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PROCEDURE FOR TERMINATING FLAT CONDUCTOR CABLES WITH EMI SHIELDING TO MTC100 CONNECTORS

Bell Helicopter/Boeing Vertol V-22 Program

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1.0 PURPOSE AND SCOPE

This standard covers the procedures for terminating flat conductor cables (FCC) to MTC100 connectors, with an inter-layer shield for crosstalk protection and a wraparound shield for EMI 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	Insert Type	Platen Set
24 (with busbar)	Pin	CE-1513200
	Socket	CE-1513300
22 (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

Abrasive stripper for flat shielding: Carpenter Model 44B with wheel No. 2490.

Solder pot

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. Pretin the exposed conductors by dipping them in molten Sn60 or Sn63 solder.

   * Solder temperature: 500 $\pm$ 20°F.

   * Skim dross from solder in pot.

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

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 dimension is shown in Figure 1, for reference.

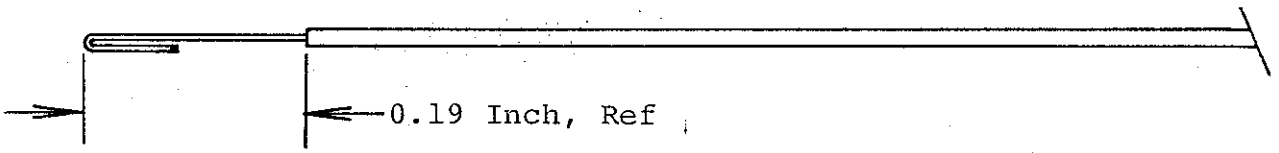


Figure 1. FCC Folding Dimensions

5.2 Busbar and Inter-Layer Shield Preparation. An inter-layer shield is normally used between the two layers of FCC to isolate the two FCC layers from each other (Figure 2). The inter-layer shield is terminated along with an FCC to either the A or B insert of the connector, by means of a busbar (Figure 3). Busbars are also used for grounding FCC conductors.

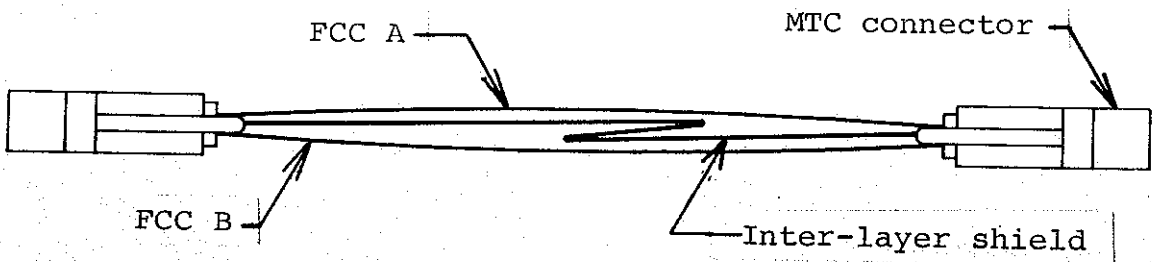
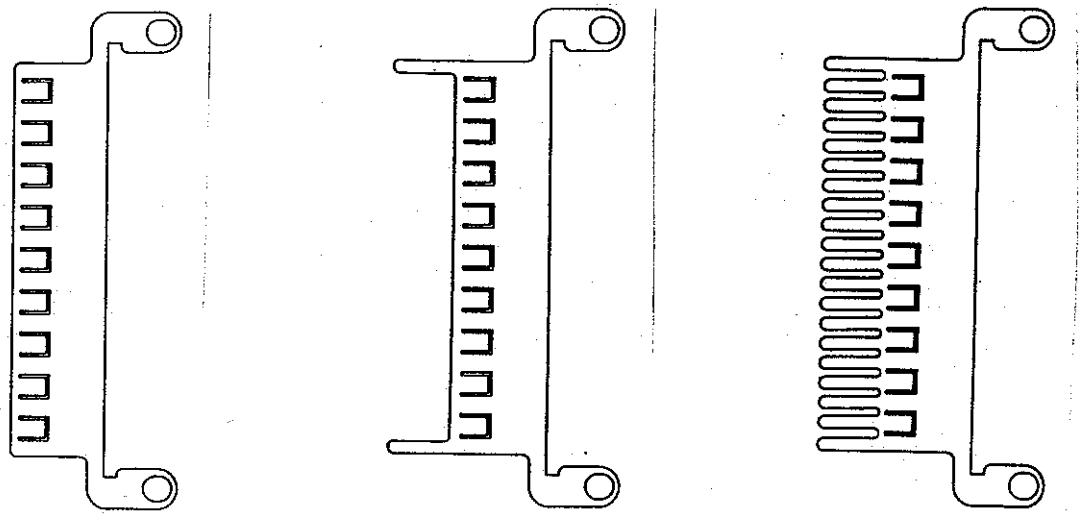


Figure 2. Location of Inter-Layer Shield in FCC Cable Assenbly



Type 1. Without Grounding Fingers

Type 2. With Grounding Fingers at Ends Only

Type 3. With Multiple Grounding Fingers

Figure 3. Busbars for Inter-layer Shield Termination and Circuit Grounding

1. If a type 3 busbar (see Figure 3) is being used, trim the grounding fingers as specified on the cable assembly drawing.

   * Figure 4 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.

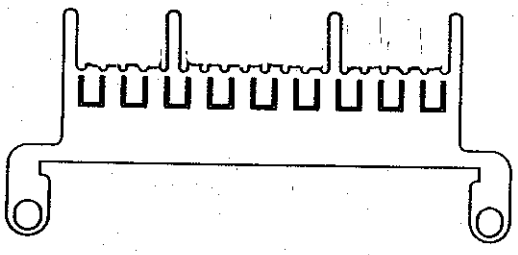


Figure 4. Example of Trimmed Type 3 Busbar

2. Cut the inter-layer shield to the required length (Figure 5).

   * Total shield length is the cable assembly interface-to-interface length plus 6.0 inches.

   * Use Carpenter Model 95A flat cable cutter or sharp paper cutter.

