

### NOTE



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  $\pm 0.13$  [ $\pm .005$ ] 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 Mini-Universal MATE-N-LOK connectors for free-hanging, panel-mount, and printed circuit (pc) board applications. These connectors provide a reliable and economic means of grouping multiple-lead connections in computers, computer/peripheral equipment, business machines, entertainment centers, and appliances.

The connectors are available in hermaphroditic housing and positively polarized: plug housing, vertical pin header, and cap housing. The housings accept socket contacts and pin contacts. Each contact features a contact stop to ensure proper insertion depth of the contact in the contact cavity of the housing. The contacts are available in strip form for machine application and loose piece for manual tooling application.

The hermaphroditic housing is available with 2, 3, or 4 circuits for free-hanging applications. The cap housing is available in 1, 2, or 3 circuits for free-hanging application and 2, 3, 4, 6, 9, 12, or 15 circuits for panel mounting or free-hanging application.

The plug housing and vertical pin header is available with 2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 22, or 24 circuits; the vertical blind-mate pin header is available in 4, 6, 8, 9, 10, 12, or 15 circuits for panel mounting or free-hanging application. The right-angle pin header is available in 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, or 24 circuits for pc board application.

### DANGER

To avoid personal injury, these connectors are not to be used for interrupting current.



When corresponding with 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.

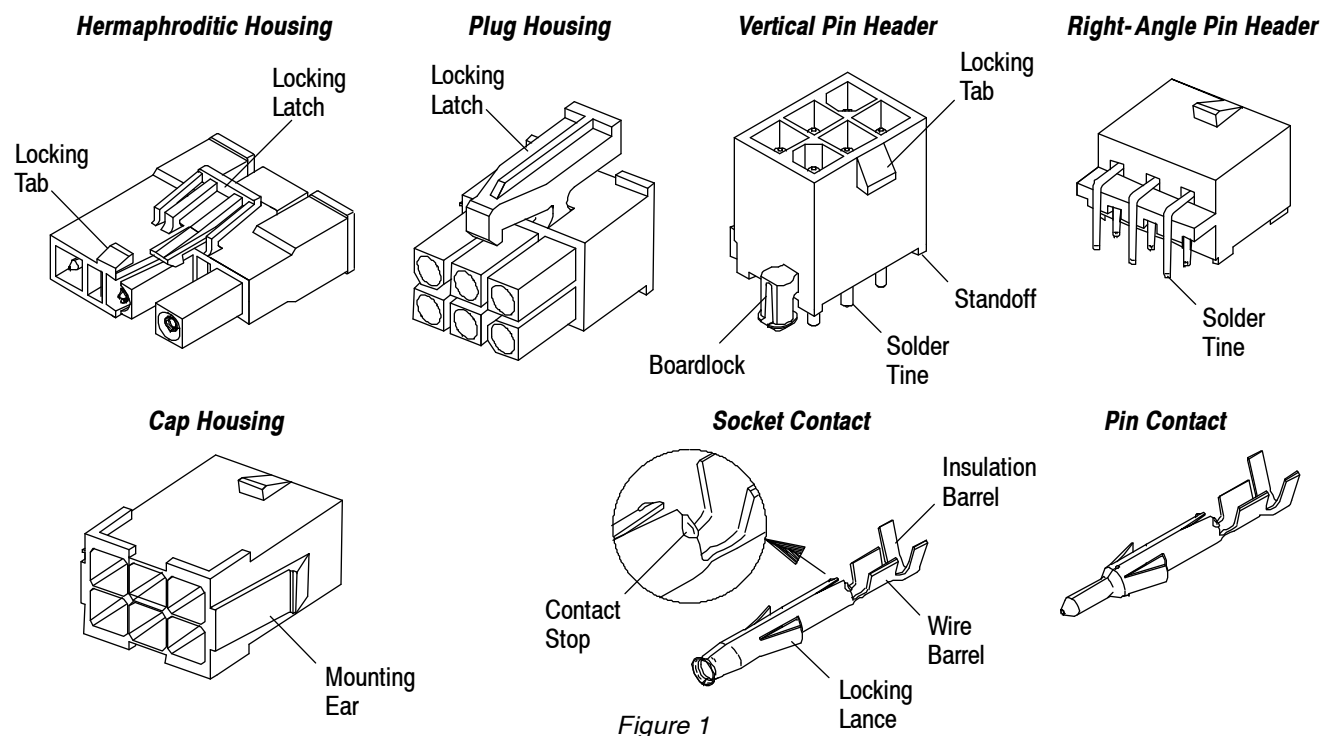


Figure 1

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

Revisions to this application specification include:

- Updated application specification to corporate requirements
- Added DANGER to Section 1 and CAUTION to Paragraph 3.3
- Added hermaphroditic housing to Figure 1 and contact stop to Section 1, Figures 1 and 10, and Paragraph 3.2,C
- Replaced superceded hand crimping tools in Section 5, and added NOTE to Paragraph 5.1

### 2.2. Customer Assistance

Reference Product Base Part Number 770166 and Product Code 1311 are representative of Mini-Universal MATE-N-LOK connectors. 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 Representative or, after purchase, by calling PRODUCT INFORMATION at the number at the bottom of page 1.

### 2.3. Drawings

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, the information contained in the Customer Drawings takes priority.

### 2.4. Specifications

Design Objective 108-5138 provides expected product performance and test information for connectors (94V-O), and 108-5151 provides expected performance and test information for connectors (94V-2).

