



All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of ± 0.13 [$\pm .005$] and angles have a tolerance of $\pm 2^\circ$. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This specification covers the requirements for application of terminating Flexible Flat Cable (FFC) contacts to cables with conductors on 1.27 mm [.050 in.] centers. The cable may be solid copper-conductor Flat Flexible Cable (FFC), Flat Etched Circuitry (FEC), Flexible Printed Wire (FPW), or conductive ink circuitry cable. Terminations can be made using semi-automatic machine crimping tools.

When corresponding with TE Connectivity Personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1. The illustrations are representative of the basic contact, cable, and housing.

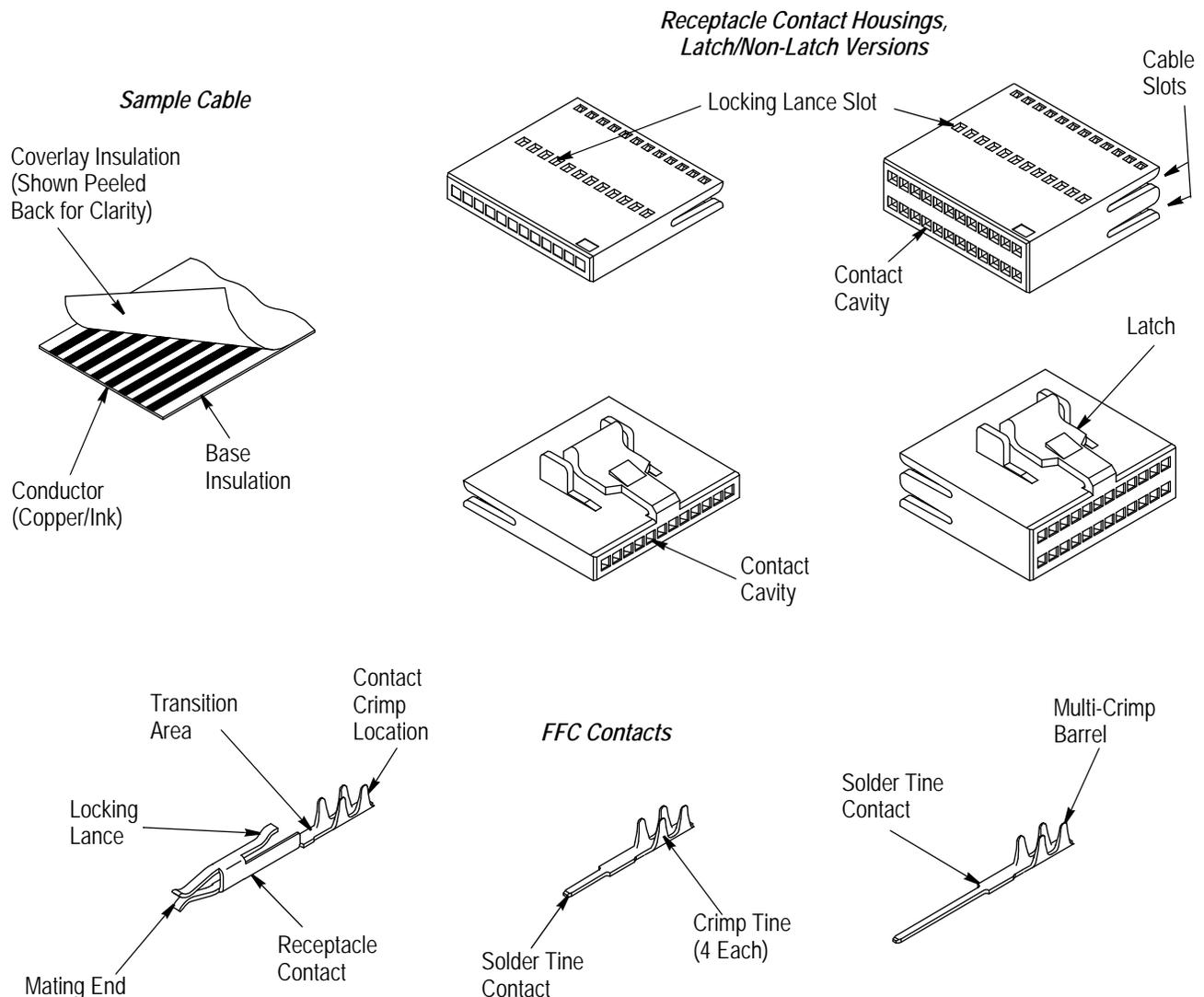


Figure 1

2. REFERENCE MATERIAL

2.1. Revision Summary

This paragraph is reserved for a revision summary covering the most recent additions and changes made to this specification which include the following:

- Upgrade document to corporate requirements
- Changed cable length dimension in Figure 3

2.2. Customer Assistance

Reference Part Number 487937 and Product Code 5863 are representative numbers of Flexible Flat Cable (FFC) Connectors for 1.27 mm [.050 in.] Centerline Cable. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local TE Representative or, after purchase, by calling the Tooling Assistance Center or the Product Information Center number at the bottom of page 1.

2.3. Drawings

Customer Drawings for each product part number are available from the service network. The information contained in Customer Drawings takes priority if there is a conflict with this specification or with any technical documentation supplied by TE.