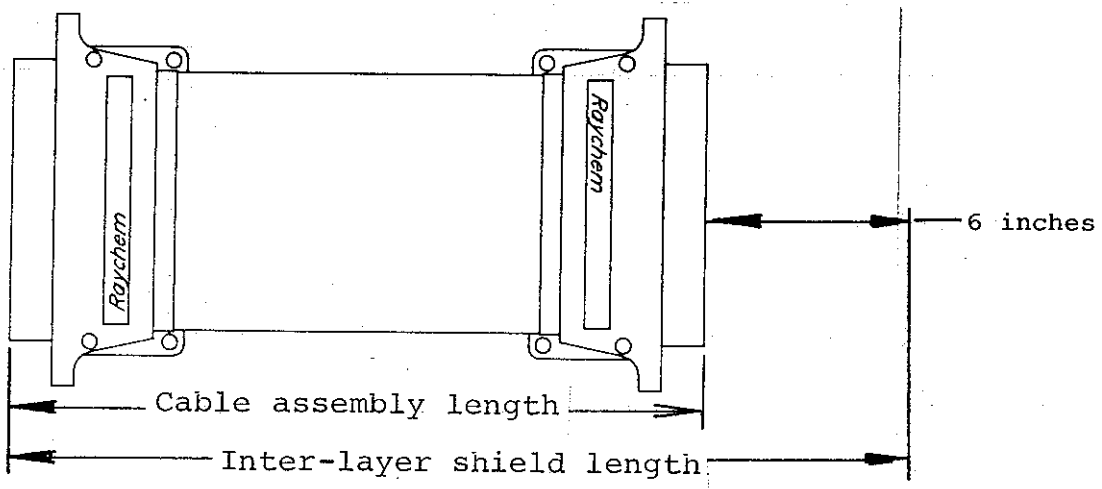


Figure 5. Length Determination of Inter-Layer Shield

3. Strip the shield insulation for a distance of 0.4 ± 0.1 inch (Figure 6).

   * Use the Carpenter Model 44B abrasive wheel stripper with abrasive wheel #2490.

   * Remove insulation from both surfaces of the shield.

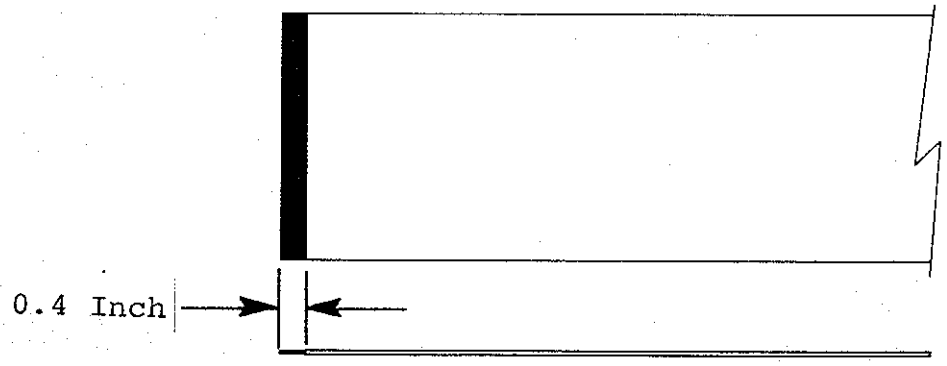


Figure 6. Stripping the Inter-Layer Shield

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 using Sn63 or Sn60 solder.

   * 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.

8. Insert the end of the shield into the clips at the rear of the busbar as shown in Figure 7.

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

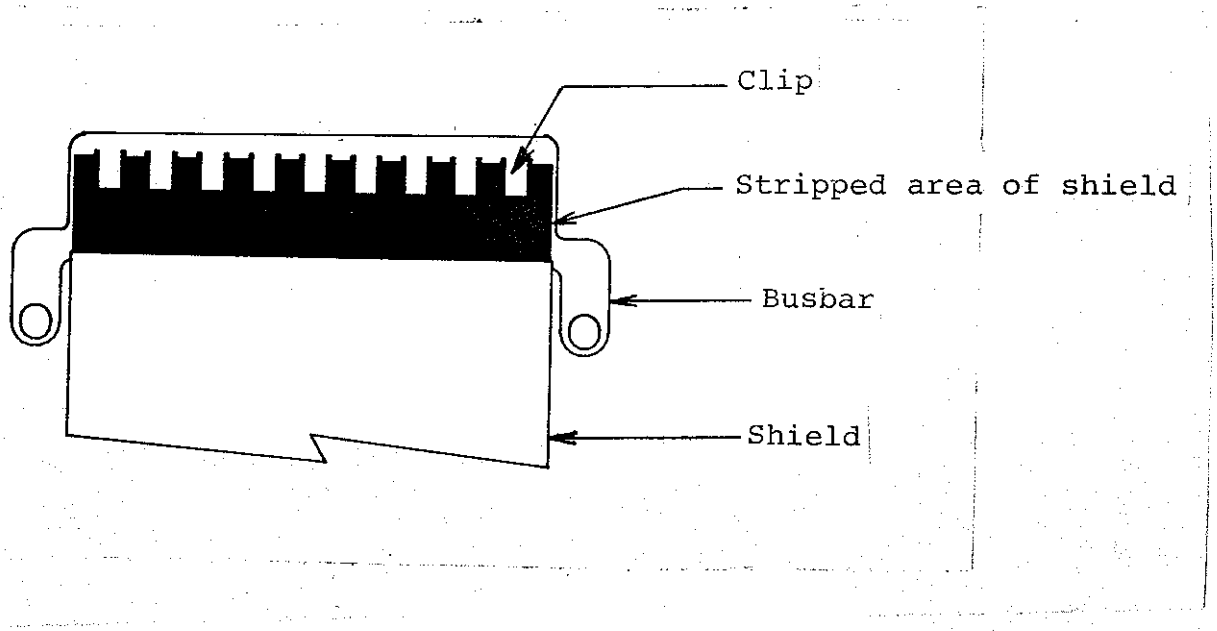


Figure 7. Inserting Prepared Inter-Layer Shield into Clips of Busbar

5.3 Inserting FCC, Shield and Busbar Into MTC Insert.

IMPORTANT

Note A: If a busbar with grounding fingers is being used, use procedure 5.3 A.

Note B: For all other configurations use procedure 5.3 B. Other configurations include (1) No busbar, and (2) Busbar with no grounding fingers.

5.3 A Insertion Procedure for Note "A" Assemblies. Use this procedure if a busbar with grounding fingers is being installed, either with or without an inter-layer shield.

1. Insert the busbar or the shield/busbar assembly into the boot of connector insert A or B, as specified on the cable assembly drawing (Figure 8).

   * Make sure that the busbar fingers go in on top of the insert terminals and the shield (if present) comes out above the busbar.

   * Push the busbar or shield/busbar assembly in until the busbar bottoms inside the boot of the insert.

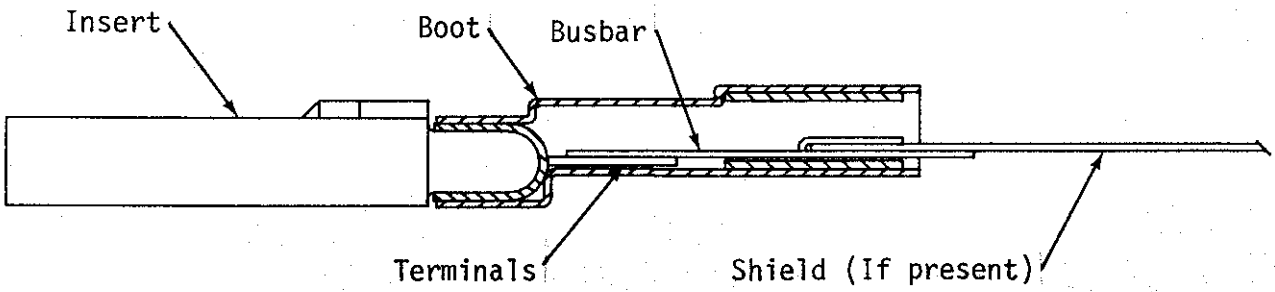


Figure 8. Shield/Busbar Assembly Inserted into Insert Boot Per Note "A"

2. Insert the prepared FCC into the insert boot (Figure 9).

   * 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 10).

