



**Electronics**

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**Raychem**

Specification: **ES-61441**

Rev: B

Date: Jan-12-04

Pages: 1 of 17

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**Procedures for Terminating MTC50  
Connectors with Soldersleeve® Terminators  
to Flat Conductor Cables, without Planar  
Shielding**

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### 1. Scope

This engineering standard describes the procedure for terminating flat conductor cable (FCC), without planar shielding, to MTC50 connector inserts. This termination process has two stages: the FCC conductors are first soldered to the terminals of the MTC50 insert using SolderSleeve terminators, and the soldered terminations are then enclosed within a sealing boot. The termination of the FCC conductors to the MTC50 inserts can be performed using either of two heating tools: the Waffle Iron heater or the SuperHeater hot air tool.

The following additional Raychem Engineering Standards are referenced in this document for instructions on certain procedures:

<b>ES-61113</b>	<i>Instructions for Flat Conductor Cable Stripping Tool</i>
<b>ES-61402</b>	<i>Waffle Iron // Operating and Maintenance Instructions</i>
<b>ES-61408</b>	<i>MTC50 Connector Round Wire Termination Procedures</i>
<b>H50324</b>	<i>SuperHeater Operating and Maintenance Instructions</i>

**2. Materials Required****Components Accomodated**

<b>Component Type</b>	<b>Part Number</b>	<b>Description</b>
FCC	TUxx 050 28B	Flat conductor cable - 50 mil pitch xx = Number of conductors
MTC50 insert	MTC50-EA1-P42	1 -inch (20 contact) A pin insert
	MTC50-EB1-P42	1 -inch (20 contact) B pin insert
	MTC50-EA1-S42	1 -inch (20 contact) A socket insert
	MTC50-EB1-S42	1-inch (20 contact) B socket insert
	MTC50-EA2-P42	2-inch (40 contact) A pin insert
	MTC50-EB2-P42	2-inch (40 contact) B pin insert
	MTC50-EA2-S42	2-inch (40 contact) A socket insert
	MTC50-EB2-S42	2-inch (40 contact) B socket insert

**Materials Required**

<b>Material Description</b>	<b>Equivalent Allowed</b>
Sn96Ag04 solder in solder pot	No
Kester 1544 RA flux	Yes (also see Note)
Kester 104 flux thinner	Yes
Tissues or Kimwipes	Yes
Flux brush	Yes
Isopropyl alcohol	Yes

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

**CAUTION**

Some of the required materials are hazardous. Consult Material Safety Data Sheets (MSDS's) before using these materials.



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**3. Tools Required**

**Tool Selection Table**

<b>Purpose</b>	<b>Description</b>	<b>Source</b>	<b>Model #</b>	<b>Equivalent Allowed</b>
Cable preparation	Solder pot containing Sn96Ag04	Any		No
	FCC cutting tool	Carpenter	Model 95A	Yes
	FCC stripping tool	Raychem	CE-1400600	Yes
FCC termination	Insertion tool for 2-Inch inserts	Raychem	CE-1401000	No
	Insertion tool for 1 -inch inserts	Raychem	CE-1406100	No
	Heating tool (one required)			
	Waffle Iron II (110 volt)	Raychem	CE-1404200	No
	Waffle Iron II (220 volt)	Raychem	CE-1404300	No
	SuperHeater hot air heater	Raychem	AA-400	No
	MTC50 platen set for Waffle Iron II: for pin inserts	Raychem	CE-1520100	No
for socket inserts	Raychem	CE-1520200	No	
Sealing boot installation	Termination fixture for use with SuperHeater	Raychem	CE-1605500	Yes
	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 Waffle Iron II: for pin inserts for socket inserts	Raychem Raychem	CE-1520100 CE-1520200	No No
Rework	Heating tool: SuperHeater hot air heater with needle point tip	Raychem	AA-400	No
	Termination fixture	Raychem	CE-1605500	Yes