2.4. Manuals

Manual 402-40 is available upon request and can be used as a guide to soldering. This manual provides information on various flux types and characteristics with the commercial designation and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

2.5. Specifications

Product Specifications 108-40002 (for cables) and 108-16022 (for contacts and housings) provide performance tests for this product line. Quality Specification 102-16050 provides measurement of crimp height.

2.6. Instructional Material

The following list includes instruction sheets (408-series) that provide assembly procedures for product, operation, maintenance and repair of tooling, as well as setup and operation procedures of applicators; and customer manuals (409-series) that provides setup, operation, and maintenance of machines.

| <u>Document Number</u> | <u>Document Title</u> |
|------------------------|---|
| 408-3295 | Preparing Reel of Contacts For Application Tooling |
| 408-7424 | Checking Terminal Crimp Height or Gaging Die Closure |
| 408-9719 | Hand Tool Kit 91292-1 for FFC Contact Positioning |
| 408-9816 | Handling of Reeled Products |
| 409-5607 | Mass Terminated Flat (MTF) Machines (for comb contacts) |
| 409-5875 | Flexible Flat Cable Terminating Machine (for strip contacts) |
| 409-5880 | Programmer for Flexible Flat Cable Terminating Machine (for strip contacts) |

2.7. Industry Standards

The American National Standards Institute for Interconnecting and Packaging Electronic Circuits (IPC) document IPC-FC-220 provides specifications on flexible flat cable and IPC-FC-250 provides specifications on flexible printed wiring. Copies of the commercial documents can be obtained from:

Institute for Interconnecting and Packaging Electronic Circuits
7380 Lincoln Avenue
Lincolnwood, IL 60646

3. REQUIREMENTS

3.1. Storage

A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the cable.

B. Heat Limitation

The heat limitation for Flexible Flat Cable Connectors shall be normal ambient temperatures.

C. Reeled Contacts

When using reeled contacts, store coil wound reels horizontally and traverse wound reels vertically.

D. Shelf Life

The contacts should remain in the shipping containers until ready for use to prevent deformation to the contact. The contacts should be used on a first in, first out basis to avoid storage contamination that could adversely affect signal transmissions.

3.2. Characteristics

The Individually Terminated Contacts (strip, reel-fed), and the Mass Terminated Flat (MTF) Contacts are both available in solder tine and receptacle contact form. See Figure 2.

