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ES-71065

**MTC50 AND 50 mil CTM
TERMINATION PROCEDURES
FOR HUGHES NIGHT VISION SYSTEM**

THIS DOCUMENT CANNOT BE REVISED WITHOUT THE APPROVAL OF

HUGHES AIRCRAFT, NIGHT VISION SYSTEM ENGINEERING

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SCOPE:

This procedure details how to terminate Flat Conductor Cable (FCC) to either MTC50 inserts or to 24 awg round wires using 50 mil CTM parts. Both of these types of terminations involve a two-stage process. The FCC conductors are first soldered to the insert terminals or to the round wires using SolderSleeve terminators. The FCC can have shielding foil on one or both sides of the cable. The soldered terminations are then enclosed within a sealing boot. The termination of FCC conductors to round wires with meltable insulation should be performed with hot air. Otherwise, the termination of the FCC conductors to terminals or to round wires can be done with the Waffle Iron. The application of the sealing boot is done with the Waffle Iron.

This procedure is in two parts:

- Part 1:** MTC50 Terminations
See pages 3 through 20
- Part 2:** 50 mil CTM Terminations
See pages 21 through 38

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PART 1: MATERIALS REQUIRED TO MAKE MTC50 TERMINATIONS**Components Required**

Component Type	Part Number	Description
FCC	TUxx-050-28B	Flat conductor cable - 50 mil pitch xx = Number of conductors
MTC50 insert	MTC50-EA2-P42 MTC50-EB2-P42 MTC50-EA2-S42 MTC50-EB2-S42	2-inch (40 contact) A pin insert 2-inch (40 contact) B pin insert 2-inch (40 contact) A socket insert 2-inch (40 contact) B socket insert
Shielding components (as required by application)	CHA-0045 CHA-0062 CTA-0103-030 CTA-0140-030 CTA-0055	2-inch planar shield without adhesive 0.8-inch planar shield without adhesive Busbar without fingers Busbar with fingers Adhesive sealant strip

Materials Required

Material Description	Equivalent Allowed
Sn96Ag04 solder in solder pot	No
Sn96Ag04 solder in wire form	No
Sn63Pb37 in wire form	No
Kester 1544 RA flux	Yes (also see Note)
Kester 104 flux thinner	Yes
Tissues or Kimwipes	Yes
Flux brush	Yes
Adhesive tape	Yes
Isopropyl alcohol	No

Note: Alpha 611 RMA flux, or the equivalent, may be substituted for the RA flux, provided that the cable and shield material demonstrate adequate solderability with the RMA flux.

PART 1: TOOLS REQUIRED TO MAKE MTC50 TERMINATIONS

Purpose	Description	Manufacturer	Model #	Equivalent Allowed
Cable preparation	Solder pot containing Sn96Ag04	Any		No
	FCC cutting tool	Carpenter	Model 95A	Yes
	FCC stripping tool	Raychem	CE-1400600	No
Shield preparation (for shielded terminations)	Scissors	Any		Yes
	Abrasive stripping tool	Carpenter	Model 44C	Yes
	Hand soldering iron - small tip	Any		No
Termination	Heating tool: Waffle Iron II (110 volt) or Waffle Iron II (220 volt)	Raychem Raychem	CE-1404200 CE-1404300	No No
	MTC50 platen set : for pin inserts for sockets	Raychem Raychem	CE-1513700 CE-1517300	No No
Sealing boot installation	Heating tool: Waffle Iron II (110 volt) or Waffle Iron II (220 volt)	Raychem Raychem	CE-1404200 CE-1404300	No No
	MTC50 platen set : for pin insert with no shield for pin insert with 1 shield for socket insert with 1 shield for socket insert with 2 shields	Raychem Raychem Raychem Raychem	CE-1513700 CE-1516600 CE-1517300 CE-1517400	No No No No
Rework	Heating tool: SuperHeater hot air heater with needle point tip	Raychem	AA-400	No

PART 1: MTC50 TERMINATION PROCESS**STEP 1: FLAT CONDUCTOR CABLE PREPARATION**

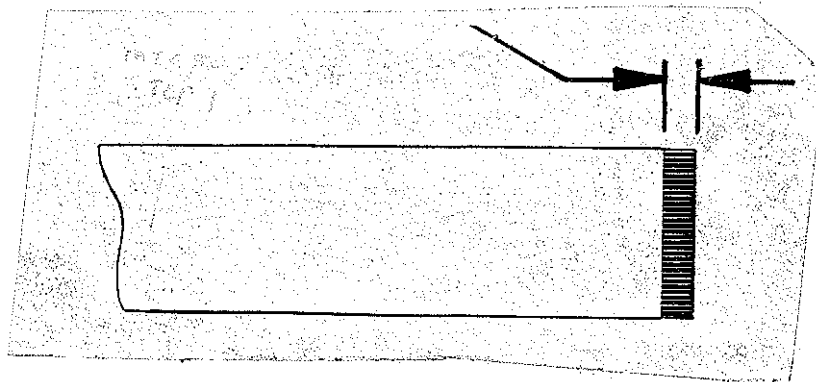
Outline: The cable is cut to the correct length, the insulation is stripped off at the termination end, and the bare conductors are pretinned.

Cut cable: Use Carpenter Model 95A cable cutter or a sharp paper cutter.

IMPORTANT: Cut end must be square, cleanly cut and free of folds or bends otherwise unacceptable terminations may result.

Strip cable: Use Raychem Model CE-1400600 cable stripper.
Refer to ES-61113 Instructions for Flat Conductor Cable Stripping Tool.

Strip Length: 0.200 ± 0.010 inch



Pretin: Dip the exposed conductors for a length of approximately 1/8 inch into a 1:1 mixture of Kester #1544 flux and Kester #104 thinner (or equivalents).

Allow fluxed conductors to dry for at least 30 seconds.

Dip exposed conductors into molten Sn96Ag04 solder in a solder pot.

Solder Temperature: $560 \pm 20^{\circ}$ F.

Skim dross from solder surface before dipping.

Immerse approximately 3/4 length of stripped conductors.

Immerse conductors for 4 to 6 seconds.

Withdraw slowly to prevent icicle formation.

PART 1: MTC50 TERMINATION PROCESS**STEP 1: FLAT CONDUCTOR CABLE PREPARATION (continued)**

Clean: Remove flux residues by wiping tinned conductors with a tissue wetted with isopropyl alcohol.

IMPORTANT: To avoid deforming the conductors while cleaning wipe in one direction only. Wipe from insulation to ends of the conductors and do not wipe across the conductors

Allow cleaned conductors to dry for at least 1 minute.