### 2.5. Instructional Material

Instruction Sheets (408-series) provide product assembly instructions or tooling setup and operation procedures and Customer Manuals (409-series) provide machine setup and operating procedures. Instruction material available that pertains to this product are:

|          |  |
|----------|--|
| 408-3234 | Mini-Universal MATE-N-LOK Connectors                           |
| 408-4118 | Extraction Tool 189727-1                                       |
| 408-4148 | Straight Action Hand Tool 90710-2                              |
| 408-4443 | Straight Action Hand Tool 90717-2                              |
| 408-7347 | Insertion Tool 91002-1   |
| 408-8040 | Heavy Duty Miniature Quick-Change Applicators (Side-Feed)      |
| 408-8547 | CERTI-CRIMP* II Straight Action Hand Tools 91522-1 and 91536-1 |
| 408-9965 | PRO-CRIMPER* III Hand Crimping Tool 90870-1                    |
| 409-5128 | AMP-O-LECTRIC* Model "K" Terminating Machine 565435-5          |
| 409-5842 | AMP-O-LECTRIC Model "G" Terminating Machines 354500-[ ]        |
| 409-5852 | AMPOMATOR* CLS III-G Lead-Making Machines 122500-[ ]           |
| 409-5878 | AMPOMATOR CLS IV+ Lead-Making Machines 356500-[ ]              |

### 2.6. Manual

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

## 3. REQUIREMENTS

### 3.1. Wire Selection and Preparation

The contacts accept *stranded* wire sizes 30 to 16 AWG within the insulation diameter range listed in Figure 2.

The wire insulation shall be stripped to a length from 3.20 to 3.71 [.126 to .146] for one-wire crimping and 3.50 to 3.99 [.138 to .157] for two-wire crimping. Reasonable care shall be taken not to nick, scrape, or cut any strands during the stripping operation.

## 3.2. Contact Crimp Requirements

### A. Carrier Cutoff

There shall be no burrs on the cutoff tab. The carrier cutoff tab length shall not exceed the dimension given in Figure 2.

### B. Crimp Height

The insulation barrel shall be formed around but not cut into the wire insulation. The wire barrel and insulation barrel crimp height and width is given in Figure 2.

#### NOTE



*The applied crimp dimension (within the function range of the product) is dependent on the termination tooling being used. Refer to the documentation (applicator logs and instruction sheets) supplied with the termination tooling for the applied crimp height.*

### C. Contact Stop

The contact stop must not be crimped. Any deformation to the contact stop will compromise the insertion depth of the contact in the contact cavity of the housing.

### D. Front and Rear Bellmouths

The front bellmouth shall be visible. The rear bellmouth shall conform to the dimensions given in Figure 2.

### E. Wire Location

The end of the wire shall be flush with the end of the wire barrel or protrude no more than the dimension given in Figure 2.

### F. Locking Lances

The locking lances shall not be deformed.

**Note:** All requirements apply to both pin and socket contact.

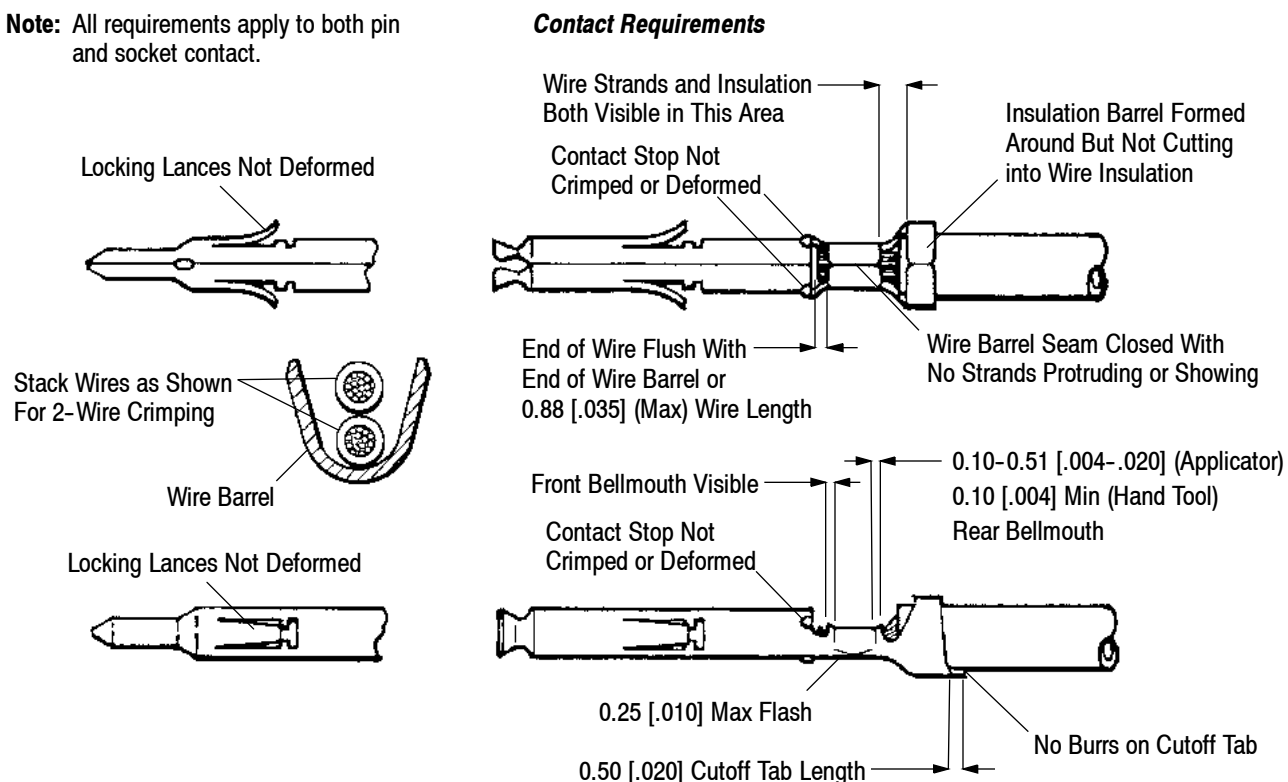


Figure 2 (Cont'd)

