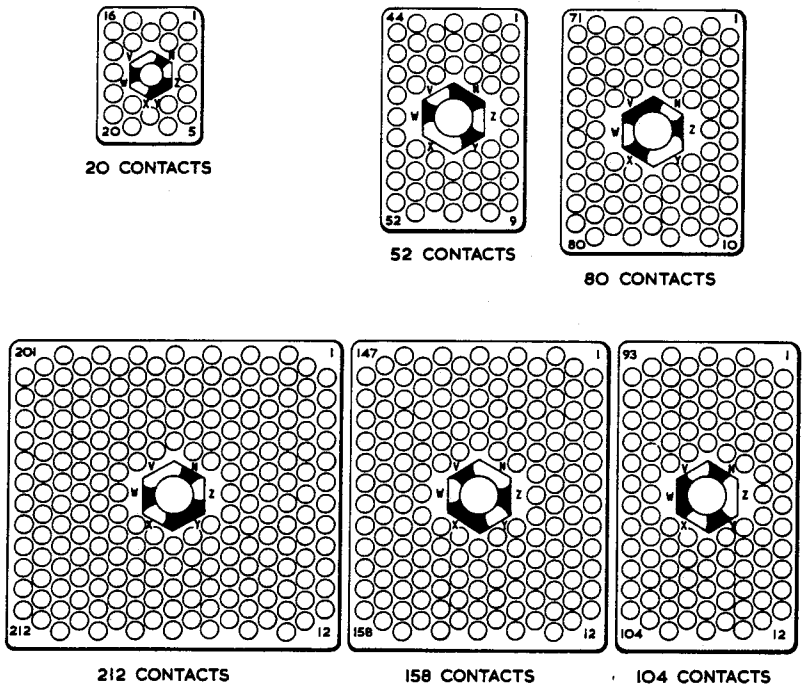

Fig. 2 Insert arrangements

TABLE 1 STANDARD CONTACTS

Size	Contact type	Current rating (max)	Contact wire accommodation (a.w.g.)	Part No.	Service Ref. No./ NATO Stock No.	Wire seal colour
16	Pin	13A	28 - 24	C21P1624A0	5999-01-0489375	Red
16	Socket	13A	28 - 24	C21S1624A0	5999-01-0491397	Red
16	Pin	13A	24 - 20	C21P1620A0	5999-01-0140403	Lavender
16	Socket	13A	24 - 20	C21S1620A0	5999-01-0487633	Lavender
16	Pin	13A	20 - 16	C21P1616A0	5999-01-0140401	Brown
16	Socket	13A	20 - 16	C21S1616A0	5999-01-0487632	Brown

TABLE 2 SHIELDED CONTACTS

Size	Contact type	Current rating (max)	Contact wire accommodation (a.w.g.)	Part No.	Service Ref. No./ NATO Stock No.
16	Pin		24	1127414S	
16	Socket		24	1127415S	

Environmental sealing

10 Fig. 3 shows the methods of environmental sealing used in C-21 connectors. Interfacial pin sealing is achieved with a replaceable seal. A pressure sensitive wire seal forms a static seal when a pin or socket is inserted into the connector body. Wire sealing ranges are detailed in Table 3.

