

RaychemINTERCONNECTION SYSTEMS
ENGINEERING STANDARD

TITLE

PROCEDURE FOR TERMINATING FLAT CONDUCTOR
CABLES WITHOUT EMI SHIELDING TO MTC100
CONNECTORS

NUMBER

ES-71016 Rev. E

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ES-71016

PROCEDURE FOR TERMINATING FLAT CONDUCTOR CABLES
WITHOUT EMI SHIELDING TO MTC100 CONNECTORS

Bell Helicopter/Boeing Vertol V-22 Program

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CONTENTS

PARAGRAPH	TITLE
1.0	Purpose and Scope
2.0	References
3.0	Tools
4.0	Materials
5.0	Termination Procedures
5.1	Flat Conductor Cable (FCC) Preparation
5.2	Busbar and Inter-Layer Shield Preparation
5.3	Inserting FCC, Shield and Busbar into MTC Insert
5.4	Heating
6.0	Inspection of Terminations
6.1	Inspection for Conductor Positioning
6.2	Inspection for Proper Soldering
6.3	Electrical Testing
7.0	Cable Assembly Procedures
7.1	Inserting Terminated Inserts into Shells
7.2	Cable Clamp Installation

REVISION REFERENCE

Sheet No.	1	2	3	4	5	6	7	8	9	10	11	12
Revision	E	E	B	C	B	B	C	B	B	B	B	B
Sheet No.	13	14	15	16	17	18						
Revision	E	E	B	D	D	E						

PROCEDURE FOR TERMINATING FLAT CONDUCTOR CABLES
WITHOUT EMI SHIELDING TO MTC100 CONNECTORS

ES-71016 Rev. B
DWG. NO.

3 OF 18
SHEET

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1.0 PURPOSE AND SCOPE

This standard covers the procedures for terminating flat conductor cables (FCC) to MTC100 connector inserts, where inter-layer shields are used for crosstalk protection.

2.0 REFERENCES

CE-1404200/CE-1404300 Waffle Iron II Heating Tool Instructions

CE-1400600 Flat Conductor Cable Stripper Instructions

3.0 TOOLS

Raychem CE-1404200 or CE-1404300 Waffle Iron II Heating Tool

Platen sets for Waffle Iron Heating Tool (Table 1)

Table 1. Platen Selection for Waffle Iron Heating Tool

FCC Conductor Size	Termination Style	Insert Type	Platen Set
24	Without busbar	Pin	CE-1510900
		Socket	CE-1511000
	With busbar	Pin	CE-1513200
		Socket	CE-1513300
22	Without busbar	Pin	CE-1508700
		Socket	CE-1508800
	With busbar	Pin	CE-1513400
		Socket	CE-1513500

CE-1400600 Flat conductor cable stripping tool

CE-1402400 Flat conductor cable folding tool

CE-1401700 Flat conductor cable insertion tool

Carpenter Model 95A flat conductor cable cutter

Solder pot

PROCEDURE FOR TERMINATING FLAT CONDUCTOR CABLES
WITHOUT EMI SHIELDING TO MTC100 CONNECTORS

ES-71016 Rev. C
DWG. NO.

4 of 18
SHEET

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4.0 MATERIALS

Solder: Sn63 or Sn60 per QQ-S-571.

Flux: Kester #1544 (Type RA per MIL-F-14256).

Flux thinner: Kester #104 for Kester #1544 flux.

Flux remover: Isopropyl alcohol.

5.0 TERMINATION PROCEDURES

NOTE: Connector components referred to as "inserts" in this document may be termed "wafers" in other documents. The terms "insert" and "wafer" refer to the same MTC connector components.

5.1 Flat Conductor Cable (FCC) Preparation.

1. Cut the FCC to the length required.

- * Cable must be cut square and cleanly, without folding or bending ends.

- * Recommended tools: Carpenter Model 95A flat cable cutter or sharp paper cutter.

2. Strip the cable insulation.

- * Strip length: 0.280 to 0.300 inch.

- * Stripping tool: CE-1400600 flat cable stripper.

3. Flux coat the exposed conductors.

- * Dip the conductors for half to three quarters of their exposed length in a 1:1 mixture of Kester #1544 flux and Kester #104 thinner.

4. Allow fluxed conductors to dry at least 30 seconds.

5. Pre-tin the exposed conductors by dipping them in molten Sn60 or Sn63 solder.

- * Solder temperature: $500 \pm 20^{\circ}\text{F}$.

- * Skim dross from solder in pot.

- * Immerse conductors for 4 to 6 seconds, and withdraw slowly to prevent icicle formation.

PROCEDURE FOR TERMINATING FLAT CONDUCTOR CABLES
WITHOUT EMI SHIELDING TO MTC100 CONNECTORS

DWG. NO. ES-71016 Rev. B

5 OF 18
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6. Remove flux residue using isopropyl alcohol.

WARNING

Isopropyl alcohol is a volatile, flammable liquid and should not be used near open flames or electrical sparks

7. Allow cleaned conductors to dry for at least 1 minute.
8. Fold the FCC conductors using the CE-1402400 folding tool.
- * Folding dimensions are shown in Figure 1, for reference.

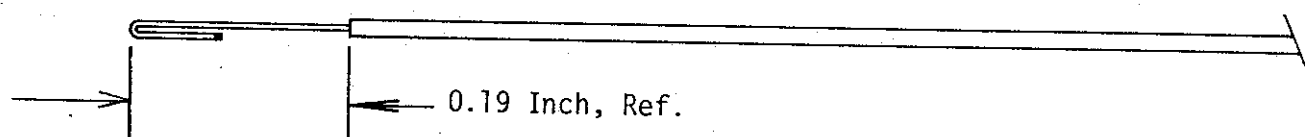
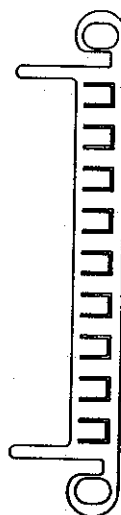


Figure 1. FCC Folding Dimensions

- 5.2 Busbar and Inter-Layer Shield Preparation. An inter-layer shield is normally used between all layers of FCC. Each inter-layer shield is terminated along with an FCC to a connector insert by means of a busbar. The inter-layer shield can be positioned on either the top or the bottom of the FCC, as specified on the applicable cable assembly drawing. Busbars used to terminate inter-layer shields to connector inserts are shown in Figure 2.