### AUTOMATIC MACHINE

| WIRE (Stranded Only) |                           | WIRE BARREL CRIMP                |                | INSULATION BARREL CRIMP WIDTH (Ref) |
|----------------------|---------------------------|----------------------------------|----------------|-------------------------------------|
| SIZE (AWG)           | INSULATION DIAMETER       | HEIGHT $\pm 0.05$ [ $\pm .002$ ] | WIDTH          |                                     |
| 30                   | 0.88-1.27<br>[.035-.050]  | 0.50 [.020]                      | 1.06<br>[.042] | 1.78<br>[.070]                      |
| 28                   |                           | 0.55 [.022]                      |                |                                     |
| 26                   |                           | 0.60 [.024]                      |                |                                     |
| 26                   | 1.20-1.75<br>[.047-.069]  | 0.63 [.025]●                     | 1.22<br>[.048] | 2.03<br>[.080]                      |
| 24                   |                           | 0.69 [.027]                      |                |                                     |
| 22                   |                           | 0.78 [.031]                      |                |                                     |
| 22                   | 1.50-2.79<br>[.059-.110]  | 0.81 [.032]                      | 1.57<br>[.062] | 2.79<br>[.110]                      |
| 20                   |                           | 0.91 [.036]                      |                |                                     |
| 18                   |                           | 1.07 [.042]                      |                |                                     |
| 22 (2 Wires)         | 1.70 [.067] Max (2 Wires) | 0.91 [.036]                      | 1.78<br>[.070] | 3.56<br>[.140]                      |
| 20                   | 2.0-3.20<br>[.079-.126]   | 1.07 [.042]                      |                |                                     |
| 18                   |                           | 1.21 [.048]                      |                |                                     |
| 16                   |                           | 1.30 [.051]                      |                |                                     |
| 20 (2 Wires)         | 1.91 [.075] Max (2 Wires) | 1.30 [.051]                      |                |                                     |

- For tin-coated 7-strand wire size 26 AWG with 0.15 [.006] insulation diameter, crimp height must be controlled to  $+0.03/-0.05$  [ $+.001/- .002$ ].

### HAND TOOL

| WIRE (Stranded Only) |                           | WIRE BARREL CRIMP |                         |                | INSULATION BARREL CRIMP WIDTH (Ref) |
|----------------------|---------------------------|-------------------|-------------------------|----------------|-------------------------------------|
| SIZE (AWG)           | INSULATION DIAMETER       | ANVIL DIE LETTER  | HEIGHT<br>±0.05 [±.002] | WIDTH          |                                     |
| 30                   | 1.52 [.060] Max           | —                 | 0.58 [.023]             | 1.07<br>[.042] | 1.78<br>[.070]                      |
| 28                   |                           |                   | 0.64 [.025]             |                |                                     |
| 26                   |                           |                   |                         |                |                                     |
| 26                   | 1.20-1.75<br>[.047- .069] | A                 | 0.69 [.027]             | 1.07<br>[.042] | 2.03<br>[.080]                      |
| 24                   |                           |                   | 0.69 [.027]             |                |                                     |
| 22                   |                           | B                 | 0.78 [.031]             |                |                                     |
| 22                   | 1.50-2.79<br>[.059- .110] | A                 | 0.79 [.031]             | 1.58<br>[.062] | 2.79<br>[.110]                      |
| 20                   |                           |                   | 0.79 [.031]             |                |                                     |
| 18                   |                           | B                 | 1.04 [.041]             |                |                                     |
| 22 (2 Wires)         | 1.70 [.067] Max (2 Wires) |                   | 1.04 [.041]             |                |                                     |
| 20                   | 2.00-3.20<br>[.079- .126] | A                 | 1.07 [.042]             | 1.78<br>[.070] | 3.56<br>[.140]                      |
| 18                   |                           |                   | 1.07 [.042]             |                |                                     |
| 20 (2 Wires)         | 1.91 [.075] Max (2 Wires) | B                 | 1.27 [.050]             |                |                                     |
| 16                   | 2.48-3.20<br>[.098- .126] | B                 | 1.27 [.050]             |                |                                     |

Figure 2 (End)

### G. Wire Barrel Seam

The wire barrel seam shall be closed adequately to confine all strands of the wire. There shall be no loose strands. Wire strands should not be embedded in the outside of the wire barrel.

### H. Straightness

The contact, including the cutoff tab, shall not be bent above or below the datum line more than the amount shown in Figure 3.

### I. Twist and Roll

There shall be no twist or roll in crimped portion that will impair usage of the contact. See Figure 3.