WARNING

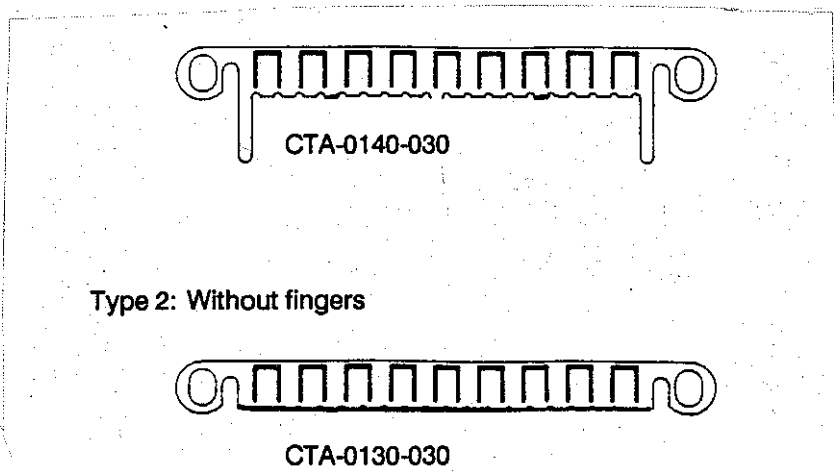
Isopropyl alcohol is a volatile, flammable liquid and may cause burns if ignited. Do not use near open flames or electrical sparks.

PART 1: MTC50 TERMINATION PROCESS**STEP 2: SHIELD PREPARATION
(Go to Step 3 if shield is NOT required)**

Outline: The appropriate busbar is chosen and the shield is prepared for termination by being cut, stripped and pretinned.

Choose busbar: The shield is attached to the connector insert by first being terminated to a busbar. There are two types of busbars:

Type 1: With fingers for attachment to insert terminals



Choose the correct busbar for the application (busbars must not be flux coated). Type 1 busbar fingers can be removed if required by cutting the fingers off flush with the busbar body. Sharp burrs should not be evident.

Cut shield: Use Carpenter Model 95A cable cutter or a pair of scissors to cut shield to desired length.

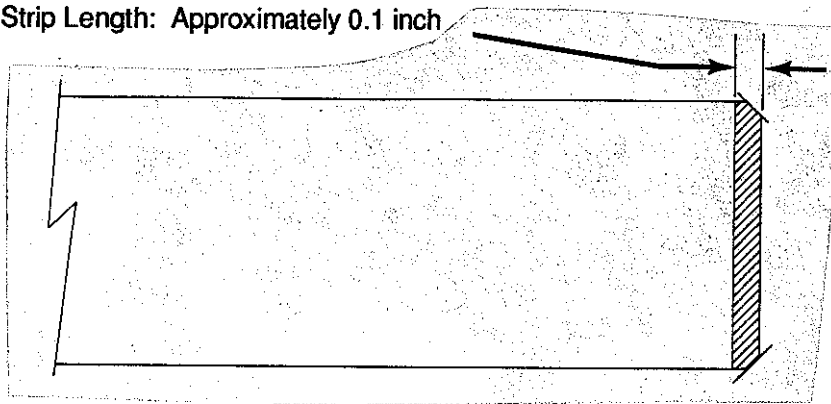
IMPORTANT: Cut ends must be square and cleanly cut to avoid poor terminations.

PART 1: MTC50 TERMINATION PROCESS**STEP 2: SHIELD PREPARATION (continued)**
(Go to Step 3 if shield is NOT required)

Strip shield: Use Carpenter Model 44C abrasive stripper or equivalent to strip the insulated backing from the copper foil at the end of the shield.

Corners may be chamfered up to 0.1 inch.

Strip Length: Approximately 0.1 inch



Pretin: Dip the exposed copper foil for half to three-quarters of the exposed length into a 1:1 mixture of Kester #1544 flux and Kester #104 thinner (or equivalent). The flux mixture can also be applied with a cotton-tipped swab.

Allow fluxed shield to dry for at least 30 seconds.

Using a hand soldering iron or a solder pot, pretin the exposed copper foil with Sn96Ag04 solder.

Clean: Remove flux residues by wiping the tinned shield with a tissue wetted with isopropyl alcohol.

IMPORTANT: Do not bend or fold the tinned shield because unacceptable terminations may result.

Allow cleaned shield to dry for at least 1 minute

WARNING

Isopropyl alcohol is a volatile, flammable liquid and may cause burns if ignited. Do not use near open flames or electrical sparks.

PART 1: MTC50 TERMINATION PROCESS

STEP 3: CONDUCTOR TERMINATION

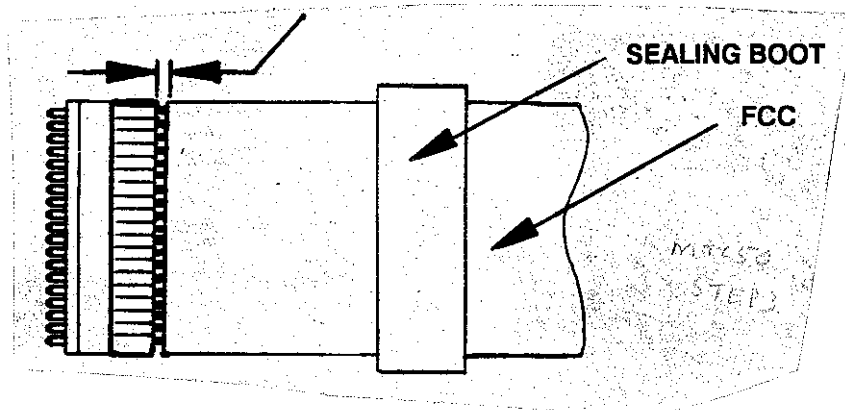
Outline: The sealing boot is slipped onto the cable. The FCC conductors and Type 1 busbars are inserted into the SolderSleeve terminators on the insert terminals and are soldered to the insert terminals in the Raychem Waffle Iron II Heating tool. The area is cleaned and the solder joints are inspected and may be electrically tested.

Slip on sealing boot: Slip the sealing boot onto the FCC and position it several inches behind the termination zone.

IMPORTANT: The sealing boot **MUST** be slipped on the cable prior to conductor termination. The sealing boot will not fit over the insert.

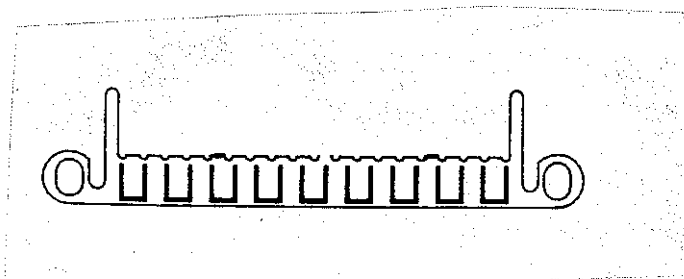
Insert cable: With the keyed side of the insert up (the side marked with **Raychem** and the numbers 1 and 40), insert the pretinned FCC conductors into the SolderSleeve terminators.

IMPORTANT: Insert the conductors until there is a gap of approximately one conductor width between the FCC insulation and the end of the SolderSleeve terminator insulation in order to properly position the cable.