Type 1. Without
Grounding Fingers



Type 2. With Grounding
Fingers at Ends Only



Type 3. With Multiple
Grounding Fingers

Figure 2. Busbars Used for Inter-layer Shield Termination

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1. If a type 3 busbar (see Figure 2) is being used, trim the grounding fingers as specified on the cable assembly drawing.
 - * Figure 3 shows an example of a trimmed busbar. The fingers to be trimmed will vary with the application.
 - * If a type 1 or 2 busbar is being used, continue to step 2.

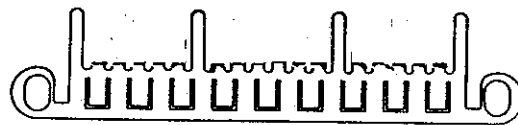


Figure 3. Example of Trimmed Type 3 Busbar

2. Cut the inter-layer shield to the required length (Figure 4).
 - * Total shield length is the cable assembly interface to interface length plus 6.0 inches.
 - * Use Carpenter Model 95A flat cable cutter or a sharp paper cutter.

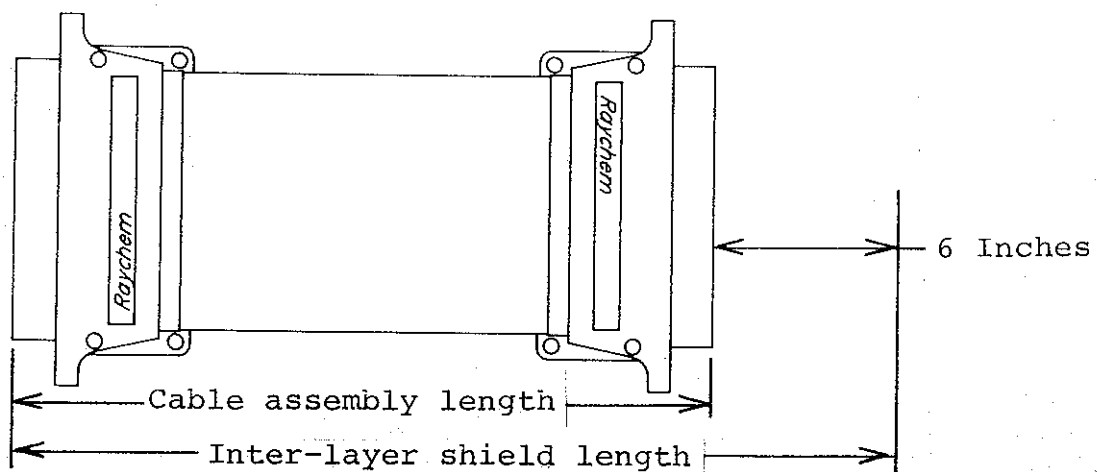


Figure 4. Length Determination of Inter-Layer Shield

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3. Strip the shield insulation for a length of 0.4 ± 0.1 inch (Figure 5).

- * Use the Carpenter Model 44B abrasive wheel stripper with abrasive wheel #2490.
- * Remove insulation from both surfaces of the shield.

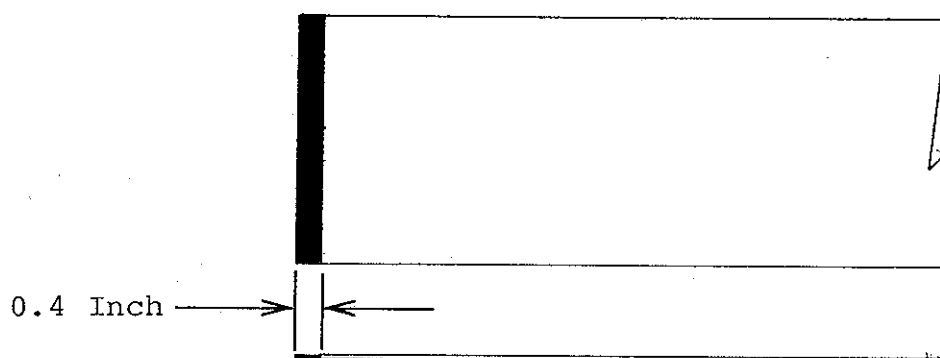


Figure 5. Stripping the Inter-Layer Shield

4. Flux the stripped end of the shield for half to three quarters of its length.
- * Use Kester #1544 flux diluted 1:1 with Kester #104 flux thinner.
 - * Flux may be applied by dipping or by use of a cotton tipped applicator.
5. Pretin the stripped end of the shield to three quarters of its length.
- * Use a hand soldering iron.
 - * Pretin both surfaces with a thin solder coating. Avoid buildup of any solder thickness.
6. Clean off the flux residue using isopropyl alcohol or appropriate flux thinner.
7. Apply a light coat of flux to the tinned end of the shield.
- * Use Kester #1544 flux diluted 1:1 with Kester #104 thinner.
 - * Use a cotton-tipped applicator and avoid heavy application.
 - * Allow flux to air dry for at least 1 minute.

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8. Insert the end of the shield into the clips of the busbar as shown in Figure 6.

* The shield fits on top of the busbar and under the clips.

* Make sure that the busbar is square with the end of the shield.