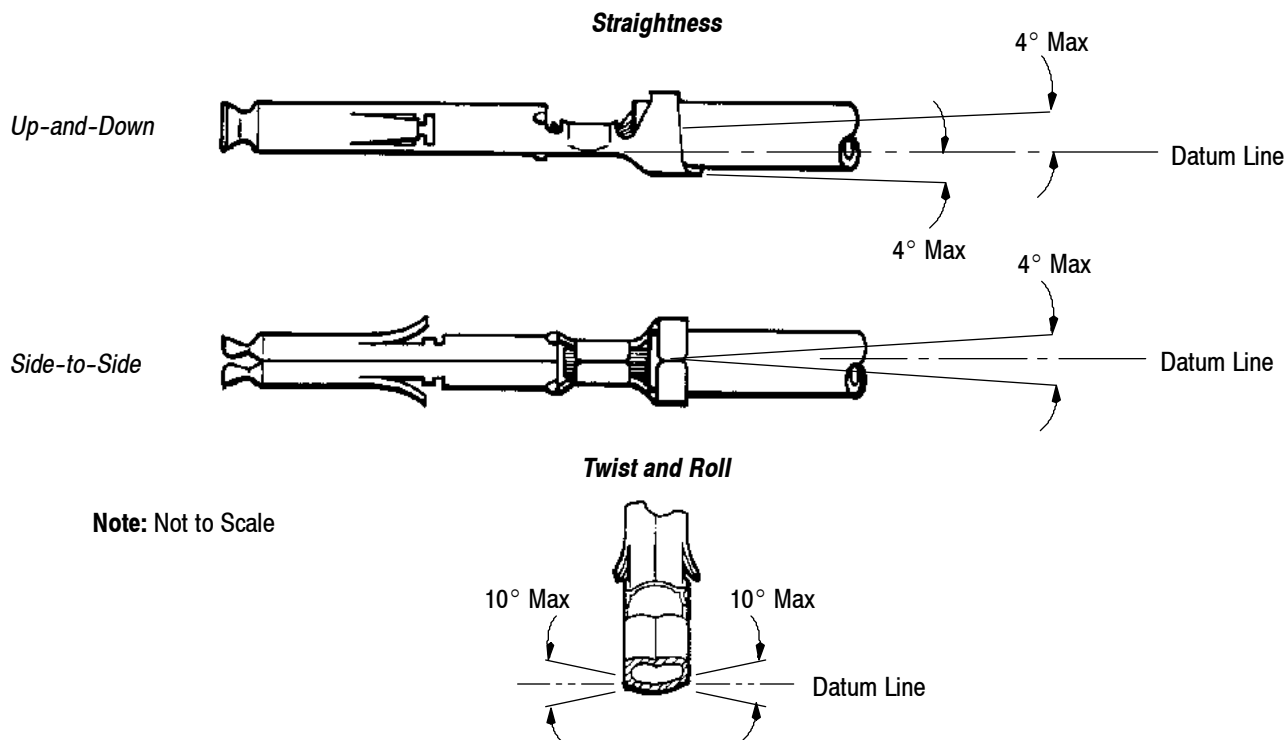


Figure 3

### 3.3. Assembly

A crimped contact (pin or socket) must be inserted into the housing by aligning it with the desired contact cavity in the BACK (wire side) of the housing. The wire must be grasped directly behind the insulation barrel and the contact pushed straight into the contact cavity until the contact bottoms (there will be an audible click).



**CAUTION** Excessive force must NOT be used when inserting the contact into the contact cavity. The contact stop of the contact is designed to ensure proper insertion depth of the contact. Over-insertion will cause damage to the contact or contact cavity of the housing and prevent the contact from floating in the contact cavity, which is necessary for optimum performance of the connector.

The wire must be pulled back *lightly* to ensure that the contact is locked in place.

### 3.4. Panel Mounting (Cap Housing)

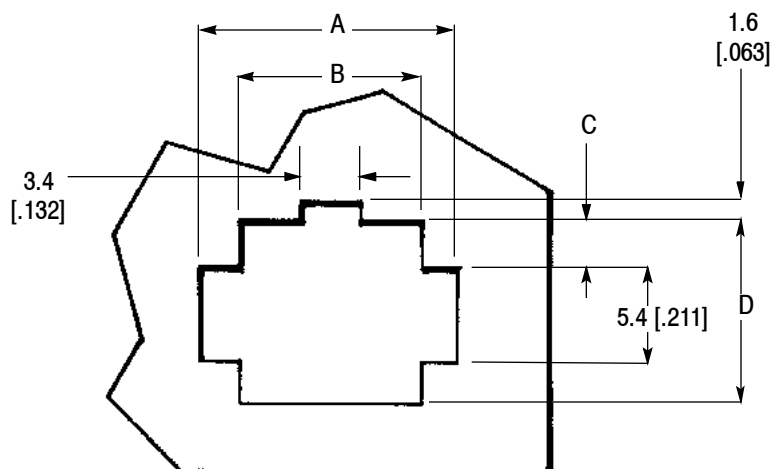
#### A. Thickness

The panel thickness range shall be 0.79 through 2.01 [.031 through .079].

#### B. Cutout

The dimensions of the panel cutout for panel mounting is provided in Figure 4.

### Cap Housing Panel Cutout



| CAP HOUSING<br>NUMBER OF CIRCUITS | PANEL DIMENSION |              |             |              |
|-----------------------------------|-----------------|--------------|-------------|--------------|
|                                   | A               | B            | C           | D            |
| 2                                 | 10.69 [.421]    | 6.15 [.242]  | 2.49 [.098] | 10.34 [.407] |
| 3                                 | 10.69 [.421]    | 6.15 [.242]  | 4.60 [.181] | 14.55 [.573] |
| 4                                 | 14.91 [.587]    | 10.34 [.407] | 2.49 [.098] | 10.34 [.407] |
| 6                                 | 19.10 [.752]    | 14.55 [.573] | 2.49 [.098] | 10.34 [.407] |
| 9                                 | 19.10 [.752]    | 14.55 [.573] | 4.60 [.181] | 14.55 [.573] |
| 12                                | 23.29 [.917]    | 18.74 [.738] |             |              |
| 15                                | 27.43 [1.080]   | 22.96 [.904] |             |              |

Figure 4

### 3.5. PC Board (Vertical and Right-Angle Pin Headers)

#### A. Thickness

The pc board thickness shall be 1.57 [.062]. Pc board thickness of 2.36 [.093] can also be used, but the plastic boardlock will function only as a press fit.

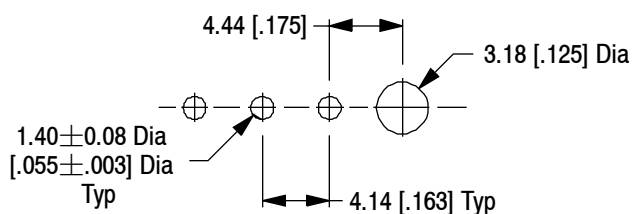
#### B. Layout

The pc board holes must be precisely located to ensure proper placement and optimum performance. Recommended pc board layouts are shown in Figure 5.