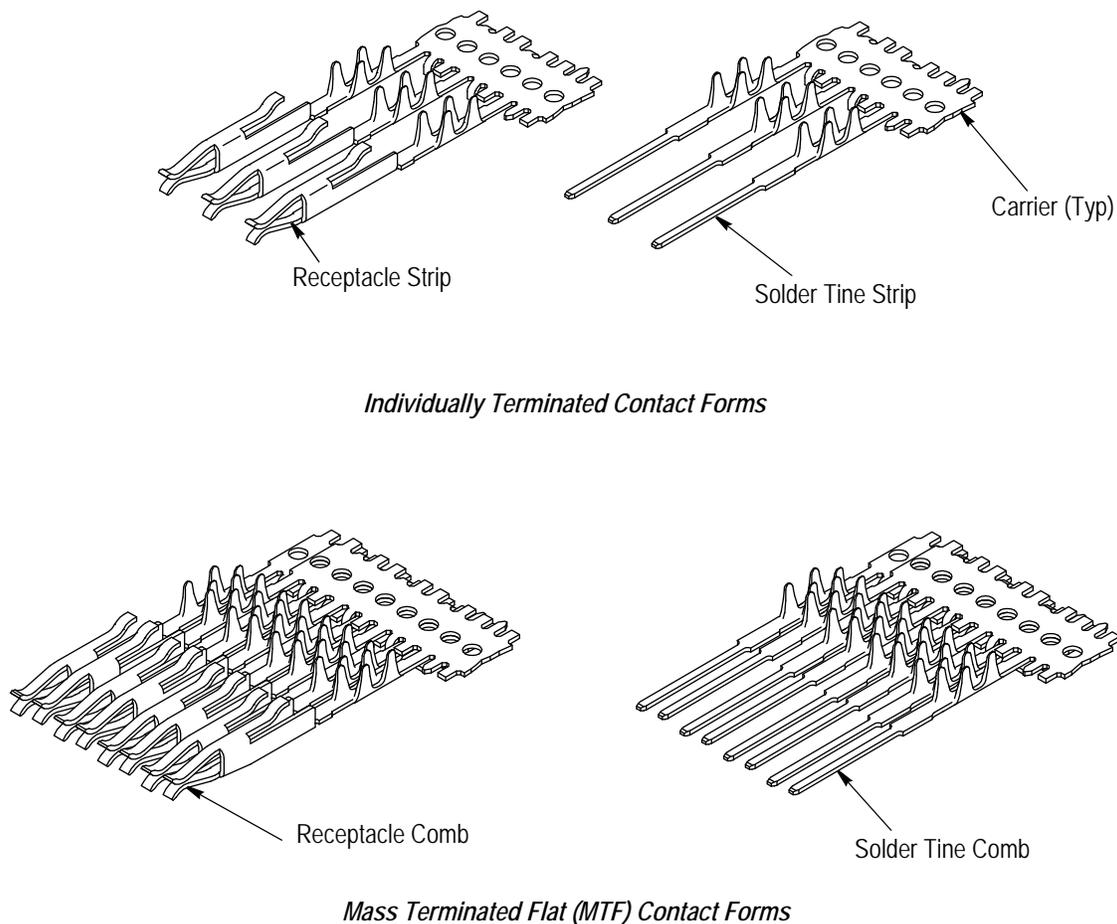


Figure 2

3.3. Cable Selection and Preparation

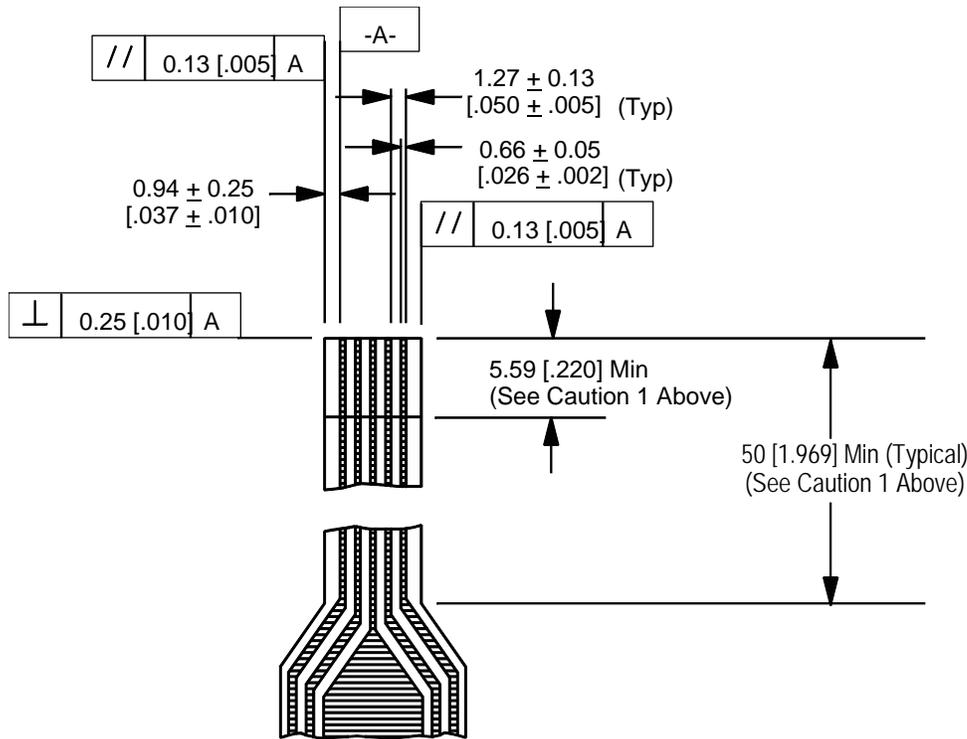
See Figure 3 for cable construction recommended for Flexible Flat Cable Contacts.



There must be a straight conductor length of 5.59 mm [.220 in.] minimum for all terminations. A straight cable length of 41.15 mm [1.620 in.] minimum is required for semi-automatic tools.

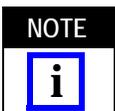


The optimum conductor width is 0.66 ± 0.05 mm [.026 ± .002 in.]. The contacts can be used to terminate wider conductors; however, the tines may shave off some of the conductor and create slivers of metal that could cause electrical shorts. If slivers are suspect, brush the tine crimp area. Visually check that there are no slivers bridging from one contact to another, then apply a thin coat of fast-drying sealant over the tine crimp area. For additional information concerning cable requirements, contact TE Engineering through the Tooling Assistance Center number at the bottom of page 1.



| CABLE | | | | | | |
|----------|------------------------------------|--------------------------|------------------------------|--------------------------|-----------------------|----------------------|
| TYPE | REFERENCE COMMERCIAL SPECIFICATION | CONDUCTOR | | INSULATION | | CRIMP AREA THICKNESS |
| | | WIDTH | THICKNESS | BASE | COVERLAY | |
| FFC | IPC-FC-220, CLASS 4 | 0.61-0.71 [.024-.028] | 0.05-0.08 [.002-.003] | 0.08-0.31 [.003-.012] | 0-0.23 [.000-.009] | 0.31 [.012] Max |
| FEC/FPW | IPC-FC-250, CLASS 1, 2, or 3 | | | | | |
| COND INK | None | | 0.008-0.025 [.0003-.0010] | | | |

Figure 3



For FEC using polyimide, There shall be no polyimide coverlay on the top side of the cable as terminated for a minimum distance of 5.59 mm [.220 in.] from the end of the cable for proper termination. If there is an environmental concern, copper tracks should be plated or a conformal coating should be applied to the exposed copper before or after termination.