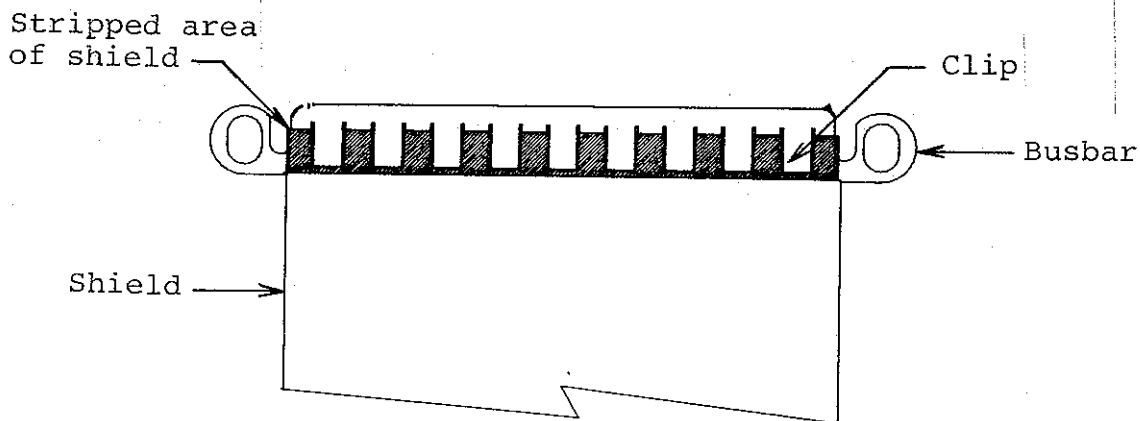


Figure 6. Inserting Prepared Inter-Layer Shield into Clips of Busbar

5.3 Inserting FCC, Shield and Busbar Into MTC Insert.

IMPORTANT

Note A: If a busbar with grounding fingers is being used and the shield goes underneath the FCC, use procedure 5.3 A.

Note B: For all other configurations use procedure 5.3 B. Other configurations include (1) FCC with no shield, (2) Busbar with no grounding fingers, and (3) Shield on top of FCC.

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5.3 A Insertion Procedure for Note "A" Assemblies. Use this procedure if a busbar with grounding fingers is being used and the shield is being installed underneath the FCC.

1. Insert the shield/busbar assembly into the boot of connector insert A or B, as specified on the cable assembly drawing (Figure 7).
 - * Make sure that the busbar fingers go in on top of the insert terminals and the shield comes out above the busbar.
 - * Push the shield/busbar assembly in until the busbar bottoms inside the boot of the insert.

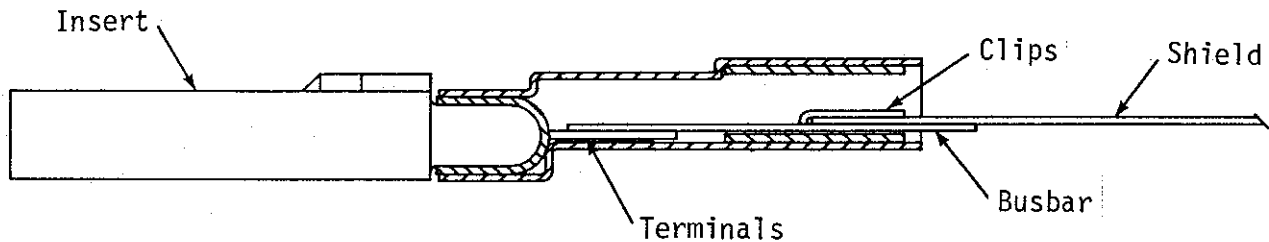


Figure 7. Shield/Busbar Assembly Inserted into Insert Boot Per Note "A"

2. Insert the prepared FCC into the insert boot (Figure 8).
 - * The folded FCC conductors go on top of the busbar fingers, or on top of the solder terminals where there are no busbar fingers.
 - * The CE-1401700 cable insertion tool can be used to aid in cable insertion (Figure 9).

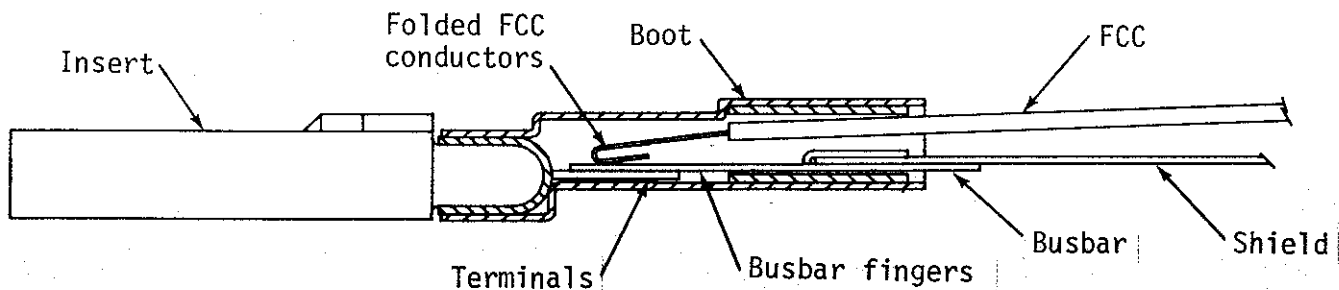


Figure 8. FCC Inserted into Insert Boot

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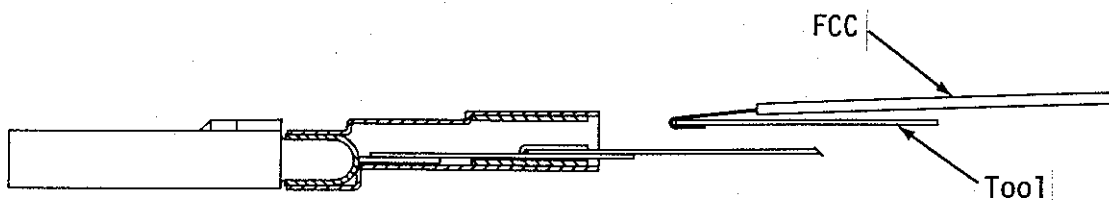


Figure 9. Use of Cable Insertion Tool to Aid FCC Insertion

3. Insert a strip of meltable sealant (P/N CTA-0055) between the FCC and the shield/ busbar assembly (Figure 10).

* Make sure the sealant is positioned within the boot.