### Recommended PC Board Layout

#### Vertical Pin Header

2- and 3-Circuit, Inline



4-, 6-, 8-, 10-, and 12-Circuit, Dual Row

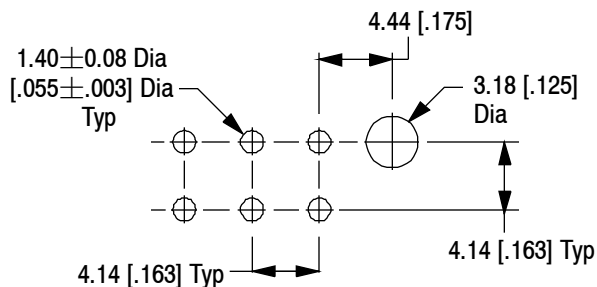
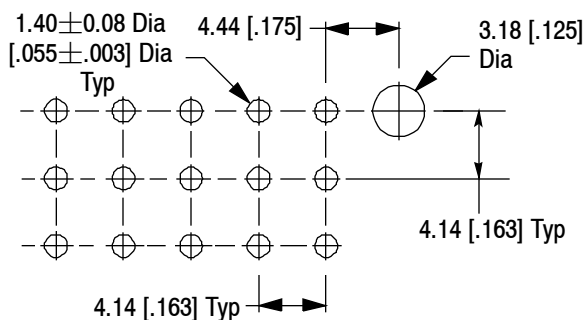


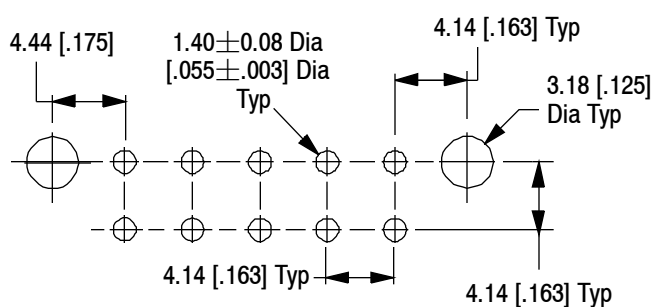
Figure 5 (Cont'd)