The conductors should be positioned on top of the terminals; however, acceptable terminations will be made if the conductors are under the terminals.

IMPORTANT: Do not deform conductors by over-inserting FCC because unacceptable solder joints may result.

PART 1: MTC50 TERMINATION PROCESS**STEP 3: CONDUCTOR TERMINATION (continued)****Insert
busbar:****IMPORTANT:** Only Type 1 busbars are installed now. Type 2 busbars are installed after the sealing boot has been positioned.**Type 1 Busbar**

Install the Type 1 busbar(s) on the correct side of the FCC as required by HAC drawing 6252681, 6252705 or 6252706 by inserting the busbar fingers into the Solder Sleeve terminators. Make sure that the busbar fingers are inserted into the correct Solder Sleeve terminators.

Set up tool: The Raychem Waffle Iron II heating tool is used to solder the conductors to the terminals. This tool must be operated and maintained in accordance with ES-61402 Waffle Iron II Operating and Maintenance Instructions.

Select the correct platen set for the type of insert:

For **Pin** inserts: use platen set **CE-1513700**
For **Socket** inserts: use platen set **CE-1517300**

Set the TEMPERATURE and TIME thumbwheels on the heating tool to these settings:

Set **TEMPERATURE** thumbwheel to setting 7.
Set **TIME** thumbwheel to setting 4 .

IMPORTANT: The tool must be properly calibrated to make acceptable terminations.

PART 1: MTC50 TERMINATION PROCESS**STEP 3: CONDUCTOR TERMINATION (continued)**

Load tool: Position the insert against the stop in the platen with the keyed side up and with the cable extending to the right.

Align the busbar(s), if used, in the positioning guides of the platen.

IMPORTANT: The FCC must remain properly inserted in the Solder Sleeve terminators in order to obtain good solder joints.

Line up cable with guide lines on the Waffle Iron II to make sure that the cable is square to the insert face.

Close the cable clamp.

Inspect for correct loading and cable position.

Close and latch the Waffle Iron lid (upper heat sink).

Terminate: Press start button.

IMPORTANT: The green READY/ERROR light must be on before heating can start.

Allow heating cycle to continue until the READY/ERROR light comes on again.

Open the Waffle Iron lid (upper heat sink) and remove the terminated cable assembly.

Clean: Clean the entire termination area with isopropyl alcohol and a small brush or tissues.

IMPORTANT: The termination area consists of both sides of the insert, the Solder Sleeve terminators and the final inch of cable insulation. This is the area covered by the sealing boot and must be clean to obtain good sealing.

Allow the cleaned termination to dry for at least 1 minute

WARNING

Isopropyl alcohol is a volatile, flammable fluid and may cause burns if ignited. Do not use near open flames or electrical sparks

PART 1: MTC50 TERMINATION PROCESS**STEP 3: CONDUCTOR TERMINATION (continued)**

Inspect: These features must be present:

The Solder Sleeve terminators must have shrunk around the terminals.
The solder band in the terminators must have completely melted and flowed.

The terminators may be slightly browned but the terminals and conductors must be visible through the sleeves.

The cable conductors and busbar fingers (if used) must not be offset from the insert terminals by more than 50% of the width of the conductor.

These features must not be present:

The terminator sleeves must not be so browned as to prevent inspection the terminals and conductors.

There must be no bridging of solder between adjacent conductors.

These features are acceptable:

Solder on the surface of the conductors outside of the termination sleeves is acceptable.

Terminator sleeves should not be split when the Waffle Iron is opened, sleeve splitting is not necessarily cause for rejection.

Test: Tests for continuity, shorts and crosses can be done at this time.

Rework: At this stage, prior to applying the sealing boot, rework of the terminated conductors can be done. Rework operations are described in Section 3a.

IMPORTANT: The need for rework operations indicates that a problem exists in operator procedures or tooling calibration. The reason for rework should be determined and the problem eliminated.

PART 1: MTC50 TERMINATION PROCESS**STEP 3a: TERMINATION REWORK
(Go to Step 4 unless rework is required)**

Outline: Rework of the terminations can be done prior to the sealing boot being applied. Three general classes of rework can be performed:

- a. Remove the wafer
- b. Reheat the entire wafer
- c. Reheat an individual solder joint

Remove wafer: If the entire wafer must be removed from the cable this can be done by replacing the terminated assembly in the Waffle Iron II and starting the heating cycle. Pull slightly on the FCC, and when the solder joints reflow (which will occur approximately 30 seconds into the heating cycle), the cable can be pulled out of the heating tool leaving the wafer behind.

The cable can be re-used if any remaining insulation sleeves are removed and if the conductors are reasonably straight and free from solder icicles. The cable may be re-dipped in solder to remove icicles and solder build-up (use the pretinning procedure described in Step 1: Flat Conductor Cable Preparation).

IMPORTANT: Do not re-use the wafer as the terminals will not be properly solderable.

Reheat wafer: If the solder in many Solder Sleeve terminators has not melted and flowed the Waffle Iron II has not reached the correct termination temperature. The Waffle Iron must be inspected, calibrated and if necessary, repaired. However, as a temporary measure the underheated wafer can be placed in the Waffle Iron II and reheated using a higher time and temperature setting.

IMPORTANT: To prevent heat damage, do not use a temperature setting above 8 or a time setting above 5.

Reheat sleeve: An individual Solder Sleeve terminator can be reheated with a pencil-type hot air tool with a needle point tip, such as the Raychem AA-400 Super Heater or a soldering iron. Taking care not to puncture the sleeve, FCC conductors that are bent can be flattened, once the solder has reflowed, by pushing on the outside of the terminator sleeve with a blunt wooden stick or similar implement.

Other rework operations are possible and may involve the removal of the insulating sleeve. These operations should be carefully evaluated upon a case-by-case basis to determine if they will unacceptably degrade the finished, booted termination.

PART 1: MTC50 TERMINATION PROCESS**STEP 4: SHIELD APPLICATION
(Go to Step 5 if shield is NOT required)**

Outline: The shield is threaded through the sealing boot and is hand soldered to the busbar. Type 1 busbars (those with fingers) are prepared for sealing boot application by the addition of a second busbar, as described below. Type 2 busbars (those without fingers) are inserted under the sealing boot, as described on page 16. For both types an adhesive strip is inserted between the busbar and the cable.

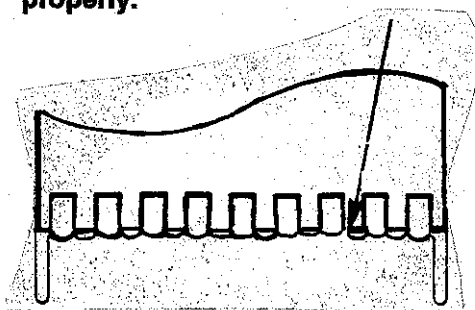
FOR TYPE 1 BUSBARS ONLY

Remove ears: Cut off the ears of the terminated Type 1 busbars equal with the edges of the FCC.