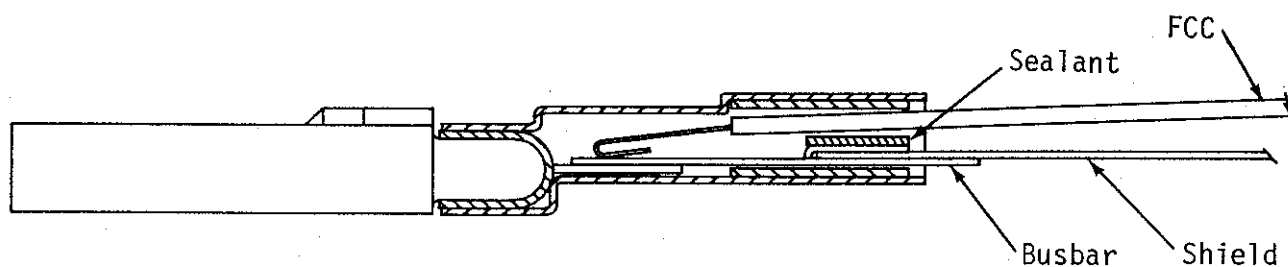


Figure 10. CTA-0055 Sealant Inserted Between FCC and Shield

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5.3 B Insertion Procedure for Note "B" Assemblies. Use this procedure if there is no shield, if the busbar has no grounding fingers, or if the shield is being installed on top of the FCC.

1. Insert the prepared FCC into the insert boot (Figure 11).
 - * The folded FCC conductors go on top of the solder terminals.
 - * The CE-1401700 cable insertion tool can be used to aid in cable insertion (Figure 9).
 - * If there is no busbar or shield, skip to Paragraph 5.4 after completion of this step.

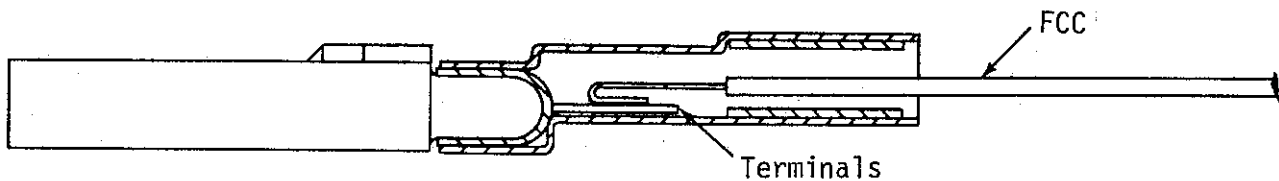


Figure 11. FCC Inserted Into Boot of Insert

2. If a shield/busbar assembly is being terminated in this insert, position the busbar as shown in Figure 12 or Figure 13.

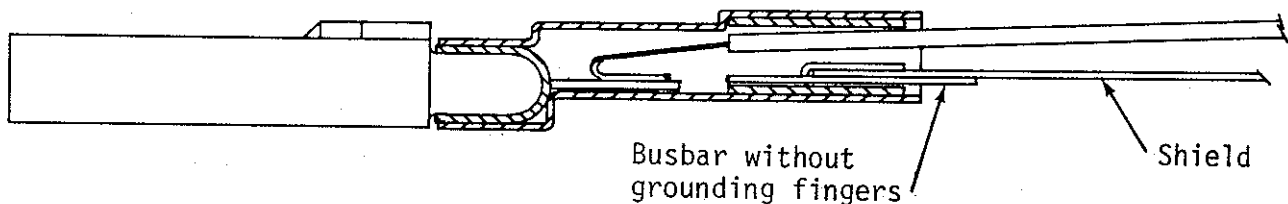


Figure 12. Busbar Position if Underneath FCC (Without Grounding Fingers)

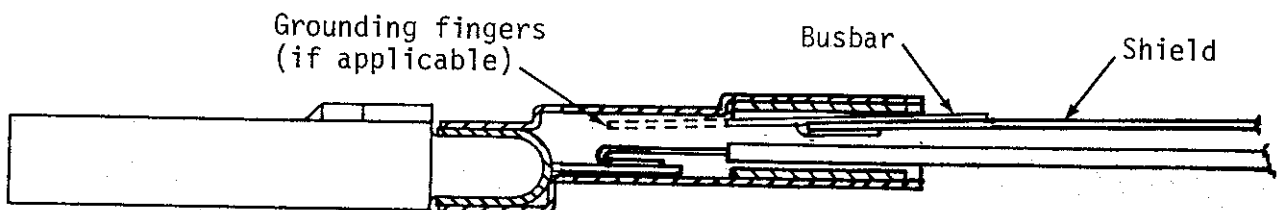


Figure 13. Busbar Position if On Top of FCC (With or Without Grounding Fingers)

PROCEDURE FOR TERMINATING FLAT CONDUCTOR CABLES
WITHOUT EMI SHIELDING TO MTC100 CONNECTORS

ES-71016 Rev. B
DWG. NO.

12 of 18
SHEET

TITLE

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3. If a busbar/shield assembly is being terminated in this insert, position a strip of meltable sealant (P/N CTA-0055) between the FCC and the shield or busbar (Figure 14 or 15).

* Make sure the sealant is positioned within the boot.