### Vertical Pin Header

9-, 12-, and 15-Circuit, Matrix

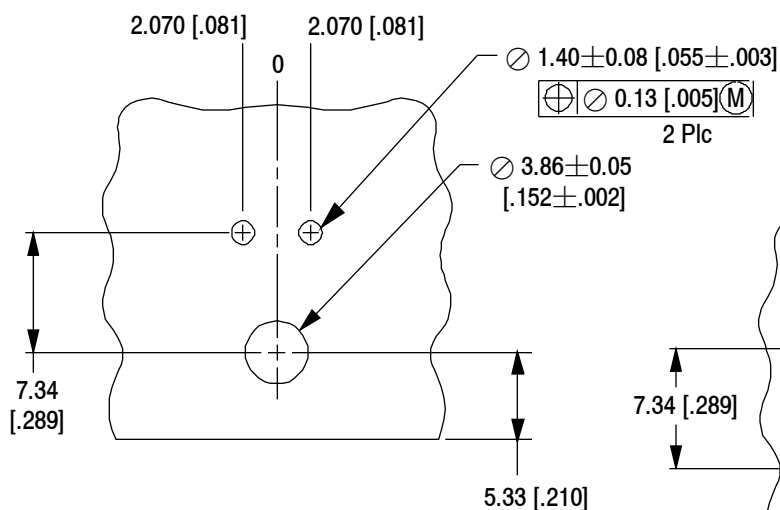


14-, 16-, 18-, 20-, 22-, and 24-Circuit, Dual Row

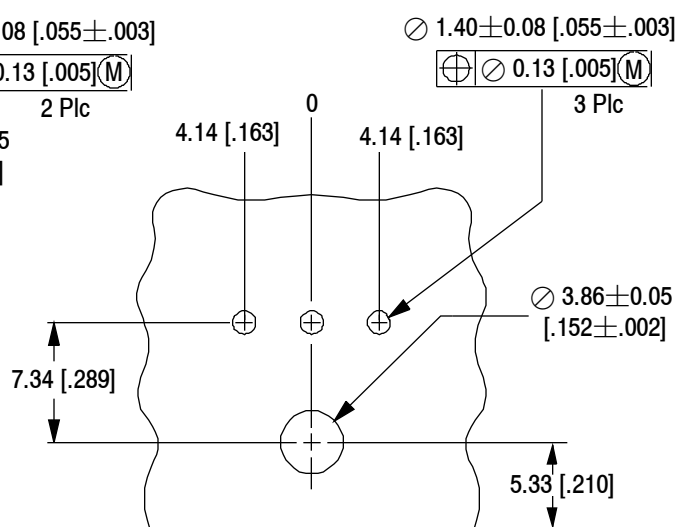


### Right-Angle Pin Header

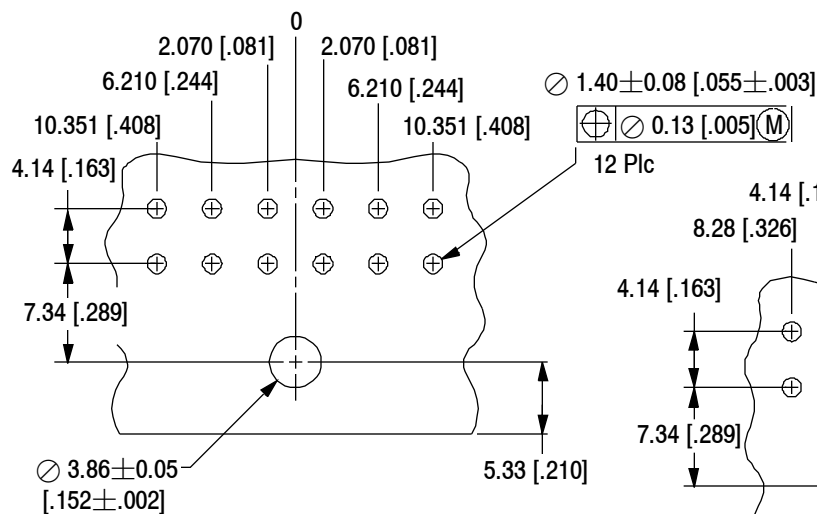
2-Circuit



3-Circuit



4-, 8-, and 12-Circuit



6- and 10-Circuit

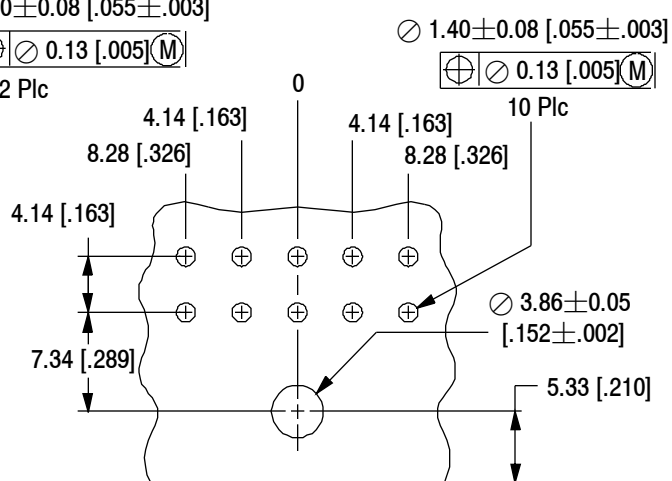
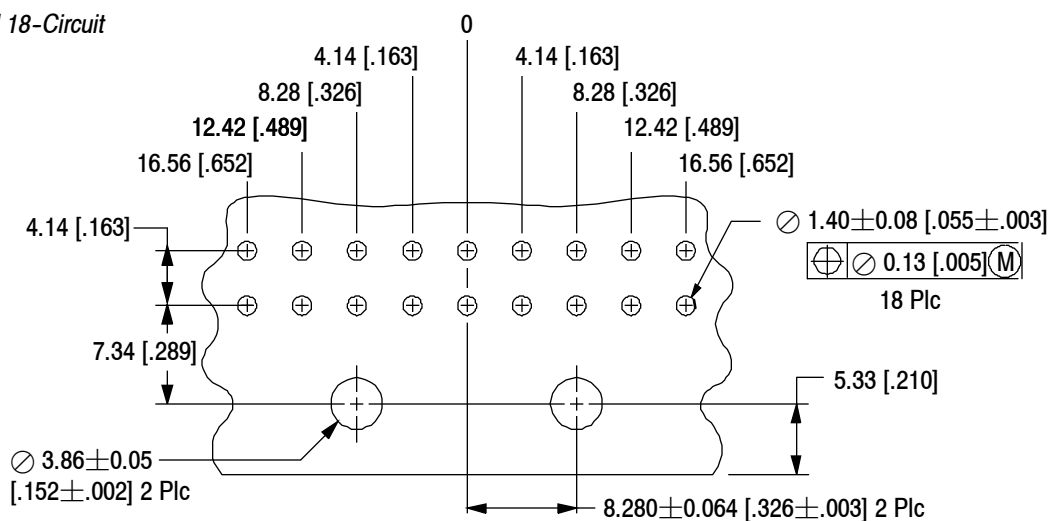
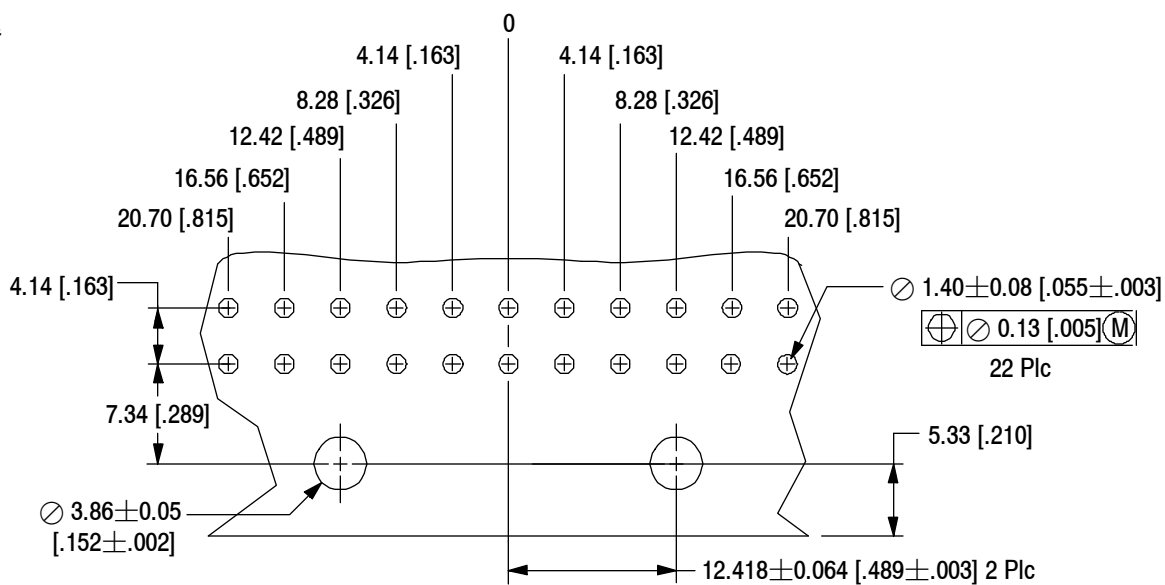