Thread shield: Thread the pretinned shield end through the sealing boot on the FCC so that the shield is correctly positioned on the cable.

Solder shield: Position the pretinned end of the shield so that the end of the shield is parallel to the end of the busbar and under the base of the tabs as shown below.

IMPORTANT: Do not lift the tabs more than the minimum amount required to insert the shield under the tabs. Raising the tabs too high may result in the sealing boot not functioning properly.



Using a hand soldering iron, solder the shield to the busbar.

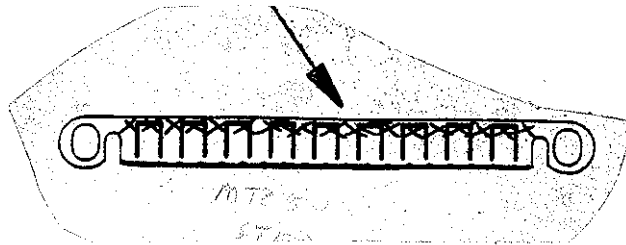
Position sealing boot: Slide the sealing boot up the cable and onto the rear of the insert.

PART 1: MTC50 TERMINATION PROCESS

STEP 4: SHIELD APPLICATION (continued) **(Go to Step 5 if shield is NOT required)**

**Pretin
second
busbar:**

Prepare a second busbar by pretinning a CTA-0103-030 busbar with Sn63Pb37 solder in the region shown below.



**Insert
second
busbar:**

Insert the second busbar between the FCC and the busbar already attached to the terminals. Position the busbar so that the holes in the ears are about even with the rear edge of the sealing boot. The exact location of this busbar will be adjusted during the sealing boot application.

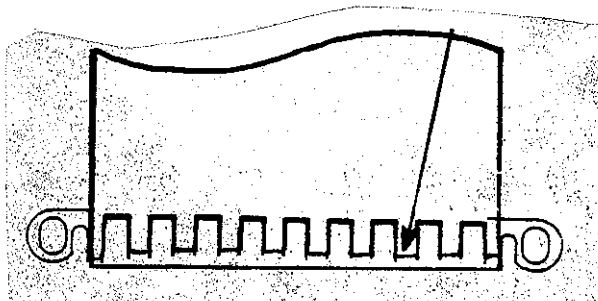
This completes the section relevant to Type 1 busbars only.
Continue with "Insert adhesive strip" step on page 17.

FOR TYPE 2 BUSBARS ONLY

**Solder
shield:**

Position the pretinned end of the shield so that the end of the shield is parallel to the end of the busbar and under the base of the tabs as shown below.

IMPORTANT: Do not lift the tabs more than the minimum amount required to insert the shield under the tabs. Raising the tabs too high may result in the sealing boot not functioning properly.



Using a hand soldering iron, solder the shield to the busbar.

PART 1: MTC50 TERMINATION PROCESS**STEP 4: SHIELD APPLICATION (continued)**
(Go to Step 5 if shield is NOT required)**Position
sealing
boot:**

Slide the sealing boot up the cable and onto the rear of the insert.

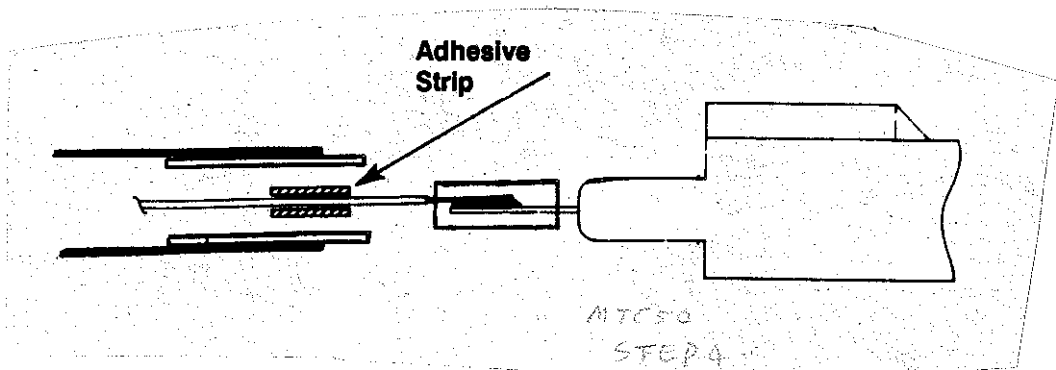
**Position
busbar:**

Slide the Type 2 busbar, with the shield up, under the rear edge of the sealing boot and position so that the holes in the ears are about equal with the rear edge of the sealing boot. The exact location of the busbar will be adjusted during the sealing boot application step.

This completes the section relevant to Type 2 busbars only.
Continue with the steps below.

FOR BOTH TYPES OF BUSBAR**Insert
adhesive
strip:**

Place a strip of adhesive sealant, CTA-0055, between the busbar and the FCC such that the rear edge of the sealant is approximately 1/2 inch from the rear edge of the insert.

**Tape
(optional):**

Place a turn of adhesive tape a few inches behind the termination zone around the FCC and shield to hold the parts in place during subsequent handling.

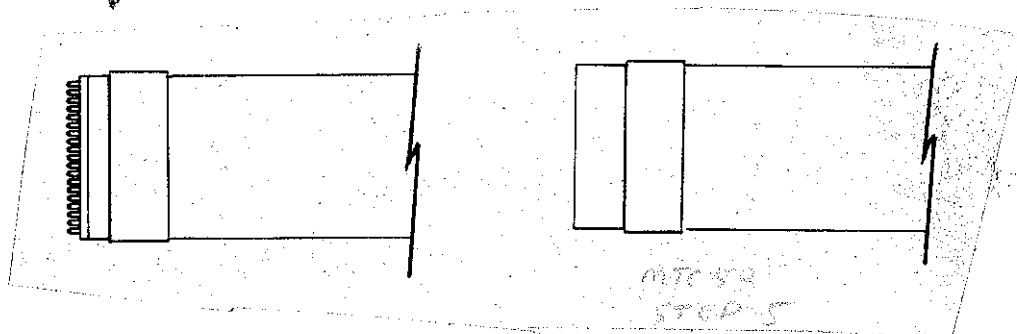
PART 1: MTC50 TERMINATION PROCESS

STEP 5: SEALING BOOT APPLICATION

Outline: If the application does not involve a shield the sealing boot is slid up the cable over the termination area. (The sealing boot is already positioned if busbars are present) The insert with the sealing boot in place is again placed in the Waffle Iron II heating tool. The positions of the boot and any busbars are adjusted, and the boot is shrunk over the termination zone.

Position sealing boot: If the boot is not already in place, slide the sealing boot up the cable and onto the rear end of the insert. When the sealing boot is in place inspect the adhesive band within the boot to make sure it has not been deformed.