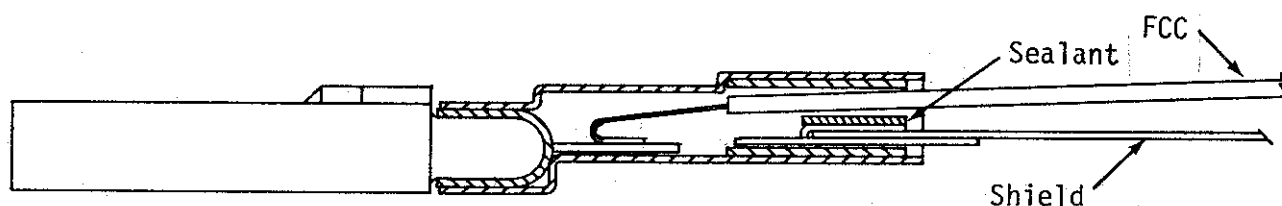


Figure 14. CTA-0055 Sealant Inserted Between FCC and Shield (Shield Below)

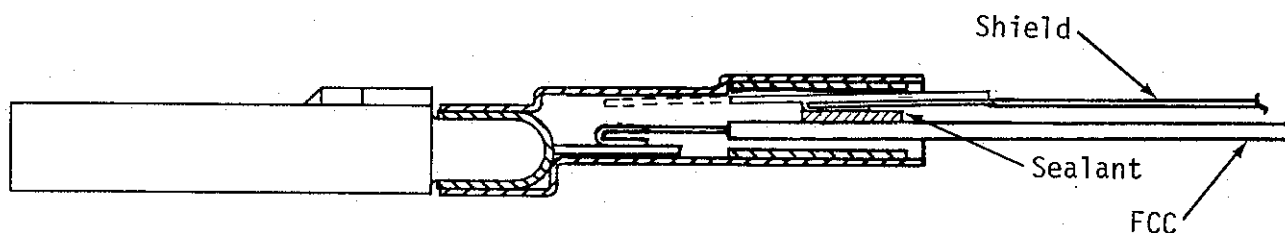


Figure 15. CTA-0055 Sealant Inserted Between FCC and Shield (Shield Above)

5.4 Heating.

The heating procedure is described in detail in Section 3.3 of the Waffle Iron II Operating and Maintenance Instruction.

WARNING

In keeping with good industrial hygienic practice, adequate ventilation must be maintained whenever plastic materials are heated.

1. Make sure that the Waffle Iron II set-up has been completed as described in Paragraph 5.1 of the Waffle Iron instructions, using the platens and control settings listed in Table 2.

Table 2. Waffle Iron II Platens and Control Settings

Cable Configuration	Insert Type	Platen Set	Control Setting TEMP/TIME
24-gauge FCC with busbar	Pin	CE-1513200	2/2
	Socket	CE-1513300	2/2
22-gauge FCC with busbar	Pin	CE-1513400	2/2
	Socket	CE-1513500	2/2
24-gauge FCC without busbar	Pin	CE-1510900	1/2
	Socket	CE-1511000	1/2
22-gauge FCC without busbar	Pin	CE-1508700	2/2
	Socket	CE-1508800	2/2

2. Load the insert/cable assembly into the Waffle Iron II.

- * The insert positioned against the stop in the platen.
- * Retention ribs facing upward.
- * Cable (and shield when applicable) extending to operator's right.
- * Busbar in position in the platen, if applicable.

3. Line up cable with guide lines in Waffle Iron upper surface.

4. Close the cable clamp.

5. Inspect for proper loading and cable insertion.

6. Close and latch the upper heat sink.
7. Press the START button.
 - * The green READY/ERROR light must be illuminated before the heating cycle can be started.
8. Allow the heating cycle to continue until the READY/ERROR light comes on again.
9. Open the upper heat sink and remove the terminated assembly.
10. Inspect the terminated assembly (Section 6).

6.0 INSPECTION OF TERMINATIONS

6.1 Inspection for Conductor Positioning.

FCC conductors and fingers of busbar (if applicable) are to be positioned on insert terminals as shown in Figure 16.

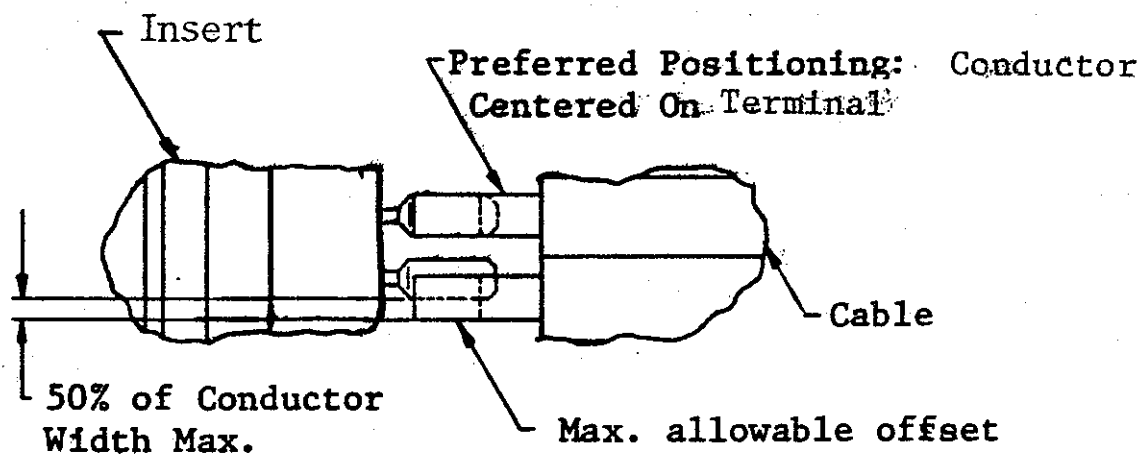


Figure 16. Inspection for Conductor Positioning

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6.2 Inspection for Proper Soldering.

The solder coating on conductors and terminals must have melted and flowed so that fillets are formed between conductors and terminals. Figure 17 illustrates the areas to inspect for solder fillets. If fillets are visible on some conductors, it indicates that the components have reached a high enough temperature to melt the solder on all of the conductors.