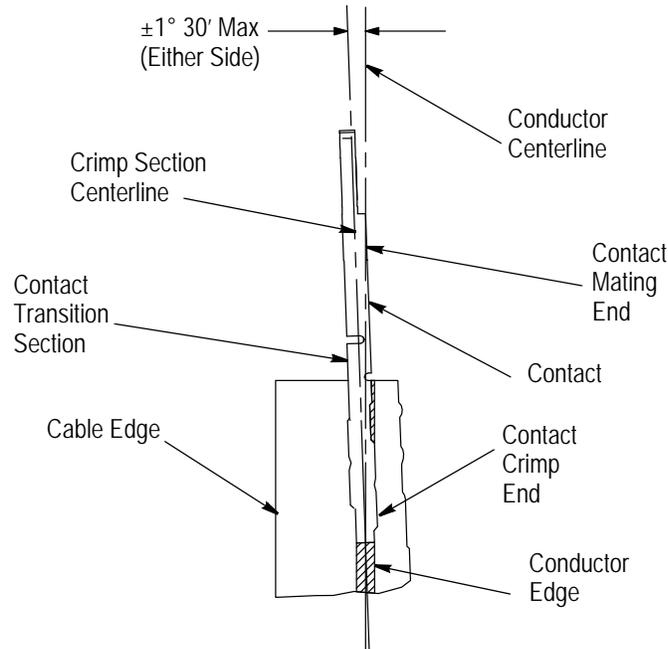
3.4. Crimp Inspection

A. Crimp Configuration

The centerline of the contact crimp end and the centerline of the conductor must be within the angular limit as shown in Figure 4.



The conductor and contact transition edges provide surfaces for accurately measuring contact-to-conductor alignment. The cable edge may be used in place of the conductor edge as long as allowance are made for any degree of non-parallelism between the conductor and cable edge.



NOTE: Contacts may vary by 1° 30' max on either side of the conductor centerline, but **ALL** contacts must "lean" in the same direction.

Figure 4

B. Contact Placement Relative to Cable End

Contacts must be crimped equal distance from the cable end and relative to each other within the limits specified in Figure 5.