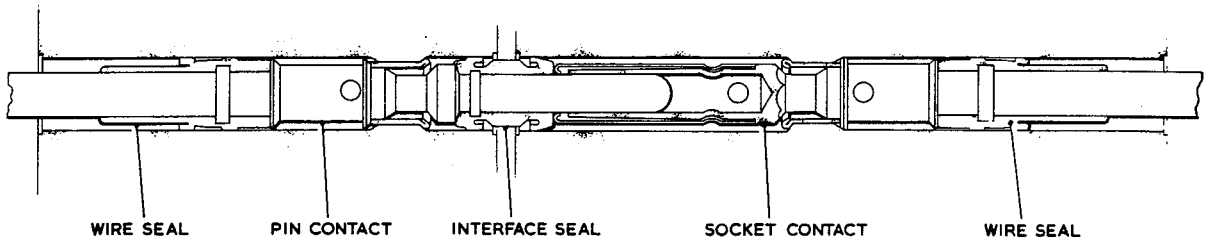

Fig. 3 Environmental Sealing

TABLE 3 WIRE SEALING RANGE

Wire range (a.w.g.)	Insulation o.d. (in)		Colour code	Part No.	NATO Stock No.
	Min.	Max.			
28 - 24	0.035	0.060	Red	M85028-5-1	
24 - 20	0.050	0.080	Lavender	M85028-5-2	
20 - 16	0.070	0.090	Brown	M85028-5-3	

Note ...

To replace wire seals use tool wire seal Part No 85028-6.

11 In cavities which are not wired, sealing plugs must be fitted into the rear of unwired contacts. Filler plug for all contacts is Part No. M85028-4.

Temperature range

12 The operating temperature range is -54 deg C to +125 deg C (-65 deg F to +257 deg F). The upper limit quoted is the maximum temperature resulting from any combination of ambient temperature and heating due to current flow.

Lubrication and cleaning

13 Connector bodies, assembled contacts, wire and interfacial seals are lubricated prior to assembly and shipment by the manufacturer. This aids assembly and prevents moisture. No further lubrication or cleaning is required.

Tooling

14 Select the correct tooling from the appropriate contact work sheet detailed in Chap. 2 or connector assembly instructions in Chap. 3. No tooling is supplied with C-21 connectors.

ACCESSORIES

15 C-21 connectors are supplied without back-end accessories. The accessories are non-environmental.

Backshells

16 Figs. 4 to 7 show backshells and Tables 4 to 7 detail the backshells available.

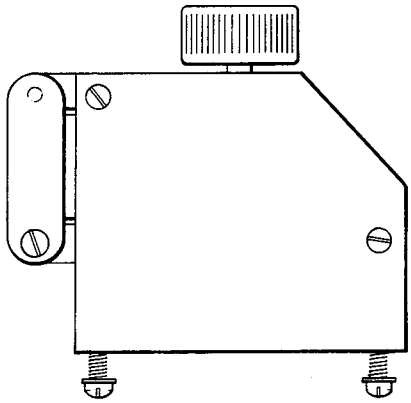

Fig. 4 Backshell 90 deg. opening (recessed jackscrew)

TABLE 4 BACKSHELL 90 DEG OPENING (RECESSED JACKSCREW)

Shell size	Part No.	NATO Stock No.
52	MAC0052H900	
80	MAC0080H900	
104	MAC0104H900	
158	MAC0158H900	
212	MAC0212H900	

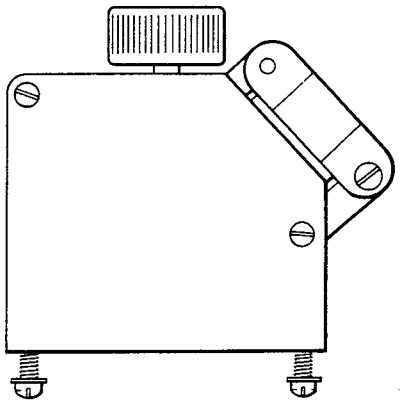

Fig.5 Backshell 45 deg opening (recessed jackscrew)

TABLE 5 BACKSHELL 45 DEG OPENING (RECESSED JACKSCREW)

Shell size	Part No.	NATO Stock No.
52	MAC0052H450	
80	MAC0080H450	
104	MAC0104H450	
158	MAC0158H450	
212	MAC0212H450	

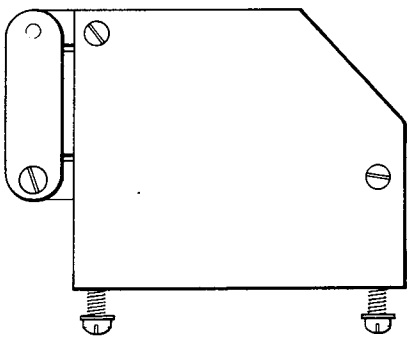

Fig. 6 Backshell 90 deg opening

TABLE 6 BACKSHELL 90 DEG OPENING

Shell size	Part No.	NATO Stock No.
52	MACL052H900	
80	MACL080H900	
104	MACL104H900	
158	MACL158H900	
212	MACL212H900	

Note ...