IMPORTANT: The adhesive band within the sealing boot must not be deformed because the boot may fail to seal properly.



Set up tool: The Raychem Waffle Iron II heating tool is used to apply the sealing boot. This tool must be maintained and operated in accordance with ES-61402: Waffle Iron II Operating and Maintenance instructions.

Select the correct platen set for the application:

Insert Being Terminated	Shielding Layers	Platen Set Required
Pin Insert	0	CE-1513700
	1	CE-1516600
Socket Insert	1	CE-1517300
	2	CE-1517400

PART 1: MTC50 TERMINATION PROCESS**STEP 5: SEALING BOOT APPLICATION (continued)**

Set up tool: Set the TEMPERATURE and TIME settings on the Waffle Iron II heating tool to these settings:
(cont)

Set TEMPERATURE thumbwheel to setting 1.

Set TIME thumbwheel to setting 2 .

IMPORTANT: These settings are very different from the conductor termination settings. The conductor termination settings must not be used during sealing boot application – they will severely damage the sealing boot.

Load tool: Position the cable assembly such that the insert, with the keyed side up is against the stop in the platen with the cable extending to the right.

Align the busbar(s), if used, in the positioning guides of the platen.

Close the cable clamp.

Inspect for correct loading and positioning.

Close and latch the Waffle Iron lid (upper heat sink).

Terminate: Press start button.

IMPORTANT: The green READY/ERROR light must be on before heating can start.

Allow heating cycle to continue until the READY/ERROR light comes on again.

Open the Waffle Iron lid (upper heat sink) and remove the terminated cable assembly.

Inspect: Visually inspect the sealing boot area for underheating or overheating.
The signs of underheating are:

Lack of adhesion between the sealing boot adhesive and the FCC.

The signs of overheating are:

Browning of the sealing boot.

Buckling of the sealing boot.

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PART 1: MTC50 TERMINATION PROCESS**STEP 5: SEALING BOOT APPLICATION (continued)****Test:**

Perform these electrical tests on the completed termination:

Electrical Continuity. Circuits must be continuous.

Insulation Resistance at 500 volts dc. Requirement is 5 gigaohms, minimum.

Dielectric Withstanding Voltage at 750 volts (rms). No breakdown of the insulation is allowed.

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PART 2: MATERIALS REQUIRED TO MAKE 50 mil CTM TERMINATIONS**Components Required**

Component Type	Part Number	Description
FCC	TUxx-050-28B	Flat conductor cable - 50 mil pitch xx = Number of conductors
Round wire	Various	Size 24 silver plated conductor
50 mil CTM parts	CTM-1052 CTM-1050	2-inch (40 wire) 1-inch (20 wire)
Shielding components (as required by application)	CHA-0045 CHA-0062 CTA-0103-030 CTA-0140-030 CTA-0055	2-inch planar shield without adhesive 0.8-inch planar shield without adhesive Busbar without fingers Busbar with fingers Adhesive sealant strip

Materials Required

Material Description	Equivalent Allowed
Sn96Ag04 solder in solder pot	No
Sn96Ag04 solder in wire form	No
Sn63Pb37 solder in wire form	No
Kester 1544 RA flux	Yes (also see Note)
Kester 104 flux thinner	Yes
Tissues or Kimwipes	Yes
Flux brush	Yes
Adhesive tape	Yes
Isopropyl alcohol	No
High-temperature adhesive tape, e.g., aluminum (optional)	Yes

Note: Alpha 611 RMA flux, or the equivalent, may be substituted for the RA flux, provided that the cable and shield material demonstrate adequate solderability with the RMA flux.

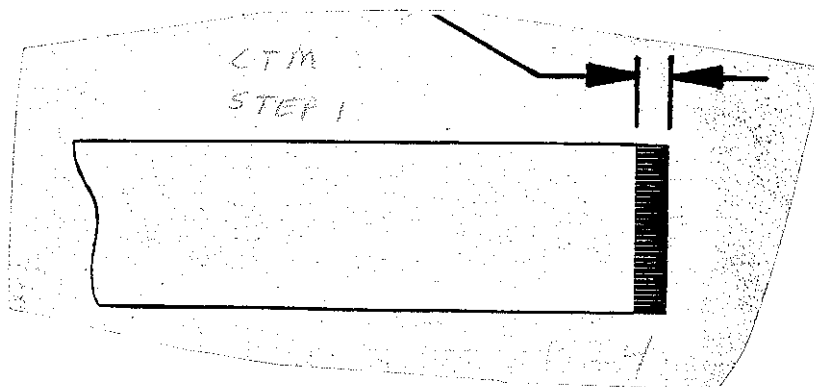
PART 2: TOOLS REQUIRED TO MAKE 50 mil CTM TERMINATIONS

Purpose	Description	Manufacturer	Model #	Equivalent Allowed
Cable preparation	Solder pot containing Sn96Ag04	Any		No
	FCC cutting tool	Carpenter	Model 95A	Yes
	FCC stripping tool	Raychem	CE-1400600	No
Shield preparation (for shielded terminations)	Scissors	Any		Yes
	Abrasive stripping tool	Carpenter	Model 44C	Yes
	Hand soldering iron - small tip	Any		No
Sleeve loading (for 50 mil CTM)	50 mil CTM loading fixture	Raychem	CE-1607000	Yes
Termination	Heating tool (Nonmelttable insulation): Waffle Iron II (110 volt) or Waffle Iron II (220 volt)	Raychem Raychem	CE-1404200 CE-1404300	No No
	50 mil CTM Platen set:	Raychem	CE-1517900	No
	Heating Tool (Melttable wire insulation): Super Heater Compressed Air Tool Needle Point Tip	Raychem Raychem	AA-400	Yes Yes
Sealing boot installation	Heating tool: Waffle Iron II (110 volt) or Waffle Iron II (220 volt)	Raychem Raychem	CE-1404200 CE-1404300	No No
	50 mil CTM Platen set: for CTM-1052 with 1 shield for CTM-1052 with 2 shields for CTM-1050 with no shield	Raychem Raychem Raychem	CE-1517900 CE-1518000 CE-1517900	No No No

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 1: FLAT CONDUCTOR CABLE PREPARATION**

- Outline:** The cable is cut to the correct length, the insulation is stripped off at the termination end, and the bare conductors are pretinned.
- Cut cable:** Use Carpenter Model 95A cable cutter or a sharp paper cutter.
- IMPORTANT:** Cut end must be square, cleanly cut and free of folds or bends; otherwise, unacceptable terminations may result.
- Strip cable:** Use Raychem Model CE-1400600 cable stripper.
Refer to ES-61113 Instructions for Flat Conductor Cable Stripping Tool.

Strip Length: 0.200 ± 0.010 inch



- Pretin:** Dip the exposed conductors for a length of approximately 1/8 inch into a 1:1 mixture of Kester #1544 flux and Kester #104 thinner (or equivalents).
- Allow fluxed conductors to dry for at least 30 seconds.
- Dip exposed conductors into molten Sn96Ag04 solder in a solder pot.