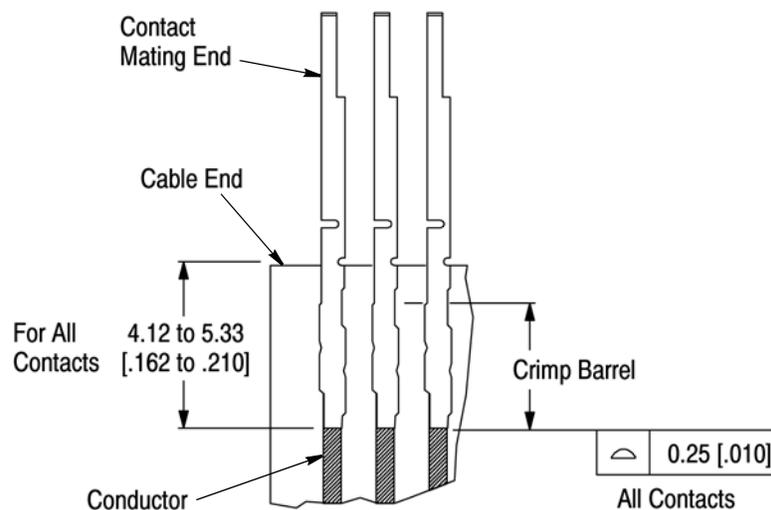


Figure 5

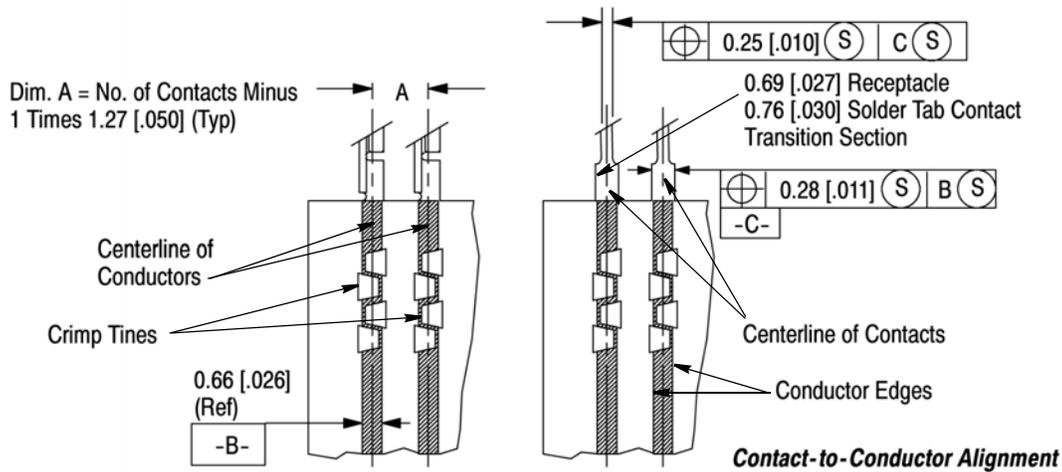


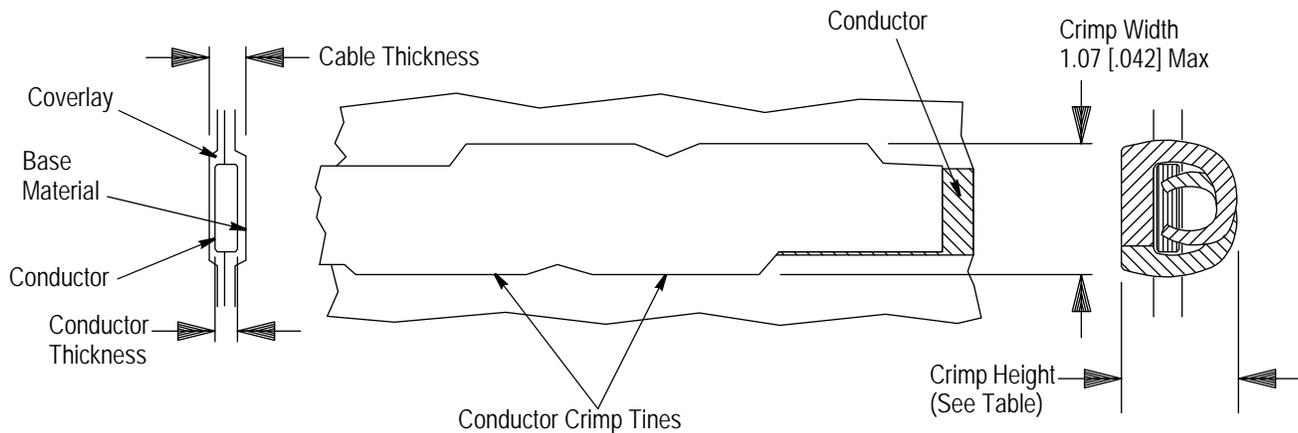
Figure 6

C. Alignment of Crimp Barrel to Conductor

The tips of the top three crimp tines must be within the conductor width. The fourth is primarily a strain relief and may or may not make electrical contact. The contact transition section and the conductor must be as specified. See Figure 6.

D. Contact Crimp Height, Width, Configuration, and Position

Crimp a series of contacts on a test strip of cable, then select a well-centered conductor and remove all extruded insulation material from the crimped area. Use a standard flat micrometer to measure the crimp height and crimp width at the centermost portion of the contact crimp barrel and compare them with the specified dimensions in Figure 7. Do not measure crimp tine closest to the end of the cable.



| CONDUCTOR | | CABLE THICKNESS (MAX) | CRIMP HEIGHT‡ | MATERIAL THICKNESS (MAX) | |
|-------------------------------|------------------------------|-----------------------|----------------------------|--------------------------|--------------|
| MATERIAL | THICKNESS | | | BASE | COVERLAY |
| Copper Standard or Equivalent | 0.05-0.08 [.002-.003] | 0.31 [0.012] | 0.78 ±0.05 [.031 ±.002] | 0.08 [0.003] | 0.08 [0.003] |
| Ink | 0.008-0.025 [.0003-.0010] | | | 0.20 [0.008] | 0.10 [0.004] |

‡This is the optimum crimp height for cables meeting the dimensional requirements provided in the chart. Other cables can be used with these contacts and termination tooling. New applications must be tested to be sure they meet your electrical and mechanical requirements, and new crimp heights established. Refer to the Customer Manual packaged with the machine for crimp height adjustments (see Paragraph 2.6).

Figure 7

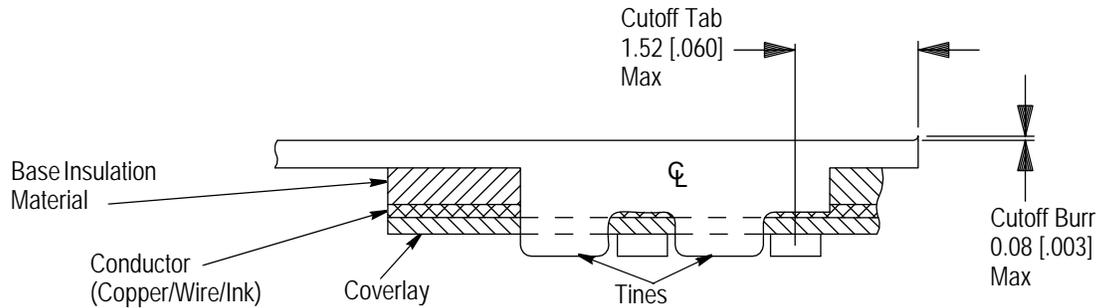


Figure 8

E. Crimp Orientation, and Contact Carrier Cutoff Tab and Burr Allowance

Orientation of the contact to the cable should be such that the tines will penetrate the thinner coverlay material rather than the cable base insulation material. The carrier cutoff tab and burr shall not exceed the limits shown. See Figure 8.

F. Workmanship

Carefully examine both sides of the crimped contact to be sure that the termination meets the requirements of this specification. The crimp area must show no signs of cracking or tearing due to mishandling or mis-adjustment of the tooling. See Section 6.

G. Solder Tine Bending

When using solder tine contacts, refer to Figure 9 for the bending variations.