Part number with suffix-T, e.g. MACL052H900-T indicates backshell is fitted with blanking plug to centre top hole.

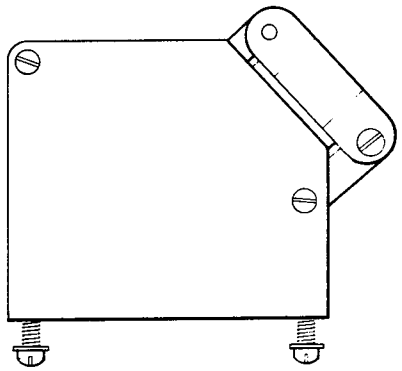

Fig. 7 Backshell 45 deg opening

TABLE 7 BACKSHELL 45 DEG OPENING

Shell size	Part No.	NATO Stock No.
52	MACL052H450	
80	MACL080H450	
104	MACL104H450	
158	MACL158H450	
212	MACL212H450	

Note ...

Part number with suffix-T, e.g. MACL052H450-T indicates backshell is fitted with blanking plug to centre top hole.

Dust covers

17 Dust covers are available with or without centre hardware. Fig. 8 shows dustcover with centre hardware and Tables 7 and 8 detail dustcovers available

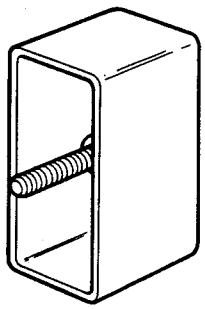

Fig. 8 Dustcover

TABLE 8 DUSTCOVER PIN BODY

Shell size	Part No.	NATO Stock No.
52	MAC0052C010	
80	MAC0080C010	
104	MAC0104C010	
158	MAC0158C010	
212	MAC0212C010	

TABLE 9 DUSTCOVER SOCKET BODY

Shell size	Part No.	NATO Stock No.
52	MAC0052C000	
80	MAC0080C000	
104	MAC0104C000	

(continued)

TABLE 9 DUSTCOVER SOCKET BODY (continued)

Shell size	Part No.	NATO Stock No.
158	MAC0158C000	
212	MAC8212C000	

Conductor size measurement

18 The contact work sheets in Chapter 2 detail each contact size and the standard a.w.g. wire size each contact size will accommodate.

Note ...

Where either it is suspected that the cable conductor (wire) is not standard a.w.g. or the integrity of the crimp is in doubt, then either DEA92, CSDE, RAF Swanton Morley, extension 290 (RAF) or OC NATEC, HMS DAEDALUS (RN) should be contacted for cable (wire) identification.

Chapter 2

CONTACT ASSEMBLY INSTRUCTIONS

CONTENTS

Introduction

1 This chapter comprises a number of work sheets detailing the procedure for crimping each wire size of contact to the range of wire sizes they are designed to accommodate.

Procedure

2 Proceed as follows:-

2.1 Identify the size and type of contact to be crimped.

2.2 Select the appropriate contact work sheet.

2.3 Identify the size of cable conductor (wire size) being used.

2.4 Carry out the stripping and crimping procedures detailed in the contact work sheet.

Contact Work Sheet 1

STANDARD CONTACT PIN SIZE 16

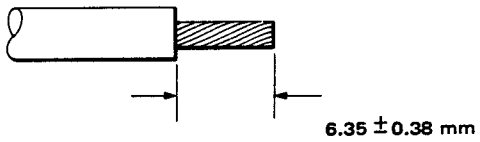

Fig. 1 Stripping dimensions

Wire insulation range	Wire conductor range
0.035 in min. 0.060 in	Wire size 28 - 24 a.w.g.