Solder Temperature: $560 \pm 20^\circ \text{F}$.
Skim dross from solder surface before dipping.
Immerse approximately 3/4 length of stripped conductors.
Immerse conductors for 4 to 6 seconds.
Withdraw slowly to prevent icicle formation.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 1: FLAT CONDUCTOR CABLE PREPARATION (continued)**

Clean: Remove flux residues by wiping tinned conductors with a tissue wetted with isopropyl alcohol

IMPORTANT: To avoid deforming the conductors while cleaning, wipe in one direction only. Wipe from insulation to ends of the conductors and do not wipe across the conductors

Allow cleaned conductors to dry for at least 1 minute.

WARNING

Isopropyl alcohol is a volatile, flammable liquid and may cause burns if ignited. Do not use near open flames or electrical sparks.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 2: ROUND WIRE PREPARATION**

Outline: The round wires are cut to the correct length, the insulation is stripped off at the termination end, and the conductors are pretinned.

Cut wires: Cut the round wires to the required length. The end of the round wire will extend approximately 0.1 inch beyond the centerline of the CTM.

IMPORTANT: Cut end must be square and cleanly cut; otherwise, unacceptable terminations may result.

Strip wires: Strip the round wire and make sure no strands are out of position.

Strip Length: 0.15 to 0.20 inch

Pretin: Dip the exposed conductor for approximately half the exposed length into a 1:1 mixture of Alpha #611 flux and isopropyl alcohol (or equivalents).

Allow fluxed conductors to dry for at least 30 seconds.

Dip exposed conductors into molten Sn96Ag04 solder in a solder pot.

Solder Temperature: $560 \pm 20^{\circ}$ F.

Skim dross from solder surface before dipping.

Immerse approximately 3/4 length of stripped conductors.

Immerse conductors for 4 to 6 seconds.

Withdraw slowly to prevent icicle formation.

Clean: Remove flux residues by wiping tinned conductors with a tissue wetted with isopropyl alcohol.

IMPORTANT: The conductors must be free of solder spurs or icicles, and the strands must be in the correct position.

Allow cleaned conductors to dry for at least 1 minute.

WARNING

Isopropyl alcohol is a volatile, flammable liquid and may cause burns if ignited. Do not use near open flames or electrical sparks.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 3: SHIELD PREPARATION**
(Go to Step 4 if shield is NOT required)

Outline: The appropriate busbar is chosen, and the shield is prepared for termination by being cut, stripped, pretinned and soldered to the bus bar.

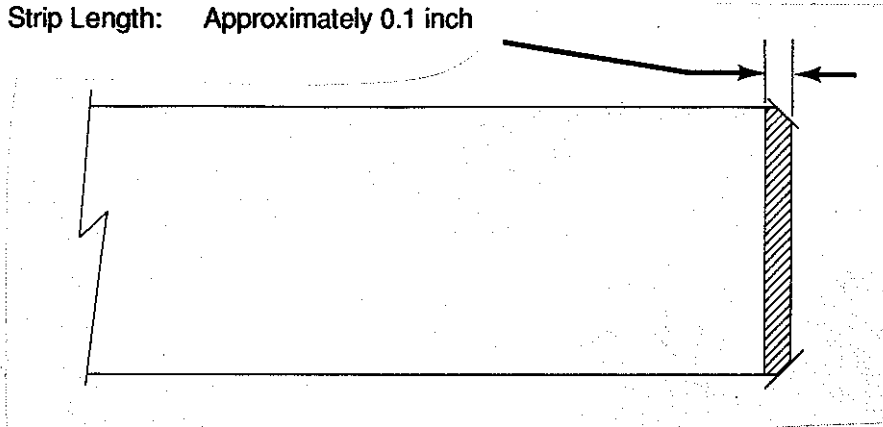
Cut shield: Use Carpenter Model 95A cable cutter or a pair of scissors to cut shield to desired length.

IMPORTANT: Cut ends must be square and cleanly cut to avoid poor terminations.

Strip shield: Use Carpenter Model 44C abrasive stripper or equivalent to strip the insulated backing from the copper foil at the end of the shield.

Corners may be chamfered up to 0.1 inch.

Strip Length: Approximately 0.1 inch



Pretin: Dip the exposed copper foil for half to three-quarters of the exposed length into a 1:1 mixture of Kester #1544 flux and Kester #104 thinner (or equivalent). The flux mixture can also be applied with a cotton-tipped swab.

Allow fluxed shield to dry for at least 30 seconds.

Using a hand soldering iron or a solder pot, pretin the exposed copper foil with Sn96Ag04 solder.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 3: SHIELD PREPARATION (continued)****(Go to Step 4 if shield is NOT required)**

Clean: Remove flux residues by wiping the tinned shield with a tissue wetted with isopropyl alcohol.

IMPORTANT: Do not bend or fold the tinned shield, because unacceptable terminations may result.

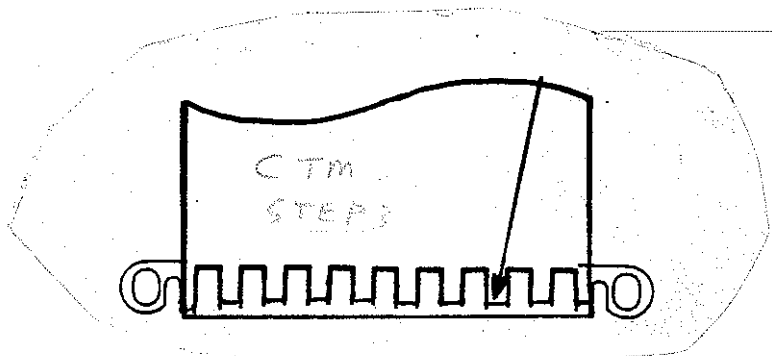
Allow cleaned shield to dry for at least 1 minute.

WARNING

Isopropyl alcohol is a volatile, flammable liquid and may cause burns if ignited. Do not use near open flames or electrical sparks.

Solder shield: Position the pretinned end of the shield so that the end of the shield is parallel to to the end of the busbar and under the base of the tabs as shown below.

IMPORTANT: Do not lift the tabs more than the minimum amount required to insert the shield under the tabs. Raising the tabs too high may result in the sealing boot not functioning properly.



Using a hand soldering iron, solder the shield to the busbar.

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PART 2: 50 mil CTM TERMINATION PROCESS

STEP 4: CONDUCTOR TERMINATION

Outline: The sealing boot is slipped onto the cable. The FCC conductors are inserted into the SolderSleeve terminators using the loading fixture. The cable is transferred to a CTM bottom platen and the round wires are loaded and taped in place. If the round wires have a meltable insulation, the FCC and round wires are soldered together by a hot air tool. Otherwise, the platen /FCC/round wire assembly is placed in the Waffle Iron II heating unit for soldering. The area is cleaned and the solder joints are inspected and may be electrically tested.