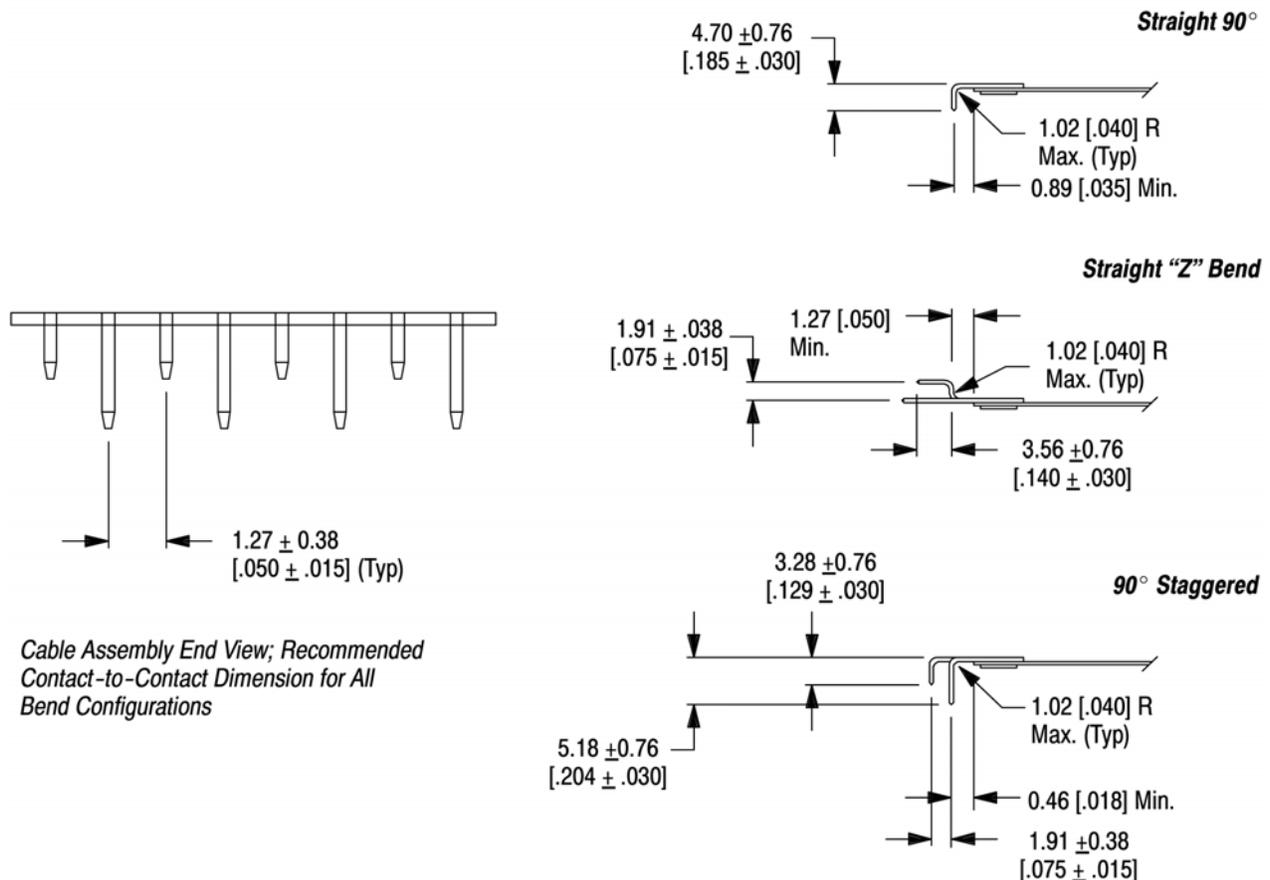


Figure 9

3.5. Printed Circuit (PC) Board Connector Requirements

A. PC Board Material

- 1) PC board materials will be glass epoxy (FR-4, G-10).
- 2) PC board thickness shall be 1.83 mm [.072 in.] max.

For suitability of other pc board thicknesses or materials, contact the Product Information Center number listed at the bottom of page 1.

B. PC Board Layout

The recommended pc board layout, dimensions, and tolerances are shown in Figure 10.

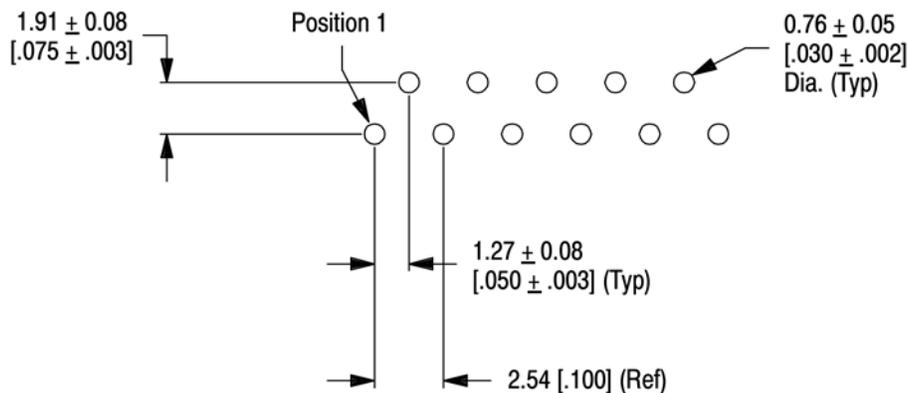


Figure 10

3.6. Soldering

FFC Solder Tine Connectors may be soldered by hand or wave soldering. The following guidelines should apply regardless of which method is preferred.



Due to temperature limitations of the cable and housing materials, reflow soldering, IR and hot air methods, are not recommended.

A. Flux Selection

Solder tines shall be fluxed before soldering using only mildly activated rosin base flux. Proper flux selection depends on the type of pc board and any components already mounted. Flux must also be compatible with the wave solder line and with manufacturing and safety requirements.