Procedure

1 Check that the wire, to which the contact is to be crimped, is within the insulation and conductor ranges given in this work sheet.

2 Strip the wire to the dimensions given in fig. 1. Ensure that the insulation is completely removed and that the conductor is undamaged.

Note ...

Information on wire stripping is detailed in AP 113D-1700-1 (RAF) and AP 120M-0600-1 (RN).

3 Select the appropriate crimping tool from Tables 1, 2 or 3.

TABLE 1 RAF CRIMPING TOOL

Crimping tool		Turret		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/1-01	1M/1653912	M22520/1-17		

Note ...

The tool and turret detailed in Table 1 are available as part of Crimping tool kit Ref. No. 1M/949. Units are to demand the tool kit rather than individual tools and turrets.

TABLE 2 RAF ALTERNATIVE CRIMPING TOOL

Crimping tool		Locator		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
MS 3191	1M/4658819	M3191-20A (Part No. 611062)	1M/300396	

TABLE 3 RN CRIMPING TOOL

Crimping tool		Turret		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/1-01	0273-1380390	M22520/1-17		

4 Where the crimping tool detailed in Tables 1 and 3 is to be used, select the appropriate tool setting from Table 4.

TABLE 4 CRIMPING TOOL MS22520/1-01 TOOL SETTING

Wire size	Tool setting
28	
26	1
24	2

5 Crimp the contact to the wire.

Note ...

Information on the use of crimping tools is detailed in AP 120M-0602-1 (RAF) and AP 120M-0600-1 (RN).

6 Inspect the contact for the following:-

6.1 All conductor strands enter the crimping barrel and the conductor is visible through the inspection hole.

6.2 The contact is not distorted and the crimp barrel is free from fractures.

6.3 The insulation seal has not been damaged.

Contact Work Sheet 2

STANDARD CONTACT WIRE SIZE 20

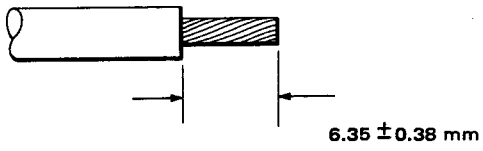

Fig. 1 Stripping dimensions

Wire insulation range	Wire conductor range
0.050 in min. 0.080 in max.	Wire size 24 - 20 a.w.g.

Procedure

1 Check that the wire, to which the contact is to be crimped, is within the insulation and conductor ranges given in this work sheet.

2 Strip the wire to the dimensions given in fig. 1. Ensure that the insulation is completely removed and that the conductor is undamaged.

Note ...

Information on wire stripping is detailed in AP 113D-1700-1.

3 Select the appropriate crimping tool from Tables 1, 2 or 3.

TABLE 1 RAF CRIMPING TOOL

Crimping tool		Turret		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/1-01	1H/1653912	M22520/1-17		

Note ...

The tool and turret detailed in Table 1 are available as part of Crimping tool kit Ref. No. 1M/949. Units are to demand the tool kit rather than individual tools and turrets.

TABLE 2 RAF ALTERNATIVE CRIMPING TOOL

Crimping tool		Locator		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
MS 3191	1H/4658819	M3191-20A (Part No. 611062)	1H/300396	Red

TABLE 3 RN CRIMPING TOOL

Crimping tool		Turret		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/1-01	0273-1380390	M22520/1-17		

4 Where the crimping tool detailed in Tables 1 and 3 is to be used, select the appropriate tool setting from Table 4.

TABLE 4 CRIMPING TOOL MS22520/1-01 TOOL SETTING

Wire size	Tool setting
24	2
22	3
20	4

5 Crimp the contact to the wire.

Note ...

Information on the use of crimping tools is detailed in AP 120M-0602-1.