#### 4. Terminating Cable to Connector Insert

##### Step 1: Flat Conductor Cable Preparation

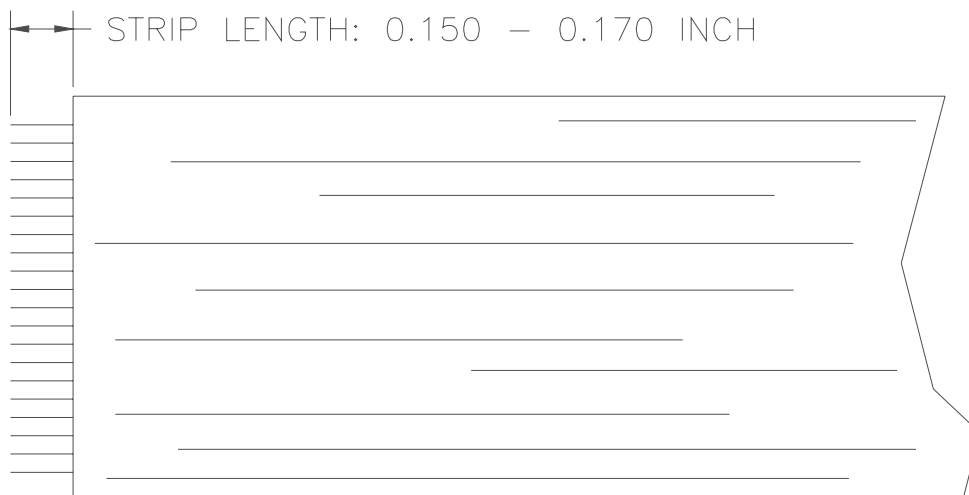
**Outline:** The cable is cut to the correct length, the insulation is stripped off at the termination end, and the bare conductors are pretinned.

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

**IMPORTANT:**

To prevent unacceptable terminations, cut end must be square, cleanly cut and free of folds or bends.

**Strip cable:** See figure below. Use Raychem Model CE-1400600 cable stripper or equivalent. Refer to ES-61113 *Instructions for Flat Conductor Cable Stripping Tool*.



Strip Length for Flat Conductor Cable

#### 4. Terminating Cable to Connector Insert (Continued)

If this document is printed it becomes uncontrolled. Check for the latest revision.

**Step 1: Flat Conductor Cable Preparation (Continued)**

**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:  $515 \pm 10^\circ$  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. Allow cleaned conductors to dry for at least 1 minute.

**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.

**WARNING**

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

#### 4. Terminating Cable to Connector Insert (Continued)

##### Step 4: Assembly

**Outline:** The sealing boot is slipped onto the cable. The FCC conductors are inserted into the SolderSleeve terminators on the insert terminals.

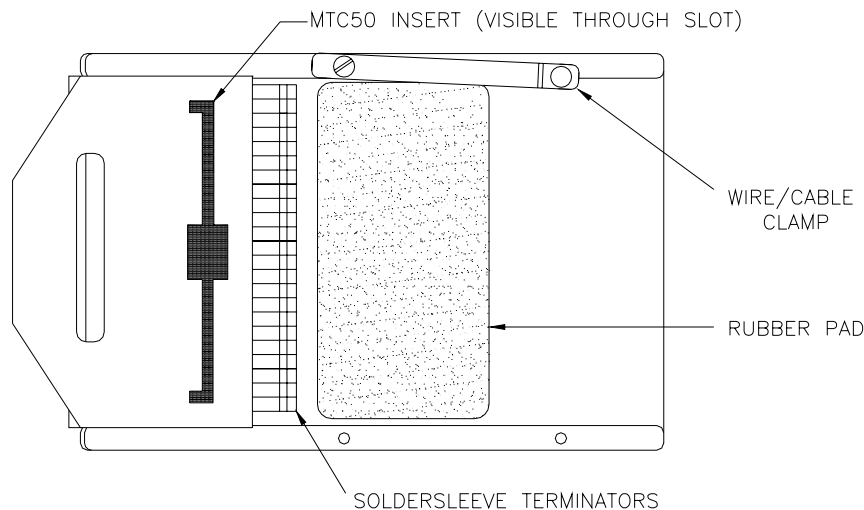
**Slip sealing boot on:** Slip the sealing boot onto the FCC and position it several inches back from the termination zone.

##### **IMPORTANT**

The sealing boot **MUST** be slipped onto the cable prior to conductor termination, because it will not fit over the insert after termination.

**Fixture the insert:** Fixture the MTC50 insert to prevent movement, using the Raychem CE-1605500 fixture or equivalent (see figure).

- The keyed side of the insert must face up (the side marked with **Raychem** and the numbers of the edge contacts).
- The retention ribs of the insert must fit into the slot in the termination fixture.