B. Soldering Guidelines

While soldering, connector/cable assembly temperatures must not exceed 125°C [257°F] for 10 minutes.

C. Cleaning

Fluxes, residues, and activators must be removed. Cleaning procedures depend on the type of flux used on the solder line. Figure 11 provides cleaning compounds and chemicals which may be used to clean the connectors without adverse affect on the housings, contacts, or cable for the time and temperature specified.

D. Drying



When drying cleaned assemblies and pc boards, make certain that recommended temperature limits are not exceeded. See Figure 11.

| CLEANER | | TIME (Minutes) | TEMPERATURE (Maximum) |
|-------------------|---------|-------------------|--------------------------|
| NAME | TYPE | | |
| ALPHA 2110 | Aqueous | 1 | 132°C [270°F] |
| BIOACT EC-7 | Solvent | 5 | 100°C [212°F] |
| Butyl CARBITOL | Solvent | 1 | Ambient Room |
| Isopropyl Alcohol | Solvent | 5 | 100°C [212°F] |
| KESTER 5778 | Aqueous | | |
| KESTER 5779 | Aqueous | | |
| LONCOTERGE 520 | Aqueous | | |
| LONCOTERGE 530 | Aqueous | | |
| Terpene | Solvent | | |

Figure 11



Consideration must be given to toxicity and other safety and health requirements as recommended in the Material Safety Data Sheet (MSDS) supplied by the solvent manufacturer.



If you have a particular solvent that is not listed, consult an TE Representative before using it on these connectors.

E. Checking Installed Connector

All solder connections should conform to the Workmanship Specification 101-21. See Figure 12.

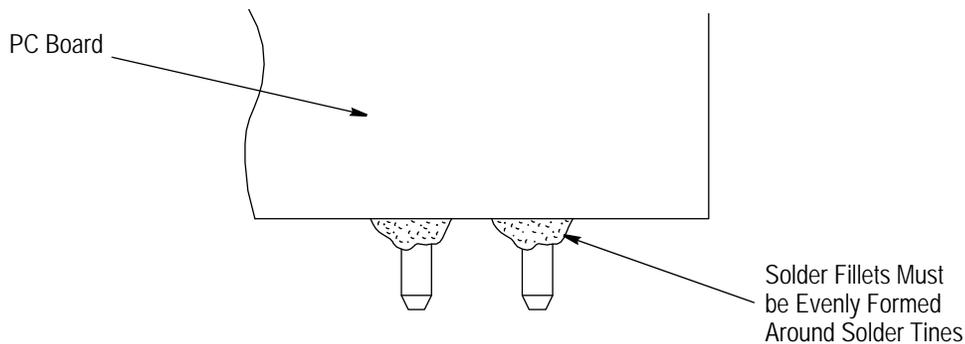


Figure 12

F. Repair/Removal

Contacts may be removed from the pc board by standard desoldering methods. See Paragraph 2.4, Manuals. Damaged crimped contacts or housings must be removed, discarded, and replaced with new components.



If a damaged contact is apparent before the contacts are inserted into the housing, cut the cable in back of the row of contacts and reterminate the cable end. If contacts are inside housing and contacts or housing become damaged, the cable must be cut directly in back of the housing and reterminated with new contacts and housing.

ALPHA, BIOACT, CARBITOL, KESTER, and LONCOTERGE are trademarks of their respective owners.

4. QUALIFICATIONS

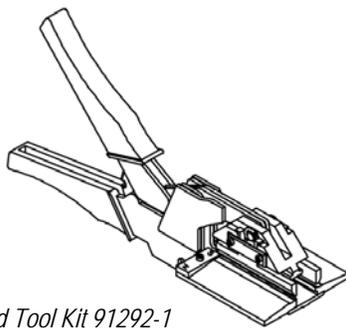
Flexible Flat Conductor Cable is Recognized by the Component Program of Underwriters Laboratories Inc. (UL) in File No. E53793 per UL Styles 2690 and 2742 (300 volts). The connectors are Recognized by the UL Component Program in File No. E28476. These connectors are Certified by CSA International in Report No. LR 7189A-91, FFC Certified in CSA Report No. LL 83498-2, and the cable assemblies are Certified in CSA Report No. LR 45924-5.

5. TOOLING

Semi-automatic machine application tooling is available for high-volume manufacturing and will crimp strip-form and/or comb-form contacts to various type cables listed in the specification. See Figure 13. Numbers in parentheses are instructional material; see Paragraph 2.6.

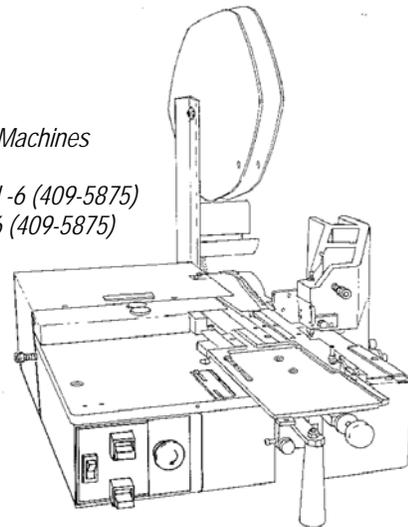


The Flexible Flat Cable Machine for comb contacts is obsolete and is no longer available for purchase. However, it is referenced on this document because of the large number of installed machines and the customers who may have a supply of comb contacts.