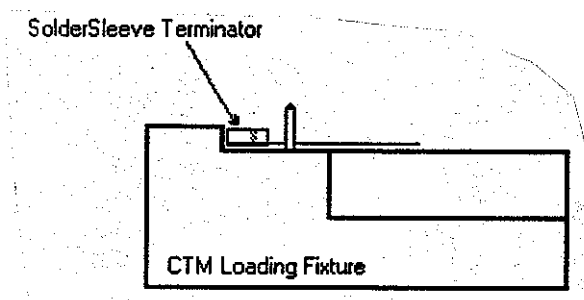
Slip on sealing boot: Slip the sealing boot onto the FCC and position it several inches behind the termination zone.

IMPORTANT: Make sure that the mark "FLAT CABLE TOP" is uppermost and will be positioned over the FCC when the assembly is loaded into the Waffle Iron II.

Load SolderSleeve terminators to FCC: Strips of SolderSleeve terminators will normally be supplied mounted on a carrier which resembles a comb. (If the SolderSleeve terminators are not mounted on a carrier, mount them now. Slip one SolderSleeve terminator over each tine of the carrier.)

IMPORTANT: Make sure the SolderSleeve terminators are placed on the carrier with the smaller opening towards the body of the carrier and with the larger opening nearest to the end of the tines.

Place the carrier with the SolderSleeve terminators in the CTM loading fixture as shown below. Position the SolderSleeve terminators against the metal stop so there is a gap between the upright fingers and the SolderSleeve terminators.



Insert the FCC conductors into the SolderSleeve terminators by pushing the conductors between the upright fingers and into the SolderSleeve terminators.

Remove the FCC, with the SolderSleeve terminators loaded on it, from the loading fixture by lifting straight up.

Discard the carrier and slide the SolderSleeve terminators along the FCC conductors until they touch the FCC insulation.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 4: CONDUCTOR TERMINATION (continued)**

Place on platen: Place the FCC with the SolderSleeve terminators onto the bottom platen of platen set CE-1517900. The exact position of the SolderSleeve terminators can be adjusted prior to termination. The tape on the SolderSleeve terminators should be against the platen.

IMPORTANT: The conductors of the FCC must protrude slightly from the SolderSleeve terminators and must not be folded over inside the sleeves.

Load round wires: Load the stripped end of the round wires into the SolderSleeve terminators. Make sure the wires lie flat and in the round wire grooves cut into the bottom platen.

Determine insulation type Determine if the round wire has a meltable or nonmeltable insulation. Most MIL Spec wires have nonmeltable insulations. MIL-W-81044, MIL-W-22759 specification sheets /32 to /44, and MIL-W-81381 have nonmeltable insulations. MIL-W-22759 specification sheets /16 to /19 have meltable insulations.

IMPORTANT: Do not terminate round wires with meltable insulations in the Waffle Iron II, because deformation of the wire insulation will result

Terminate wires with meltable insulations as described in the procedure titled **Hot Air Termination** on page 31.

Terminate wires with nonmeltable insulations as described in the procedure titled **Waffle Iron II Termination** on pages 32 and 33.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 4: CONDUCTOR TERMINATION (continued)****HOT AIR TERMINATION
(For wires with meltable insulation)**

Set up tool: The Raychem AA-400 compressed air heating tool is recommended for terminating FCC conductors to round wires with meltable insulation. This tool must be operated and maintained in accordance with the AA-400 Super Heater - Mark III Operating and Maintenance Manual.

The AA-400 heating tool must be equipped with the needle point tip (part number 979647).

Set the air regulator to the minimum air pressure on the gauge that allows the HEAT ON light to come on. This will ensure the air stream is at the maximum temperature.

Terminate: Begin at one edge and hold the heating tool at an angle so that the hot air will pre-heat the next SolderSleeve terminator.

Hold the tip about 1/8 to 1/4 inch from the SolderSleeve terminators and aim the hot air stream directly at the solder preforms.

Heat each SolderSleeve terminator until the solder preform melts, flows and wets to the round wire and FCC conductor

Cool Down: Let the parts cool for at least 30 seconds before removing the assembly from the fixture.

Skip the next section titled Waffle Iron II Termination and proceed to the cleaning and inspection steps on page 34.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 4: CONDUCTOR TERMINATION (continued)****WAFFLE IRON II TERMINATION
(For wires with nonmelttable insulation)**

Set up tool: The Raychem Waffle Iron II heating tool is used to solder the conductors to the terminals. This tool must be operated and maintained in accordance with ES-61402, Waffle Iron II Operating and Maintenance Instructions.

Select the correct platen set. (The FCC and round wires will be already positioned on the bottom platen.)

Use platen set **CE-1517900**

Set the **TEMPERATURE** and **TIME** thumbwheels on the heating tool to these settings:

Set **TEMPERATURE** thumbwheel to setting **7**.

Set **TIME** thumbwheel to setting **2**.

IMPORTANT: The tool must be properly calibrated to make acceptable terminations.

Load tool: Load the bottom platen carrying the FCC and round wires into the Waffle Iron II. The FCC should extend to the left. If necessary, adjust the position of the Solder Sleeve terminators so that they line up in the center of the platens.

Line up cable with guide lines on the Waffle Iron II to make sure that the cable is square to the insert face.

Close the cable clamp.

Inspect for correct loading and cable position

Once the Solder Sleeve terminators are correctly positioned, high-temperature tape, such as adhesive backed aluminum tape, can be used to secure the wires in place.

IMPORTANT: The FCC and round wires must remain properly inserted in the Solder Sleeve terminators in order to obtain good solder joints.

IMPORTANT: Make sure that the position of any tape used to secure the wires does not interfere with the closing of the platens.

Close and latch the Waffle Iron lid (upper heat sink).

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PART 2: 50 mil CTM TERMINATION PROCESS**STEP 4: CONDUCTOR TERMINATION (continued)****WAFFLE IRON II TERMINATIONS**

Terminate: Press start button.

IMPORTANT: The green READY/ERROR light must be on before heating can start.

Allow heating cycle to continue until the READY/ERROR light comes on again.

Open the Waffle Iron lid (upper heat sink) and remove the terminated cable assembly.

Remove the adhesive tape from the back of the SolderSleeve terminators.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 4: CONDUCTOR TERMINATION (continued)**

Clean: Clean the entire termination area with isopropyl alcohol and a small brush or tissues.

IMPORTANT: The termination area consists of both sides of the SolderSleeve terminators and the final inch of cable and round wire insulation. This is the area covered by the sealing boot, and must be clean to obtain good sealing.

Allow the cleaned termination to dry for at least 1 minute

WARNING

Isopropyl alcohol is a volatile, flammable fluid and may cause burns if ignited. Do not use near open flames or electrical sparks

Inspect: These features must be present:

The SolderSleeve terminators must have shrunk around the conductors. The solder band in the terminators must have completely melted and flowed.