Insert Installed in CE-1605500 Termination Fixture

#### 4. Terminating Cable to Connector Insert (Continued)

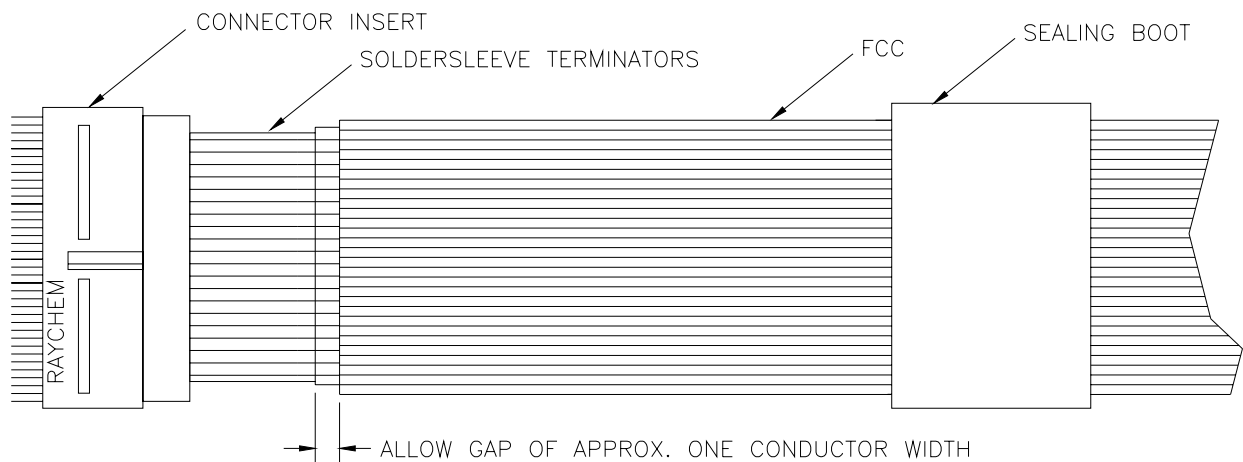
##### Step 4: Assembly (Continued)

**Insert cable:** Insert the pretinned FCC conductors into the SolderSleeve terminators at the rear of the insert. Use of the CE-1406100 (1-inch) or CE-1401000 (2-inch) insertion tool is recommended.

- o First insert the insertion tool fingers into the SolderSleeve terminators and on top of the terminals; then slide the cable conductors along the top of the fingers and onto the terminals. Finally, remove the tool.

#### IMPORTANT

To obtain the proper cable insertion depth, insert the conductors until there is a gap of approximately one conductor width between the FCC insulation and the ends of the SolderSleeve terminators. Do not deform conductors by over-inserting FCC, because unacceptable solder joints may result.



Inserting Flat Conductor Cable Conductors into SolderSleeve Terminators of Connector Insert



#### 4. Terminating Cable to Connector Insert (Continued)

##### Step 5: Cable Termination

**Outline:** The insert and cable are heated using one of the specified heating tools, soldering the FCC conductors to the terminals of the insert. The area is cleaned, the solder joints are inspected, and the terminations may be electrically tested.

Proceed to the applicable step below according to the heating tool being used:

- Waffle Iron II: Step 5A.
  - AA-400 tool: Step 5B.
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##### Step 5A: Cable Termination Using Waffle Iron II

**Set up tool:** If using the Raychem Waffle Iron II heating tool, refer to ES-61402, *Waffle Iron II Operating and Maintenance Instructions* for proper operating procedures.

- Platen selection: Select the correct platen set according to the type of insert (pin or socket). See the Tool Selection Table in Section 3 to select the platen.
- Heating time and temperature setting:

Set the **TEMP** thumbwheel to **7**.

Set the **TIME** thumbwheel to **4**.

**IMPORTANT**

The Waffle Iron heating tool must be properly calibrated to make proper terminations. See ES-61402 for information on heating tool calibration.

#### 4. Terminating Cable to Connector Insert (Continued)

##### Step 5a: Cable Termination Using Waffle Iron II (Continued)

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

**IMPORTANT**

The FCC conductors must remain properly inserted in the SolderSleeve terminators in order to obtain good solder joints.

Line up the cable with the guide lines on the Waffle Iron II, so 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 the **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.

Proceed to Section 5.

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##### Step 5B: Cable Termination Using AA-400 Superheater

If using the AA-400 Superheater tool with the CE-1605500 termination fixture, refer to ES-61408, *MTC50 Connector Round Wire Termination Procedures*, and substitute flat conductor cable wherever those procedures refer to round wires.

#### 4. Terminating Cable to Connector Insert (Continued)

## Step 6: Cleaning

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

### IMPORTANT

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

## Step 7. Inspection, Test, and Rework

INSPECT BOTH TOP AND BOTTOM OF THE TERMINALS. MINIMUM 10X MAGNIFICATION RECOMMENDED.

**Inspect: These features must be present:**

- The SolderSleeve terminators must be shrunk around the terminals and cable conductors.
- The cable conductors must overlap the insert terminals by at least half of the conductor width (offset may be no more than 50 percent of the conductor width).
- A solder fillet must be visible between each conductor and terminal.

**These features must not be present:**

- The terminator sleeves must not be browned or darkened to the point where visual inspection of the solder joints is impossible.
- There must be no bridging of solder between adjacent conductors.
- There must not be any remnant of the solder preform shape. If any portion of a preform is visible, see section 4A for rework procedure.

**These features are acceptable:**

- The SolderSleeve terminators may be slightly browned.
- Solder on the surface of the conductors outside of the termination sleeves is acceptable.
- Splitting of the terminator sleeves is not cause for rejection as long as there is no solder bridging between conductors. Splitting of more than a few sleeves is an indication of possible overheating or other problems that must be corrected.