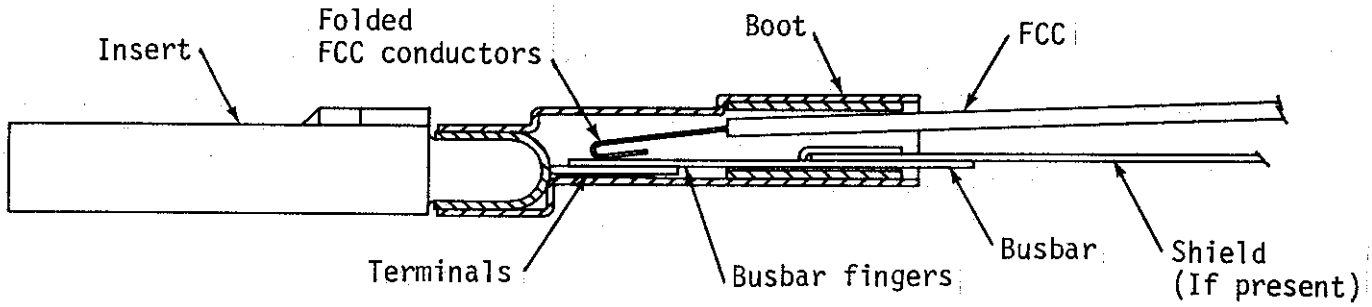


Figure 9. FCC Inserted into Insert Boot

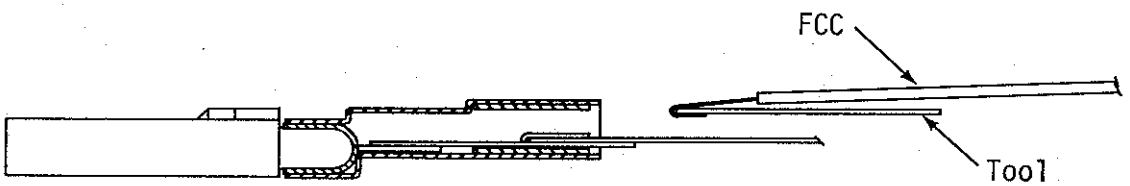


Figure 10. Use of Cable Insertion Tool to Aid FCC Insertion

3. Insert a strip of meltable sealant (P/N CTA-0055) between the FCC and the busbar (Figure 11).

   * Make sure the sealant is positioned within the boot.

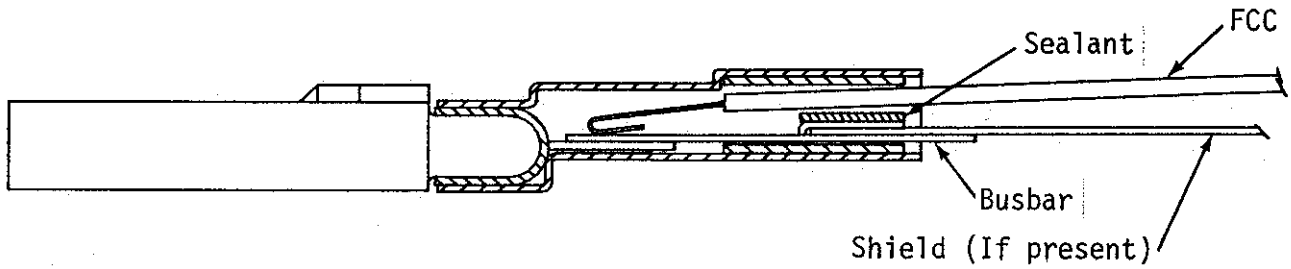


Figure 11. CTA-0055 Sealant Inserted Between FCC and Shield/Busbar

5.3 B Insertion Procedure for Note "B" Assemblies. Use this procedure if there is no busbar, or if there is a busbar without grounding fingers.

1. Insert the prepared FCC into the boot of connector insert A or B, as specified on the cable assembly drawing (Figure 12).

   * 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 10).

   * If there is no busbar or shield, proceed to paragraph 5.4 after completion of this step.

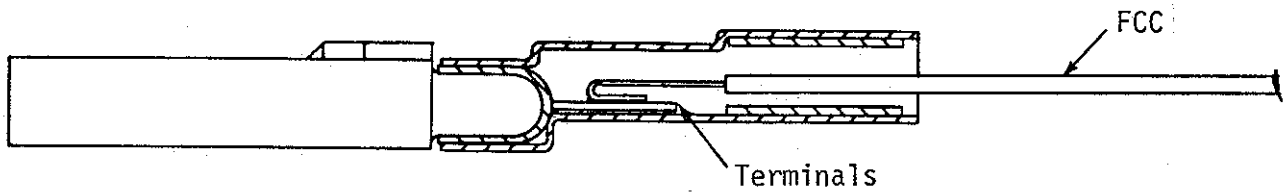


Figure 12. FCC Inserted Into Boot of Insert

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

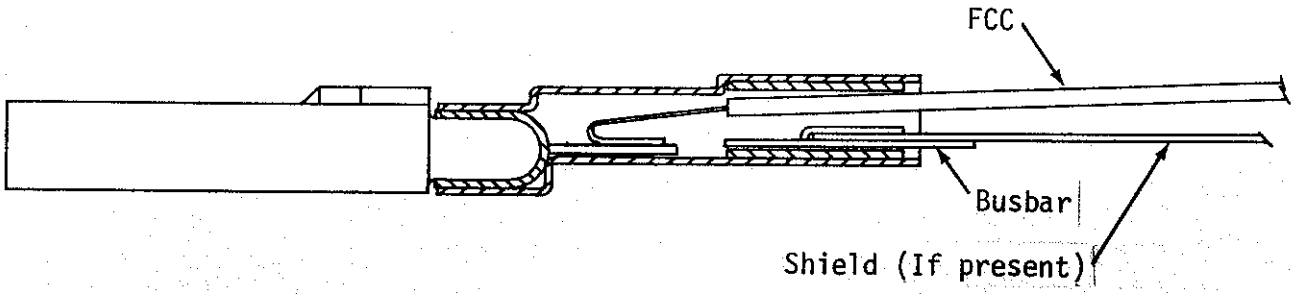


Figure 13. Position of Busbar Without Grounding Fingers

3. If a busbar or a shield/busbar 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).

   * Make sure the sealant is positioned within the boot.