Figure 5 (Cont'd)

14- and 18-Circuit



22-Circuit



16-, 20-, and 24-Circuit

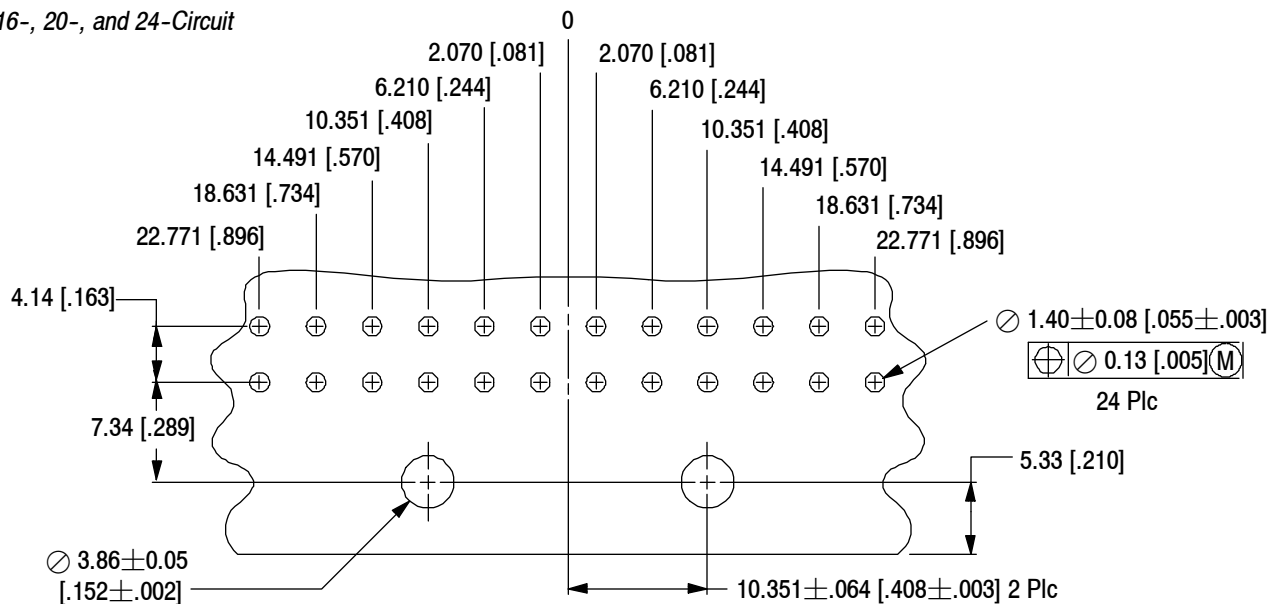


Figure 5 (End)



### 3.6. Soldering

#### A. Flux Selection

The solder tines must be fluxed prior to soldering with a mildly active, rosin base flux. Selection of the flux will depend on the type of pc board and other components mounted on the board. Additionally, the flux must be compatible with the wave solder line, manufacturing, health, and safety requirements. Call the PRODUCT INFORMATION at the number at the bottom of page 1 for consideration of other types of flux. Fluxes that are compatible with these connectors are provided in Figure 6.

| FLUX TYPE | ACTIVITY | RESIDUE       | COMMERCIAL DESIGNATION |       |
|-----------|----------|---------------|------------------------|-------|
|           |          |               | KESTER                 | ALPHA |
| RMA       | Mild     | Non-Corrosive | 186                    | 611   |

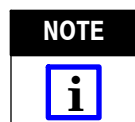
Figure 6

#### B. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. A list of common cleaning solvents and specified time and temperature that will not affect the connectors is given in Figure 7.



*Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Refer to the manufacturer's Material Safety Data Sheet (MSDS) for characteristics and handling of cleaners. Trichloroethylene and Methylene Chloride can be used with no harmful affect to the connectors; however Tyco Electronics does not recommend them because of the harmful occupational and environmental effects. Both are carcinogenic (cancer-causing) and Trichloroethylene is harmful to the earth's ozone layer.*



*For solvents not listed, contact the PRODUCT INFORMATION at the number at the bottom of page 1.*

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

Figure 7

#### C. Drying

When drying cleaned assemblies and pc boards, make certain that temperature limitations of -55 to 105°C [ -67 to 222°F] are not exceeded. Excessive temperatures may cause connector degradation and/or plating deterioration.

#### D. Process

The connectors and pc boards can be soldered using wave soldering techniques. The temperatures and exposure time shall be within the ranges specified in Figure 8.

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

| SOLDERING PROCESS | MAXIMUM WAVE TEMPERATURE |            | TIME<br>(At Max Temperature) |
|-------------------|--------------------------|------------|------------------------------|
|                   | CELSIUS                  | FAHRENHEIT |                              |
| Wave Soldering    | 260                      | 500        | 5 Seconds                    |

Figure 8

### 3.7. Mating and Unmating

#### A. Polarization

The connectors (excluding hermaphroditic) are fully polarized (ribs and slots) to provide proper mating using a positive locking mechanism to prevent accidental disengagement of mated connectors.

#### B. Keying

Keying plugs provide additional polarization for mating connectors. The keying plug may be inserted into the FRONT of the plug housing or cap housing.

#### C. Engagement

The mating connectors must have an identical number of circuit positions. Polarizing features must be properly oriented. The connectors must be inserted straight toward each other until they bottom and the positive locking latch and locking tab engage.

#### D. Disengagement

For panel-mounted and free-hanging connectors, the lock on the plug housing must be pinched and the plug housing must be pulled straight out.