**Test:** Perform any required electrical tests, such as continuity or short circuits.

**Rework:** If any rework of the cable conductor terminations is required, it must be completed at this stage, prior to applying the sealing boot. Rework operations are described in Section 4A.

**IMPORTANT**

If rework becomes necessary, the cause should be determined and the problem corrected.

#### 4A. Termination Rework (Go to Section 5 unless rework is required)

**Outline:** This section describes rework to be performed, if necessary, before the sealing boot is applied. There are three rework procedures that can be performed at this point.:

- a. Replace the insert (instructions below)
- b. Reheat the entire insert (instructions below).
- c. Reheat an individual solder joint (instructions on next page).

**Replace insert:** If the FCC is long enough, you may cut off the insert and install a new one (start at beginning of Section 4). If the FCC has no extra length, remove the connector insert from the cable by installing the terminated assembly in the Waffle Iron II heating tool and performing the heating cycle. Pull gently on the FCC, and when the solder melts (which will occur approximately 30 seconds into the heating cycle), the cable can be pulled out of the heating tool and out of the connector insert. 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 conductors **must** be re-dipped in solder to remove icicles and solder build-up (use the pretinning procedure described in Step 1 of Section 4.0.).

**IMPORTANT**

Do not re-use the connector insert, because the terminals will not be properly solderable.

**Reheat Entire insert:** If the solder in many of the SolderSleeve terminators has not melted and flowed, that indicates that the heating tool did not reach the correct termination temperature.

- If using a Waffle Iron II, it must be inspected, calibrated, and if necessary, repaired (See ES-61402, *Waffle Iron // Operating and Maintenance Instructions*). However, as a temporary measure the underheated termination (connector insert and cable) can be placed in the Waffle Iron II and reheated using higher time and temperature settings.

**IMPORTANT**

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

**4A. Termination Rework (continued)****Insert reheating, continued:**

- If using an AA-400 SuperHeater, heat each SolderSleeve terminator longer before continuing to the next one. If the sleeves are browned but the solder does not melt and flow properly, the AA-400 tool may need calibration or repair (See document No. H50324, *SuperHeater Operatina and Maintenance Instructions*).

**Reheat individual** An individual SolderSleeve terminator can be reheated with a pencil-type hot air heating tool with a narrow tip, such as the Raychem AA-400

**solder joint:** Super Heater or a fine-tip soldering iron.

If the FCC conductor is bent upward, carefully flatten it while the solder is melted by pressing on the terminator sleeve with a blunt wooden stick or similar implement. Take care not to puncture the sleeve.

**Other Rework procedures:** Other rework operations are possible and may involve the removal the insulating sleeve. These operations should be carefully evaluated to ensure that they will not unacceptably degrade the finished, booted termination.

## 5. Sealing Boot Application

**Outline:** The sealing boot is slid up the cable and over the termination area.

The entire assembly (FCC, connector insert, and boot) is loaded into the Waffle Iron II heating tool and heated to seal the boot over the termination area.

**Position sealing boot:** Slide the sealing boot along the cable and onto the back end of the connector insert. When the sealing boot is in place, inspect the strip of sealant inside the boot to make sure it has not been deformed.

**IMPORTANT**

The strip of sealant within the sealing boot must be smooth, flat, and properly positioned; if the sealant is deformed, the boot may fail to seal properly.

**5. Sealing Boot Application, continued**

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

Select the correct platen set from the table below.

Insert Being Terminated		Platen Set Required
Pin Insert		CE-1520100
Socket Insert		CE-1520200

Platen Selection Table for Sealing Boot Installation

Set the **TEMPERATURE** and **TIME** settings on the Waffle Iron II heating tool to the following settings:

- Set **TEMPERATURE** thumbwheel to setting **0**.
- Set **TIME** thumbwheel to setting **4**.

**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 Assembly into tool:** Position the cable assembly in the Waffle Iron II such that the insert, with the keyed side up, is against the stop in the platen, with the cable extending to the right.

Close the cable clamp.

Inspect for correct loading and positioning.

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



## 5. Sealing Boot Application, Continued

**Heat:** 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 completed cable assembly.

**Inspect:** Visually inspect the sealing boot area for underheating or overheating.

The signs of underheating are:

- Lack of adhesion between the sealant and the FCC.

- 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 have electrical continuity.

- 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.

**Rework:** The rework procedure is to cut off the insert, discard it, and install a new insert on the FCC. If this makes the FCC too short for retermination, a new FCC must be prepared.

**IMPORTANT**

Any excess adhesive between the sealing  
boot and the insert must be removed or the  
insert will not fit properly in the connector housing.