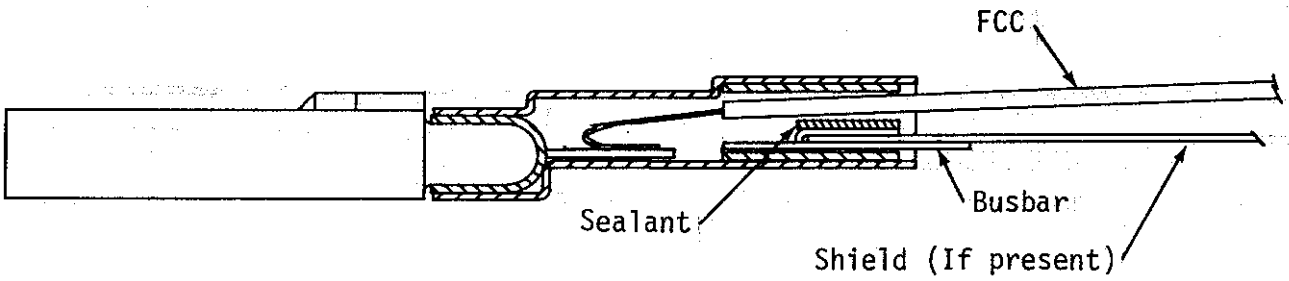


Figure 14. CTA-0055 Sealant Inserted Between FCC and Shield/Busbar

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

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

   * Insert against the stop in the platen.

   * Retention ribs facing upward.

   * Cable (and shield when applicable) extending to operator's right.

3. Line up cable and shield 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 inter-layer shield are to be positioned on insert terminals as shown in Figure 15.

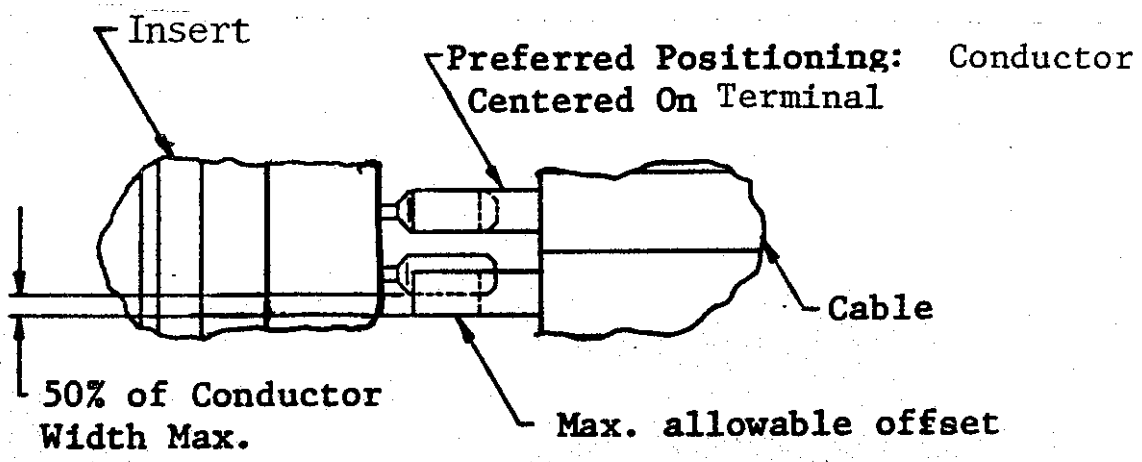


Figure 15. Inspection for Conductor Positioning

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 16 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.

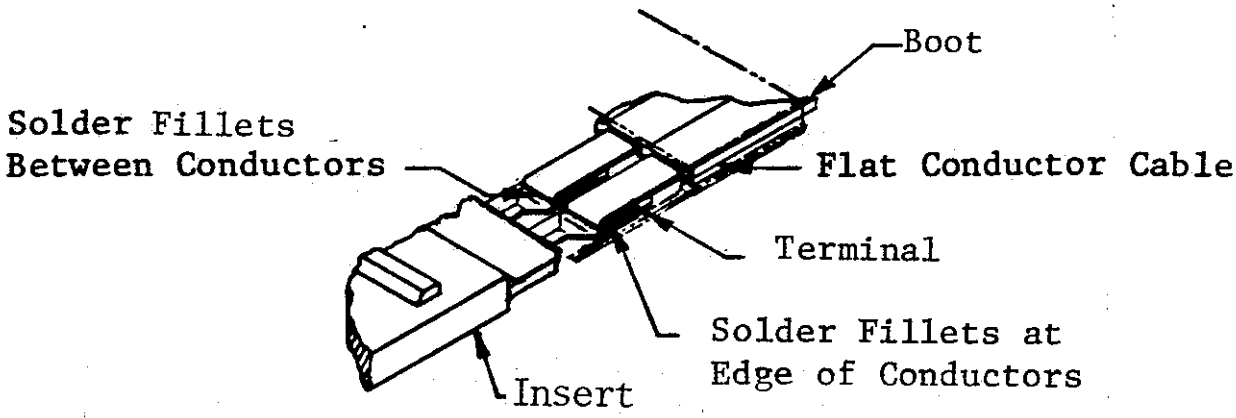


Figure 16. Inspection for Solder Flow

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.

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.

   * One of the inserts will have inter-layer shielding terminated to the busbar. The other insert will have a busbar terminated to it, but no shielding.

2. Position the two inserts evenly together with their retention ribs facing outward.

   * The attached inter-layer shield will now be between the two FCC layers.

3. Orient the A insert toward the A side of the shell and the B insert toward the B side of the shell (Figure 17).

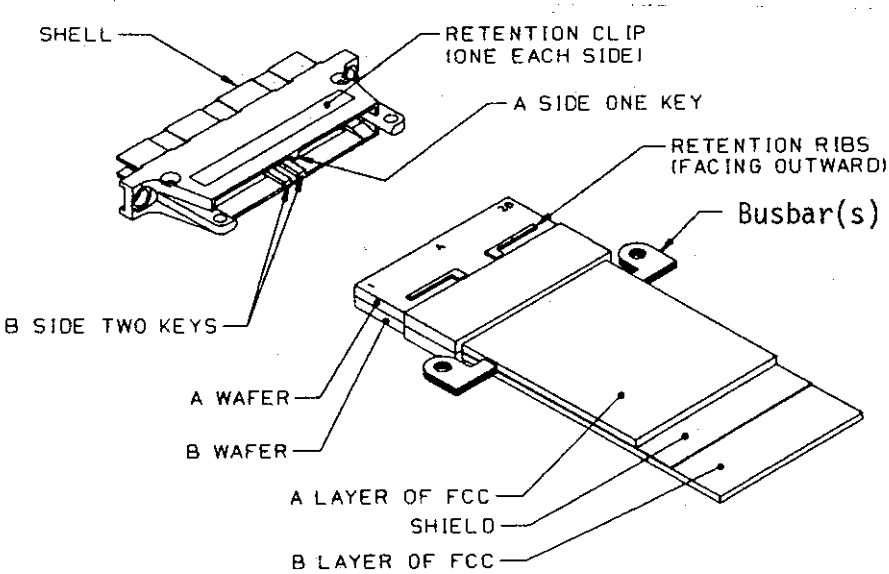


Figure 17. Terminated Insert Pair Ready for Insertion into Shell

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, 3 and 4 for the opposite end of the cable assembly.