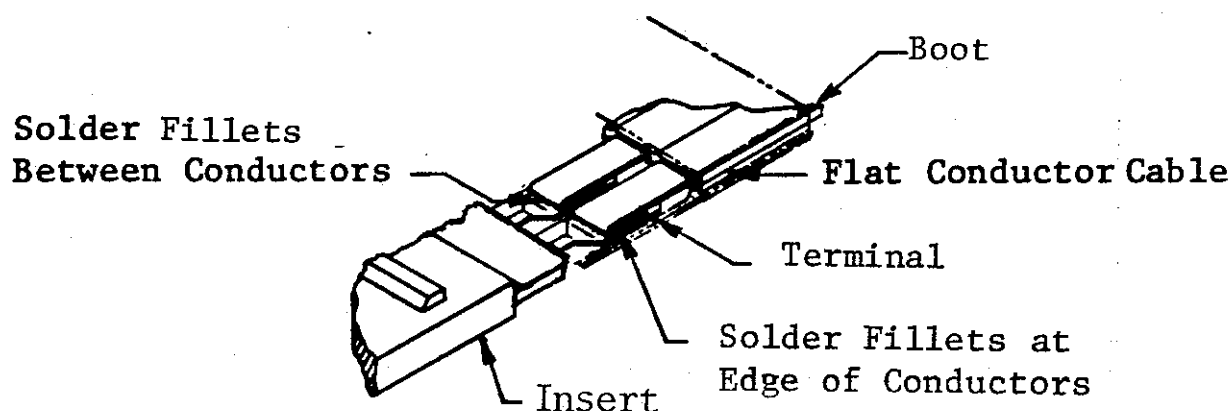


Figure 17. Inspection for Solder Flow

6.3 Electrical Testing. The following electrical tests are recommended for the completed termination.

1. Electrical continuity.
2. Insulation resistance. Requirement is 5000 megohms, minimum, at 500 V dc.
3. Dielectric withstanding voltage. Requirement is 2.0 mA maximum leakage at 300 V rms.

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7.0 CABLE ASSEMBLY PROCEDURES

7.1 Inserting Terminated Inserts Into Shells.

1. Check the cable assembly drawing and match up the correct insert pairs for insertion into the connector shell.
 - * Both inserts must be the same mating type: two pin inserts or two socket inserts.
 - * One A insert and one B insert always fit together in one shell.
2. Position the two inserts evenly together with their retention ribs facing outward.
 - * There will always be a layer of shield between the two FCC layers, and there will be a layer of shield outside of one of the FCC layers if specified on the applicable assembly drawing.
3. Orient the A insert toward the A side of the shell and the B insert toward the B side of the shell (Figure 18).

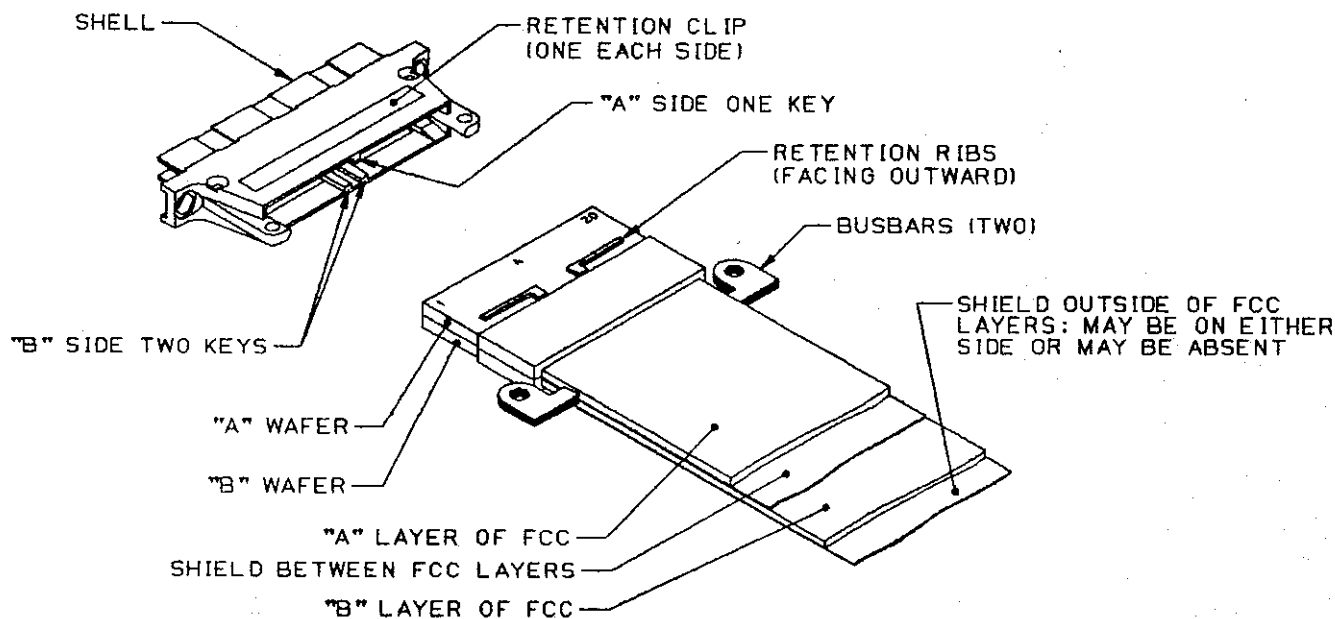


Figure 18. Terminated Insert Pair Ready for Insertion into Shell

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4. Push the inserts in until the retention clips for both inserts click into place.

* If one of the inserts is a dummy or has no cable attached, use the D-659-0001 insert removal tool to push the insert into place.

5. Pull on each FCC separately to make sure that both inserts are seated and locked into place.

6. Repeat steps 2 through 5 for the opposite end of the cable assembly.

* Make sure the cables are not twisted or wrapped around each other.

7. Fold any inter-layer shields into "Z" folds as shown in Figure 19, so that their length matches the FCC length.

* The positions of the "Z" folds on different cable assemblies within a flat cable bundle should be staggered to avoid thickness buildup.