6 Inspect the contact for the following:-

6.1 All conductor strands enter the crimping barrel and the conductor is visible through the inspection hole.

6.2 The contact is not distorted and the crimp barrel is free from fractures.

6.3 The insulation seal has not been damaged.

Contact Work Sheet 3

STANDARD CONTACT WIRE SIZE 16

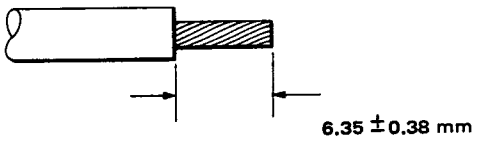

Fig. 1 Stripping dimensions

Wire insulation range	Wire conductor range
0.070 in min. 0.090 in max.	Wire size 20 - 16 a.w.g.

Procedure

1 Check that the wire, to which the contact is to be crimped, is within the insulation and conductor ranges given in this work sheet.

2 Strip the wire to the dimensions given in fig. 1. Ensure that the insulation is completely removed and that the conductor is undamaged.

Note ...

Information on wire stripping is detailed in AP 113D-1700-1.

3 Select the appropriate crimping tool from Tables 1, 2 or 3.

TABLE 1 RAF CRIMPING TOOL

Crimping tool		Turret		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/1-01	1H/1653912	M22520/1-17		

Note ...

The tool and turret detailed in Table 1 is available as part of Crimping tool kit Ref. No. 1H/949.

TABLE 2 RAF ALTERNATIVE CRIMPING TOOL

Crimping tool		Locator		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
MS 3191	1H/4658819	M3191-20A (Part No. 611062)	1H/300396	Blue

TABLE 3 RN CRIMPING TOOL

Crimping tool		Turret		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/1-01	0273-1380390	M22520/1-17		

4 Where the crimping tool detailed in Tables 1 and 3 is to be used, select the appropriate tool setting from Table 4.

TABLE 4 CRIMPING TOOL MS22520/1-01 TOOL SETTING

Wire size	Tool setting
20	4
18	5
16	6

5 Crimp the contact to the wire.

Note ...

Information on the use of crimping tools is detailed in AP 120M-0602-1.

6 Inspect the contact for the following:-

6.1 All conductor strands enter the crimping barrel and the conductor is visible through the inspection hole.

6.2 The contact is not distorted and the crimp barrel is free from fractures.

6.3 The insulation seal has not been damaged.

Contact Work Sheet 4

SHIELDED CONTACT (TWISTED PAIR) WIRE SIZE 24

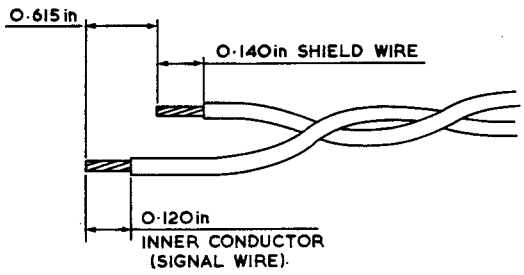

Fig. 1 Stripping dimensions

Wire insulation range

Wire conductor range

Wire size 24 a.w.g

Procedure

1 Slide the crimp ring over the twisted pair.

2 Strip the wire to the dimensions given in fig. 1. Ensure that the insulation is completely removed and that the conductor is undamaged.

Note ...

Information on wire stripping is detailed in AP 113D-1700-1 (RAF) and AP 120M-0600-1 (RN).

3 Select the appropriate crimping tool from Tables 1, or 2.

TABLE 1 RAF CRIMPING TOOL

Crimping tool		Die Set	
Specification	Sect. Ref.	Specification	Sect. Ref.
M22520/5-01	1M/997	Y561	

TABLE 2 RN CRIMPING TOOL

Crimping tool		Die set		
Specification	Sect. Ref.	Specification	Sect. Ref.	Colour code
M22520/5-01	0273-	Y561		

4 Align the signal wire centre conductor with the coaxial contact centre conductor, and slide the pre-stripped shield wire into position as shown by the arrow in fig. 2.

Note ...

During this operation the shield wire will lie close against the outer crimp barrel.