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

7. Fold the inter-layer shield into a "Z" fold as shown in Figure 18, so that its 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.

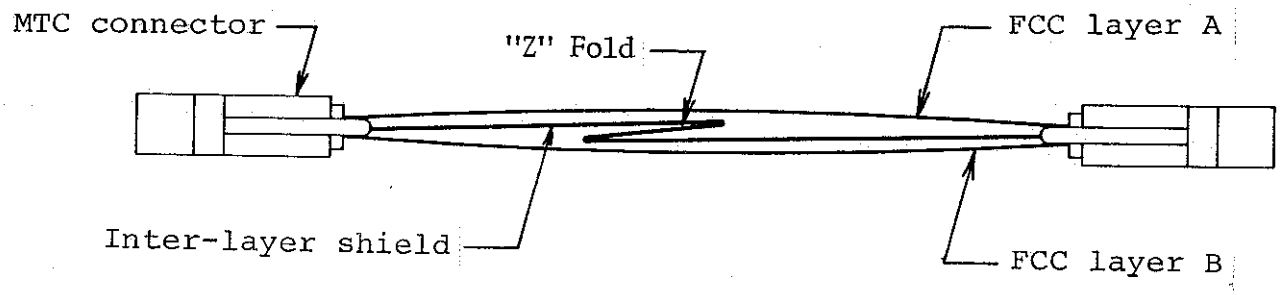


Figure 18. Inter-Layer Shield Folded to Match Length of FCC

7.2 Installing Wraparound Shield and EMI Backshells.

1. Cut the wraparound shield to the same length as the overall length of the cable assembly from connector interface to connector interface (Figure 19).

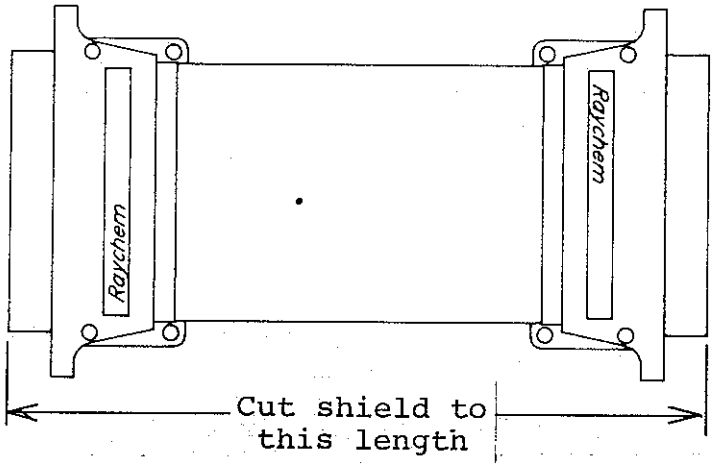


Figure 19. Length Measurement for Wraparound Shield

2. Trim both ends of the shield as shown in Figure 20.

   * Make lengthwise cuts about 1/16 inch from drain wires.

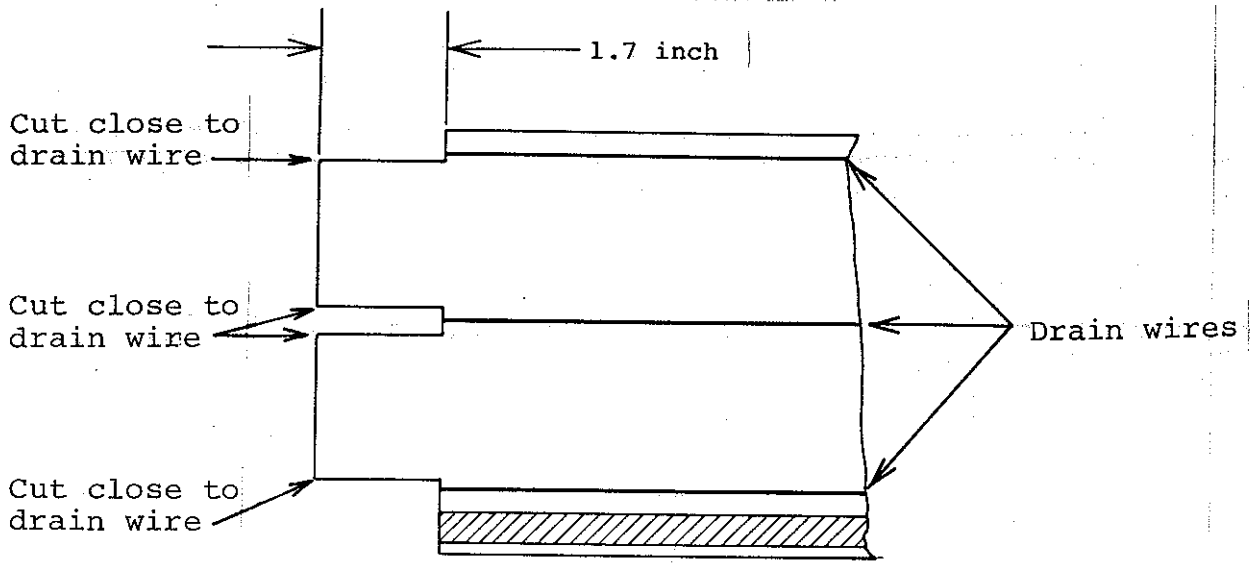


Figure 20. Trimming of Wraparound Shield

3. Fold both flaps back over the shield at both ends of the cable assembly (Figure 21).

   * Fold the inner (bare) surface of flaps outward.

   * Fold flaps back flush with main part of shield.