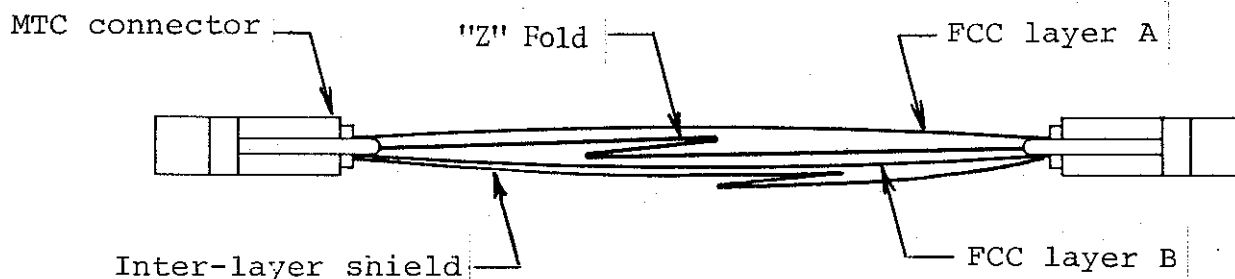


Figure 19. Inter-Layer Shields Folded to Match Length of FCC

7.2 Cable Clamp Installation.

1. Seat the inserts by mating the connector with a corresponding connector.
 - * The mating connector must contain the appropriate inserts.
 - * Tighten the jackscrews to 7 - 9 inch-lbs torque.
2. Install the cable clamps at the rear of the backshells (Figure 20).
 - * The clamp screws pass through the busbar ears and the shell ears.

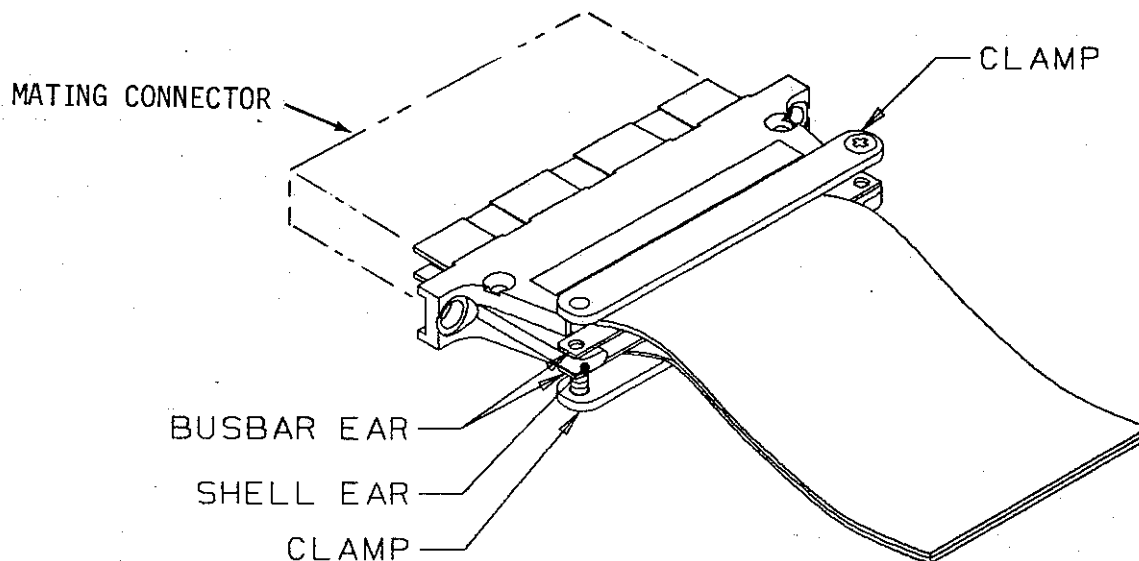


Figure 20. Installing Cable Clamps

3. Remove the mating connector that was installed in step 1.
4. Inspect the mating face of the connector.
 - * The mating faces of the two inserts must be flush with each other within 0.032 inch. If they are not flush as required, loosen the clamp screws, install the mating connector as described in step 1, and retighten the clamp screws. Then repeat steps 3 and 4.

FLAT CONDUCTOR CABLE GROUNDING PROCEDURE
FOR CONNECTORS AT EQUIPMENT INTERFACE
(WITHOUT EMI SHIELDING)

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ES-71016 Addendum 1

DWG. NO.

1 OF 3
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FLAT CONDUCTOR CABLE GROUNDING PROCEDURE
FOR CONNECTORS AT EQUIPMENT INTERFACE
(WITHOUT EMI SHIELDING)
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FLAT CONDUCTOR CABLE GROUNDING PROCEDURE
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(WITHOUT EMI SHIELDING)

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DWG. NO. ES-71016 Addendum 1

2 OF 3
SHEET

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1.0 PURPOSE AND SCOPE

This addendum covers the procedure for terminating flat conductor cable (FCC) ground conductors and/or unused conductors when the connector being terminated is to be mated at an equipment box. When this procedure is followed, ground conductors and unused conductors are grounded to the connector shell or cut off, preventing them from conducting stray signals through the connector and into the equipment. This procedure is for cables without EMI shielding.

2.0 REFERENCES

ES-71016: Procedure for Terminating Flat Conductor Cables Without EMI Shielding to MTC100 Connectors (With and Without Inter-Layer Shield)

3.0 TOOLS

CE-1405200 Cable and Busbar Alignment Fixture

4.0 MATERIALS

Per ES-71016

5.0 PROCEDURES

Paragraph 5.1 of ES-71016

Insert the following steps between step 7 and step 8:

7A. If a busbar will be used, bend all spare conductors and ground conductors of the FCC back against the FCC insulation (Figure 1A). Direction of fold must be toward the side of the FCC that will have the busbar and shield attached. If there is no busbar, cut off all spare and ground FCC conductors flush with the end of the FCC insulation.

7B. Trim the folded-back spare and ground conductors to the length indicated in Figure 1A.