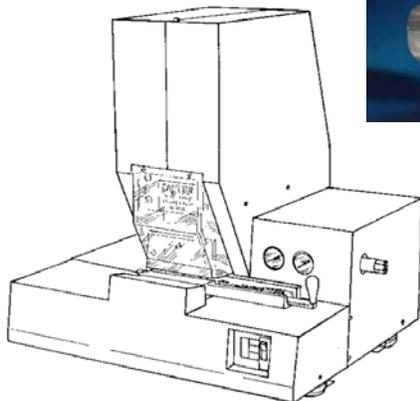


*Hand Tool Kit 91292-1
for Bending Solder
Contacts (408-9719)*

*Flexible Flat Cable Terminating Machines
(For Strip Form Contacts)
W/O Programmer 224910-4 and -6 (409-5875)
W/Programmer 318619-4 and -6 (409-5875)*



*FFC Termination Base
Machine 528000-7 (Uses
Applicator 3-528441-9)*



*Flexible Flat Cable Machine
(For Comb Form Contacts)
818973-3, -4 (409-5607)*



*Programmer 356484-1
(409-5880)*

Figure 13

6. VISUAL AID

The illustration below shows a typical application of this product. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

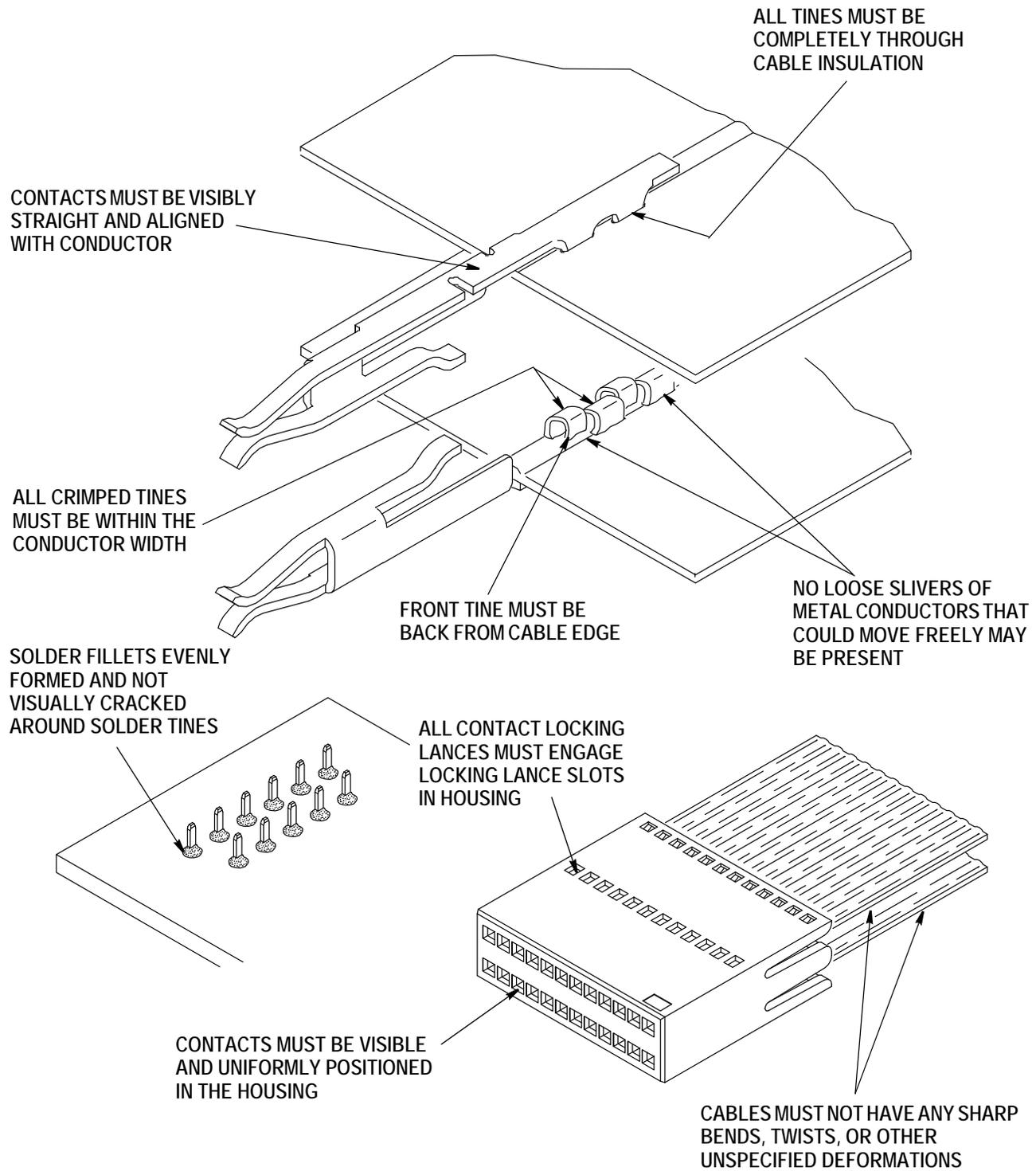


FIGURE 14. VISUAL AID