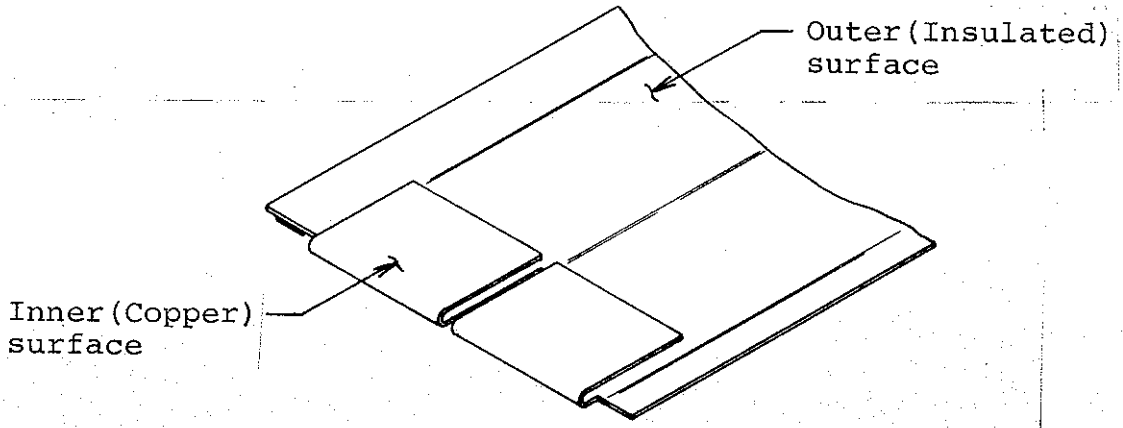


Figure 21. Flaps Folded Back

4. Fold the shield around the FCC for the full length of the cable assembly as shown in figure 22.

   * Be careful not to deform the ears of the busbar.

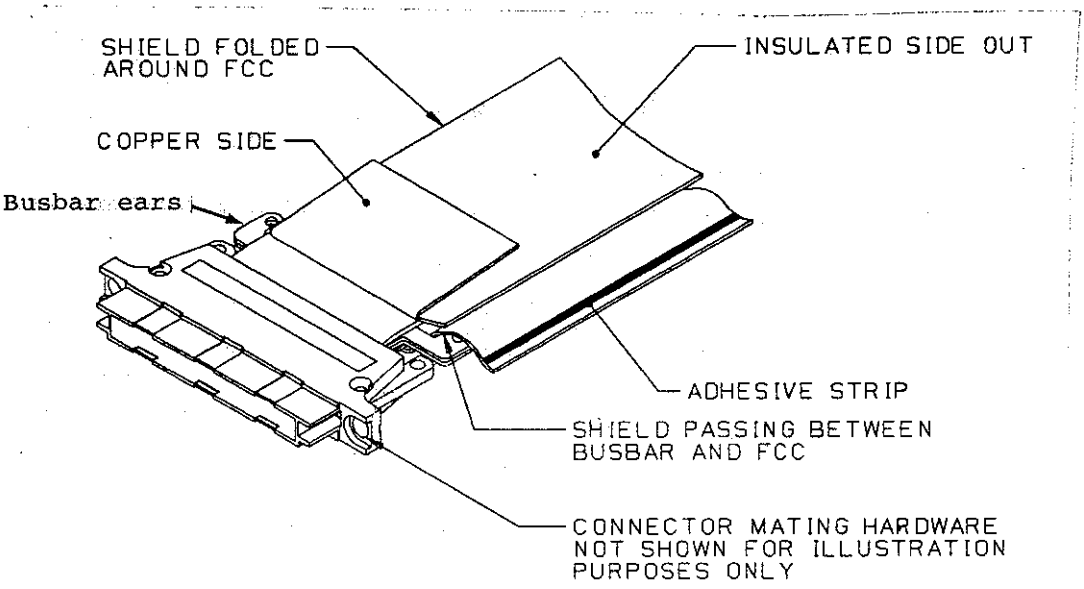


Figure 22. Wraparound Shield Folded Around FCC

5. Fold the upper flap forward over the connector at both ends of the cable assembly.

6. Fold the narrow edge of the shield (the edge without an adhesive strip) back on itself for the full length of the cable assembly (Figure 23).

   * Keep the cable assembly straight, and fold carefully to prevent buckling of the shield.

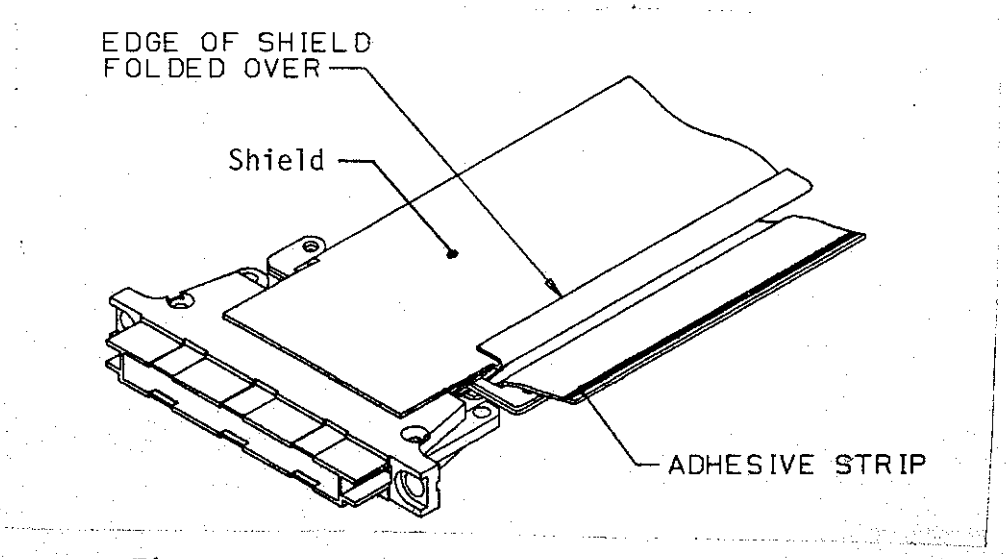


Figure 23. First Edge of Shield Folded Over

7. Remove the release paper from the adhesive strip and fold the adhesive edge of the shield over so that it sticks to the shield along the full length of the cable (Figure 24).

   * Be sure that the flaps are out of the way at each connector.

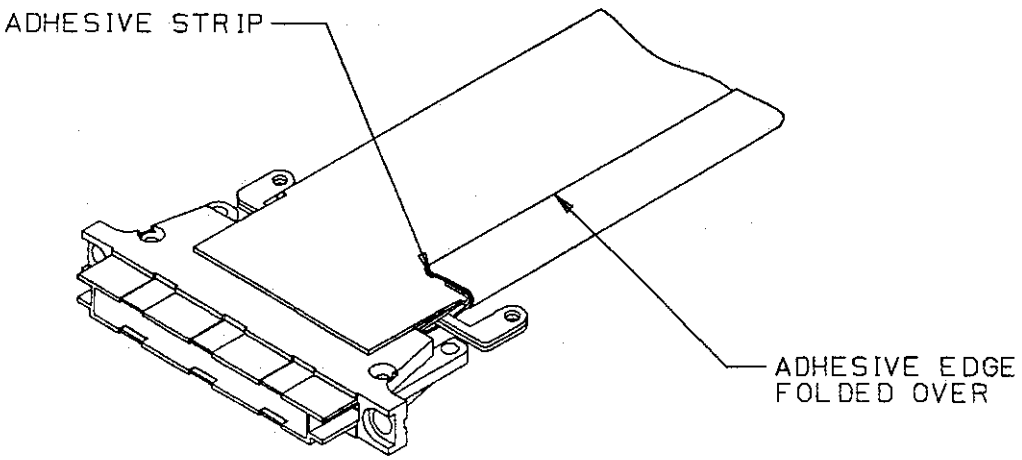


Figure 24. Adhesive Edge of Shield Folded Over

8. Fold the flaps back over the shielding at both ends of the cable assembly.

9. Select the proper EMI backshell to fit the connector shell.

   * Backshells for plug connectors have contact tabs to match recesses in the plug shells.