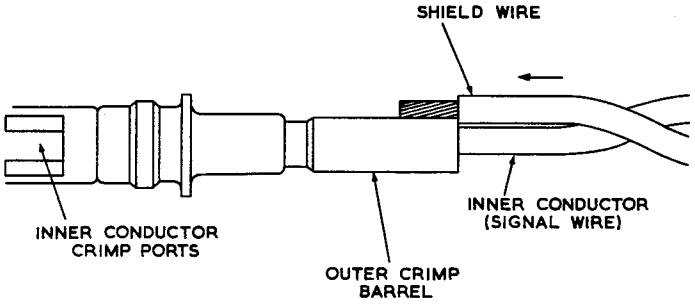

Fig. 2 Twisted pair and contact alignment

5 Slide the crimp ring over the shield and position the ring at the end of the shield. Final location of the crimp ring is determined by the locator in the crimp tool.

6 Crimp the contact to the twisted pair, ensuring that the crimp ring is in its correct position.

Note ...

Information on the use of crimping tools is detailed in AP 120M-0602-1.

7 Inspect the crimped contact for the following:-

6.1 All conductor strands enter the crimping barrel and the inner indentors are visible through the inspection hole.

6.2 The contact is not distorted and the crimp barrel is free from fractures.

6.3 The insulation seal has not been damaged.

Chapter 3

CONNECTOR ASSEMBLY INSTRUCTIONS

Contact insertion

1 Proceed as follows:-

1.1 If required, slide backshell over the wire bundle.

1.2 Insert the insertion tool into the correct contact cavity, at the mating face of the connector, until the tip of insertion tool protrudes from the rear of the connector.

1.3 Insert the correct contact into the tip of the insertion tool and pull back with the thumb the tool locking lever to lock the contact into the tool.

1.4 Carefully withdraw the insertion tool, complete with contact, from the connector block until the contact snaps into a retained position in the block.

Note ...

A click will be heard as the contact becomes fully seated.

1.5 Check that the contact is locked into place by pushing the contact forward.

1.6 Release the contact from the insertion tool by pushing forward the tool thumb locking lever.

1.7 Fill all unused cavities with unwired contacts and fit sealing plugs in unwired contact wire barrels.

1.8 Inspect the front face of the connector, ensuring that there are no bent contacts and that all contacts are locked into position.

1.9 Where fitted, slide backshell over the wire bundle and fit to the connector.

Contact removal

2 Proceed as follows:-

2.1 Disconnect accessories fitted to the rear of the connector and slide the accessories over the wire bundle.

2.2 Insert the tip of the contact removal tool over the contact to be removed, maintaining the tool and contact axially in line.

2.3 Rotate the tool slightly to firmly locate the tool tip inside the connector cavity.

2.4 Whilst maintaining pressure on the tool tip, push the inner plunger of the tool to release the contact.

Caution ...

Only a slight pressure is required to remove the contact. If a large force appears to be required DO NOT FORCE the tool. Remove the tool from the contact and carry out contact insertion followed by contact removal procedures.

2.5 Remove the contact from the rear of the connector by gently pulling on the wire.

Interfacial seal insertion

3 Proceed as follows:-

3.1 Push the seal over the pin contact either by hand or using the insertion tip of the interfacial seal insertion/removal tool.

3.2 Push the seal fully to the rear of the pin contact until it touches the connector body.

Interfacial seal removal

4 Proceed as follows:-

4.1 Insert the retention sleeve end of the interfacial seal insertion/removal tool over the pin contact.

4.2 Fully seat the nose of the tool in the inside diameter of the seal and push the retention sleeve forward to capture the seal.

4.3 Remove the tool complete with seal.

TABLE 1 INSERTION AND REMOVAL TOOLS

Part No.	Description	NATO Stock No.
M81969/23-01	Pull-Thru insertion tool (pin)	
M81969/23-02	Pull-Thru insertion tool (socket)	
M81969/22-01	Removal tool (contact)	
M81969/21-01	Insertion/Removal tool (interface seal)