The terminators may be slightly browned but the conductors must be visible through the sleeves.

These features must not be present:

The terminator sleeves must not be so browned as to prevent inspection of the conductors.

There must be no bridging of solder between adjacent conductors.

These features are acceptable:

Solder on the surface of the conductors outside of the termination sleeves is acceptable.

Terminator sleeves should not be split after termination, but sleeve splitting is not necessarily cause for rejection.

Test: Tests for continuity, shorts, and crosses can be done at this time.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 4a: TERMINATION REWORK
(Go to Step 5 unless rework is required)**

Rework: At this stage, prior to applying the sealing boot, rework of the terminated conductors can be done.

IMPORTANT: The need for rework operations indicates that a problem exists in operator procedures or tooling calibration. The reason for rework should be determined and the problem eliminated.

Outline: Rework of the terminations can be done prior to the sealing boot being applied. Two general classes of rework can be performed:

- a. Reheat the assembly
- b. Reheat an individual solder joint

Reheat assembly: This section only applies if the Waffle Iron II was used.

If the solder in many SolderSleeve terminators has not melted and flowed, the Waffle Iron it did not reach the correct termination temperature. The Waffle Iron must be inspected, calibrated and if necessary, repaired. However, as a temporary measure the overheated assembly can be placed in the Waffle Iron II and reheated with a higher time and temperature setting.

IMPORTANT: To prevent heat damage, do not use a temperature setting above 8 or a time setting above 5.

Reheat individual solder joints An individual SolderSleeve terminator can be reheated with a pencil-type hot air tool with a needle point tip, such as the Raychem AA-400 Super Heater or a soldering iron. Taking care not to puncture the sleeve, FCC conductors that are bent can be flattened, once the solder has reflowed, by pushing on the outside of the terminator sleeve with a blunt wooden stick or similar implement.

Other rework operations are possible and may involve the removal of the insulating sleeve. These operations should be carefully evaluated upon a case-by-case basis to determine if they will unacceptably degrade the finished, booted termination.

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 5: SEALING BOOT APPLICATION**

Outline: The sealing boot is slid up the cable over the termination area. The assembly, with the sealing boot in place, is again placed in the Waffle Iron II heating tool. If a shield is required, the busbar and sealant are inserted. The positions of the boot and any busbars are adjusted, and the boot is shrunk over the termination zone.

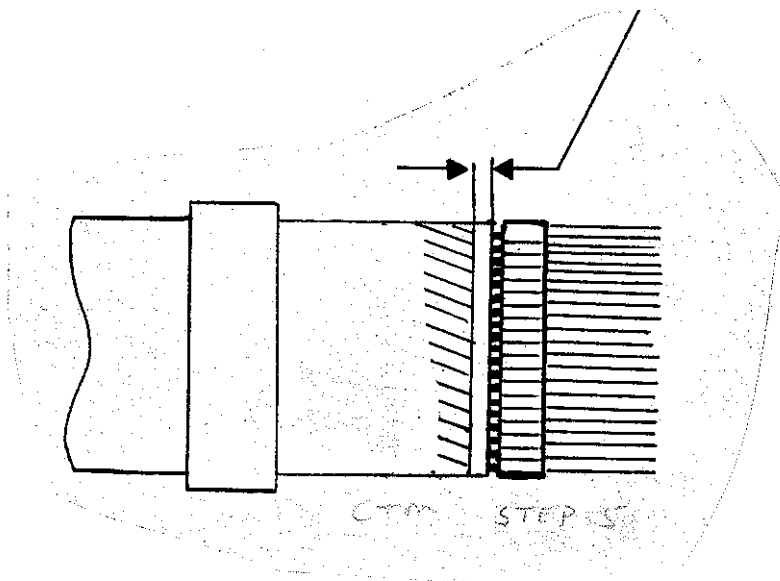
Position sealing boot: Slide the sealing boot along the cable and over the terminated conductors.

IMPORTANT: Make sure that the mark "FLAT CABLE TOP" is uppermost and positioned over the FCC when the assembly is loaded into the Waffle Iron II.

Position the sealing boot so that the SolderSleeve terminators are visible between the strips of sealant.

Insert busbar (when required): If a shield is to be used, insert the busbar between the sealing boot and the FCC. Place a strip of adhesive sealant, CTA-0055, between the busbar and the FCC.

Position the end of the shield/busbar assembly approximately 0.050 inch behind the stripped edge of the FCC as shown.



PART 2: 50 mil CTM TERMINATION PROCESS**STEP 5: SEALING BOOT APPLICATION (continued)**

Set up tool: The Raychem Waffle Iron II heating tool is used to apply the sealing boot. **This tool must be maintained and operated in accordance with ES-61402; Waffle Iron II Operating and Maintenance instructions.**

Select the correct platen set for the application:

CTM Being Terminated	Shielding Layers	Platen Set Required
CTM-1050	0	CE-1517900
CTM-1052	1	CE-1517900
CTM-1052	2	CE-1518000

Set up tool: Set the TEMPERATURE and TIME settings on the Waffle Iron II heating tool to these settings:
(cont)

Set **TEMPERATURE** thumbwheel to setting 1.

Set **TIME** thumbwheel to setting 2 .

IMPORTANT: These settings are very different from the conductor termination settings. The conductor termination settings must not be used during sealing boot application; they will severely damage the sealing boot.

Load tool: Position the sealing boot carefully in the platen with the FCC extending to the left. When the sealing boot is in place, inspect the strips of sealant within the boot to make sure they have not been deformed.

IMPORTANT: The boot may fail to seal properly if the sealant strips within the sealing boot are deformed.

Close the cable clamps.

Inspect for correct loading and positioning.

Close and latch the Waffle Iron lid (upper heat sink).

PART 2: 50 mil CTM TERMINATION PROCESS**STEP 5: SEALING BOOT APPLICATION (continued)**

Terminate: Press start button.

IMPORTANT: The green READY/ERROR light must be on before heating can start.

Allow heating cycle to continue until the READY/ERROR light comes on again.

Open the Waffle Iron lid (upper heat sink) and remove the terminated cable assembly.

Trim ears: If the HAC drawing shows a CTM without ears, trim the ears flush with the body of the CTM using scissors.

IMPORTANT: Do not cut into the white sealant material.

Inspect: Visually inspect the sealing boot area for underheating or overheating.
The signs of underheating are:

Lack of adhesion between the sealing boot sealant and the FCC.

Lack of adhesion between the sealing boot sealant and the round wires.

The signs of overheating are:

Browning of the sealing boot.

Buckling of the sealing boot

Test: Perform these electrical tests on the completed termination:

Electrical Continuity. Circuits must be continuous.

Insulation Resistance at 500 volts dc. Requirement is 5 gigohms, minimum.

Dielectric Withstanding Voltage at 750 volts (rms). No breakdown of the insulation is allowed.