   * Receptacle shells and backshells do not have these recesses and tabs.

10. Attach the two backshell halves to the connector shells (Figure 25).

    * The top and bottom backshell halves are identical, and overlap each other at the edges.

    * CAUTION: When attaching backshells to a plug shell, be sure that the small fingers at the ends of the tabs are hooked around the lip of the shell in the recessed areas. Improperly installed tabs will prevent proper connector mating.

    * Each backshell half attaches by two size 2-56 Phillips head screws. Use a #0 Phillips screwdriver and tighten gently with fingertips to avoid stripping the threads.

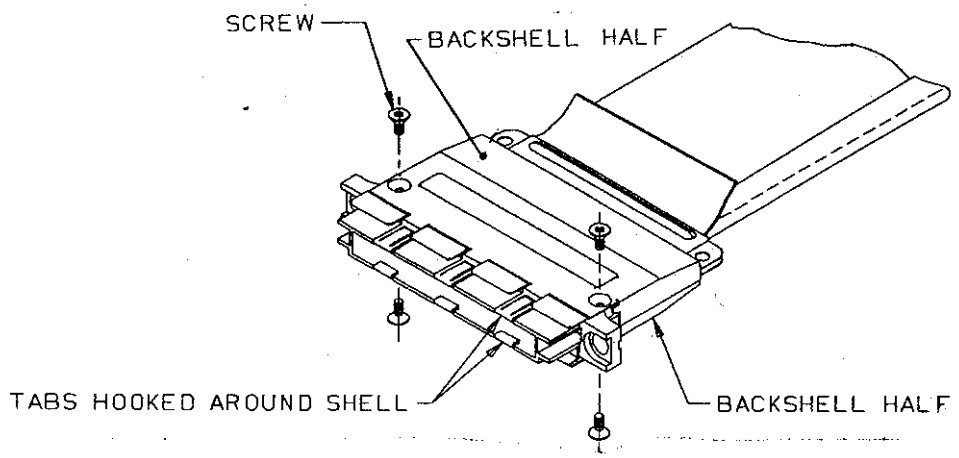


Figure 25. Attaching EMI Backshell to Connector Shell

11. Seat the inserts by mating the connector with a corresponding connector.

    * This procedure must be done at this time to seat the inserts in the shell. Do not perform this step out of sequence.

    * The mating connector must contain the appropriate inserts.

    * Tighten the jackscrews to 7 - 9 inch-lbs torque.

12. Insert the two inner clamps (with rubber inserts) into the rear of the backshell, between the shield flaps and the shield (Figure 26).

    * The ends of the inner clamps fit between the busbars and the backshell.

    * Make sure that the rounded corners of the clamps go next to the rounded corners of the backshells.

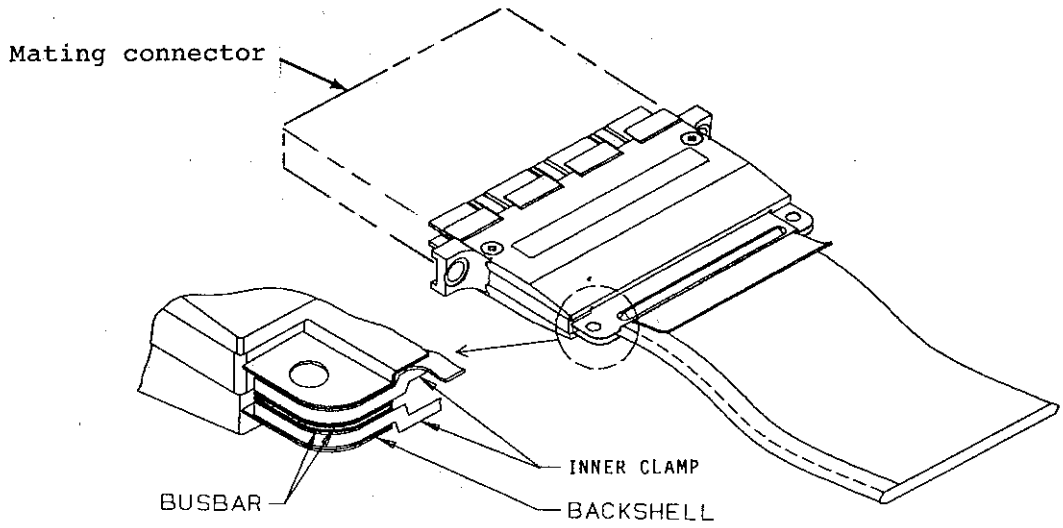


Figure 26. Inserting Inner Clamps

13. Fold the shield flaps forward over the connector.

14. Install the the outer clamps at the rear of the EMI backshells (Figure 27).

    * The shield flaps must be under the outer clamps and folded forward toward the connector.

    * Make sure that the rounded corners of the outer clamps are to the rear, lining up with the rounded corners of the inner clamps and EMI backshells.