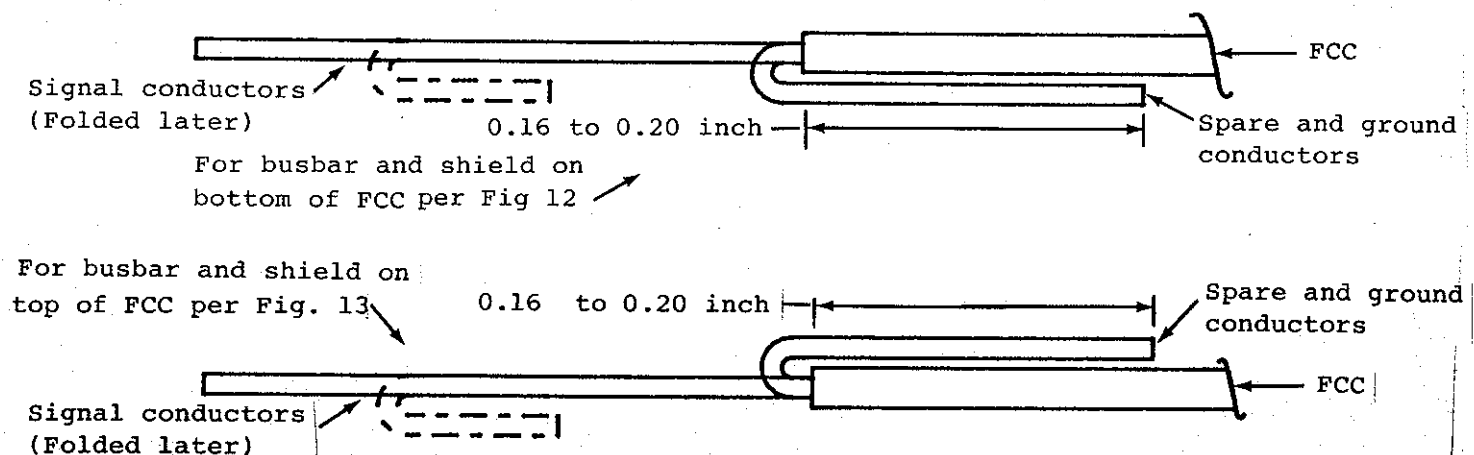


Figure 1A. Folding and Trimming of Spare and Ground Lead Conductors

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FLAT CONDUCTOR CABLE GROUNDING PROCEDURE
FOR CONNECTORS AT EQUIPMENT INTERFACE
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ES-71016 Addendum 1

3 OF 3

DWG. NO.

SHEET

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Paragraph 5.2 of ES-71016

Modify Step 1 as follows:

Remove all of the grounding fingers from the busbar (Figure 3A).

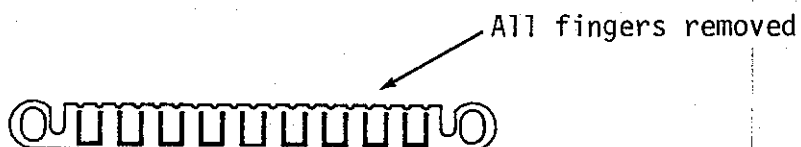


Figure 3A. Busbar Trimming for Connector at Equipment Box

Insert the following step after step 1:

1A. Solder the folded-back ground and spare conductors to the trimmed busbar.

* Busbar clips are to face toward the FCC insulation (Figure 3B).

* Use the CE-1405200 alignment tool to position the busbar and FCC (Figure 3C).

* Avoid solder buildup. Reflow of existing solder coating is preferred.

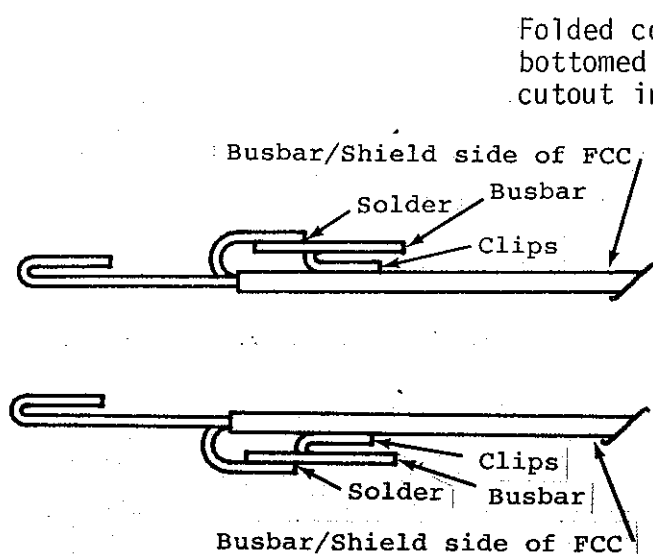


Figure 3B. Soldering FCC Conductors to Busbar

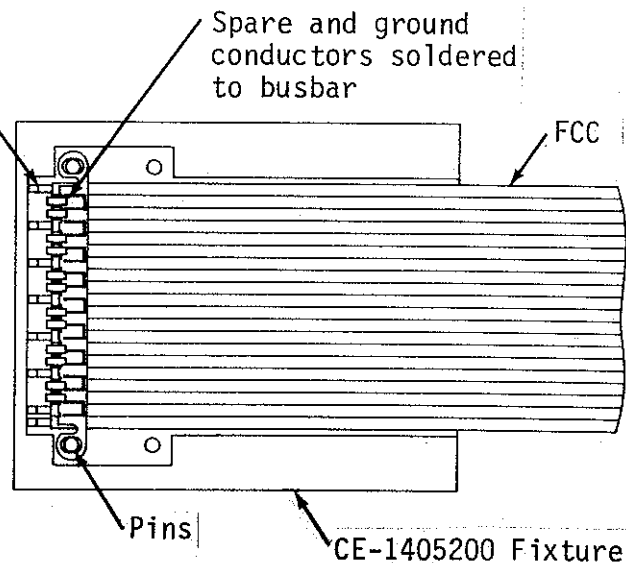


Figure 3C. Use of CE-1405200 Alignment Tool