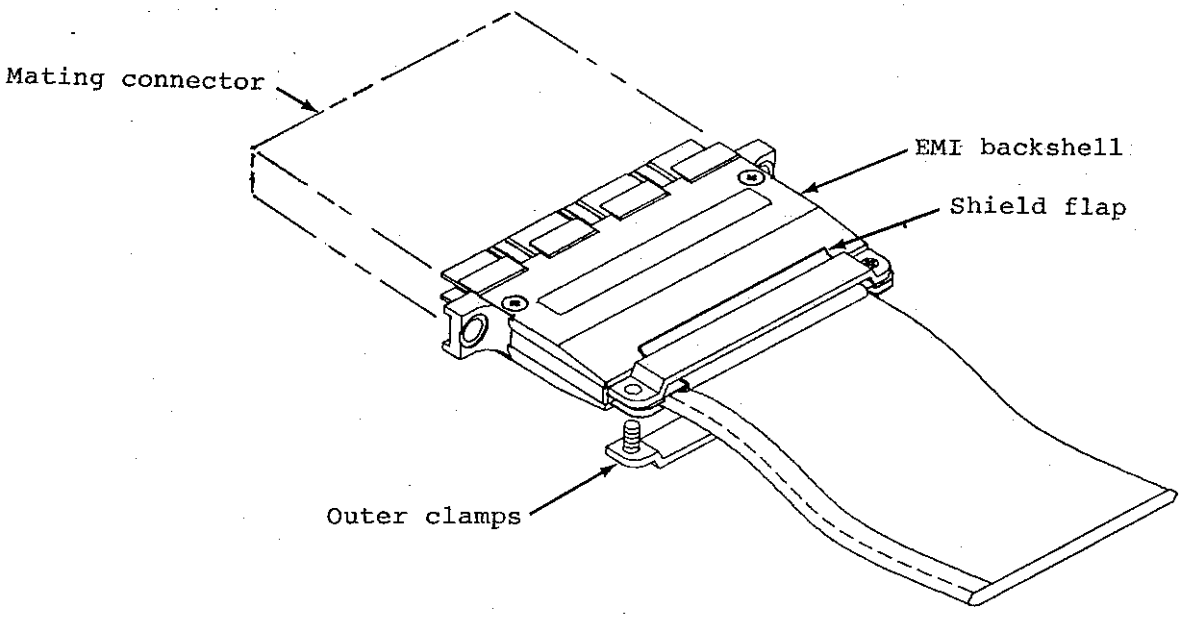


Figure 27. Installing Outer Clamps

15. Cut off the excess length of shield flap using small scissors.

16. Remove the mating connector that was installed in step 11.

17. 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 11, and retighten the clamp screws. Then repeat steps 16 and 17.

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ELECTRONICS GROUP
ENGINEERING STANDARD

ES-71014 ADDENDUM 1

FLAT CONDUCTOR CABLE GROUNDING PROCEDURE FOR CONNECTORS AT EQUIPMENT INTERFACE (WITH EMI SHIELDING)

Bell Helicopter/Boeing Vertol V-22 Program

Rev. B
2/20/87

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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 to the shield busbar 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, preventing them from conducting stray signals through the connector and into the equipment.

2.0 REFERENCES

ES-71014: Procedure for Terminating Flat Conductor Cables with EMI Shielding to MTC100 Connectors

3.0 TOOLS

CE-1405200 Cable and Busbar Alignment Fixture

4.0 MATERIALS

Per ES-71014

5.0 PROCEDURES

Paragraph 5.1 of ES-71014

Insert the following steps between step 7 and step 8:

7A. Bend all spare conductors and ground conductors of the FCC back against the FCC insulation. Direction of fold must be toward the side of the FCC that will have the busbar and shield attached.

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

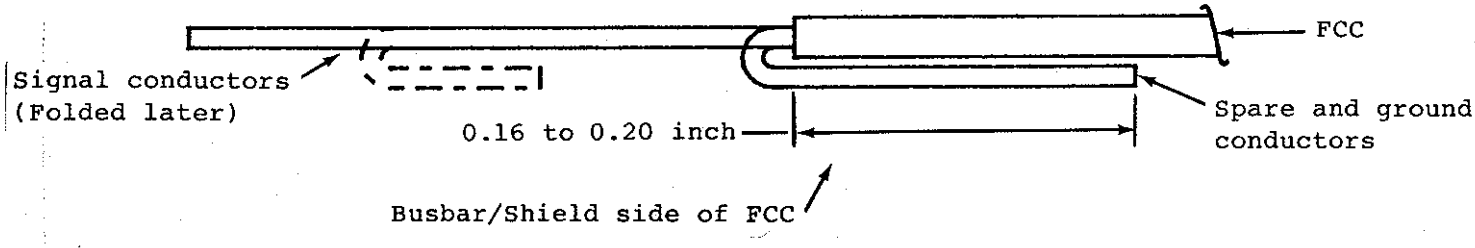

Figure 1A. Folding and Trimming of Spare and Ground Lead Conductors

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Paragraph 5.2 of ES-71014

Modify Step 1 as follows:

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

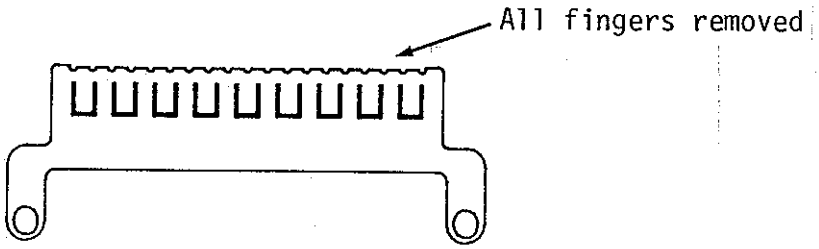

Figure 3A. Busbar Trimming for Connector at Equipment Box

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.

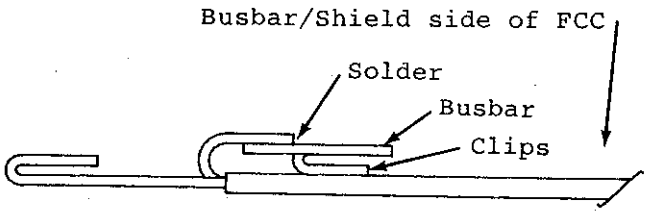

Figure 3B. Soldering FCC Conductors to Busbar

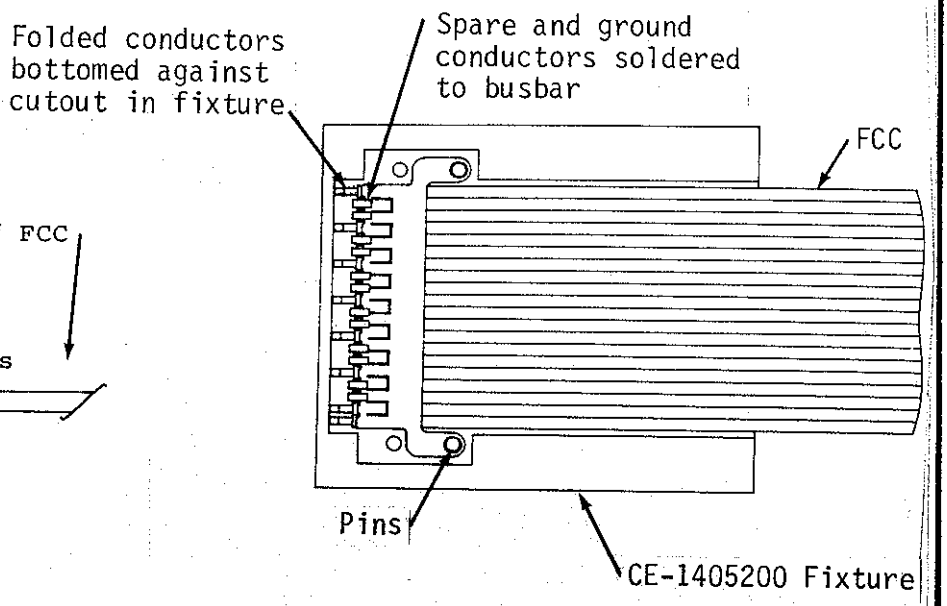

Figure 3C. Use of CE-1405200 Alignment Tool