### 3.8. Strain Relief and Wire Dress

If required, wires can be bundled together and supported with cable ties. Wires must not be stretched or confined in any way that would restrict the floating action of the contacts. Therefore, the wires must remain perpendicular to the connector and avoid an excessively sharp bend radius. The minimum distance for the cable tie, measured from the wire end of the connector to the cable tie, must be 76.2 [3.00].

### 3.9. Replacement and Repair

Damaged, worn, or improperly crimped contacts and damaged connectors must not be used. Such components should be removed, discarded, and replaced with new components.

## 4. QUALIFICATION

Mini-Universal MATE-N-LOK connectors are Recognized by Underwriters Laboratories Inc. (UL) under File E28476 and Certified by CSA International under File LR 7189.

## 5. TOOLING

Tooling for crimping, inserting, and extracting contacts is given in Figure 9.

### 5.1. Crimping Contacts

Strip-form contacts are designed to be crimped with a miniature applicator installed in a semi-automatic or automatic machine. Loose-piece contacts are designed to be crimped with a hand crimping tool.

#### NOTE

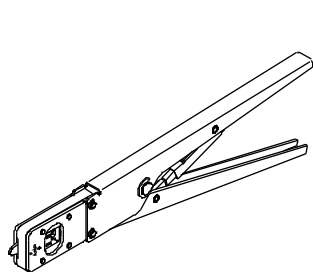


*AMP-O-LECTRIC Model "K" Terminating Machine 565435-5 can be used for terminating the contacts; however, it is no longer being manufactured new. It has been superseded by AMP-O-LECTRIC Model "G" Terminating Machine 354500-1.*

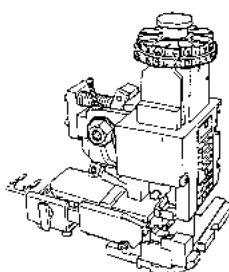
### 5.2. Contact Insertion and Extraction

An insertion tool is not usually required for inserting contacts into housings. However, an insertion tool is available for inserting contacts crimped to small wire or when the wire bundle is too large for hand insertion.

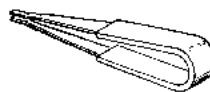
An extraction tool is available for removing both pin and socket contacts from the housings.



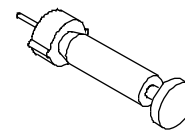
Hand Crimping Tool (Typ)  
(Refer to Table)



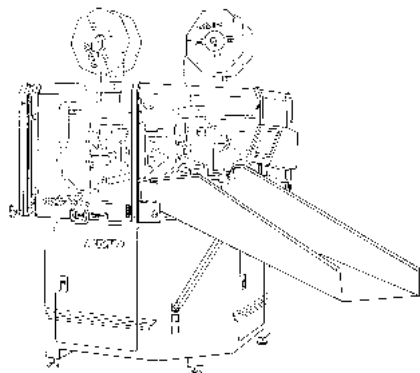
Heavy Duty Miniature Quick  
Change Applicator (Refer to  
Table) (408-8040)



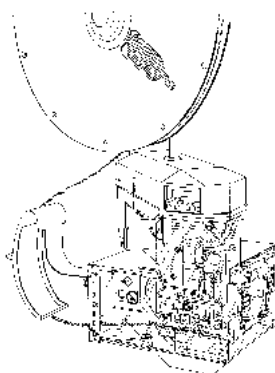
Insertion Tool 91002-1  
(408-7347)



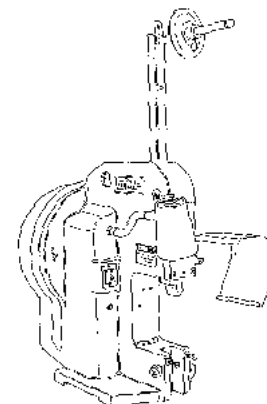
Extraction Tool 189727-1  
(408-4118)



AMPOMATOR CLS Lead-Making  
Machines 122500-[ ] (409-5852) or  
356500-[ ] (409-5878)



AMP-O-LECTRIC Model "G"  
Terminating Machine 354500-[ ]  
(409-5842)



AMP-O-LECTRIC Model "K"  
Terminating Machine 565435-5  
(409-5128)

| WIRE         |                           | APPLICATOR | POWER UNIT                   | HAND CRIMPING TOOL<br>(Instruction Sheet)   |
|--------------|---------------------------|------------|------------------------------|---|
| SIZE (AWG)   | INSULATION DIAMETER       |            |                              |   |
| 30           | 0.88-1.52 [.035-.060]     | 567418-1   | 122500-2, -3 or 356500-1, -2 | 90870-1 (408-9965) or<br>90717-2 (408-4443) |
| 28, 26       | 0.88-1.52 [.035-.060]     | 567418-2   | 354500-1 or 565435-5         |   |
| 26           | 1.20-1.75 [.047-.069]     | 567066-3   | 122500-2, -3 or 356500-1, -2 | 91529-1 (408-8547)                          |
| 24, 22       | 1.20-1.75 [.047-.069]     | 567066-4   | 354500-1 or 565435-5         |   |
| 22, 20       | 1.50-2.79 [.059-.110]     | 567067-1   | 122500-2, -3 or 356500-1, -2 | 91522-1 (408-8547)                          |
| 18           | 1.50-2.79 [.059-.110]     | 567067-2   | 354500-1 or 565435-5         |   |
| 22 (2 Wires) | 1.70 [.067] Max (2 Wires) |            |                              |   |
| 20, 18       | 2.00-3.20 [.079-.126]     | 567251-2   | 354500-1 or 565435-5         | 91536-1 (408-8547)                          |
| 16           | 2.00-3.20 [.079-.126]     | 567251-3   | 354500-[ ]                   |   |
| 20 (2 Wires) | 1.91 [.075] Max (2 Wires) |            |                              |   |

Figure 9

## 6. VISUAL AID

The illustration below shows a typical application of Mini-Universal MATE-N-LOK connectors. 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.

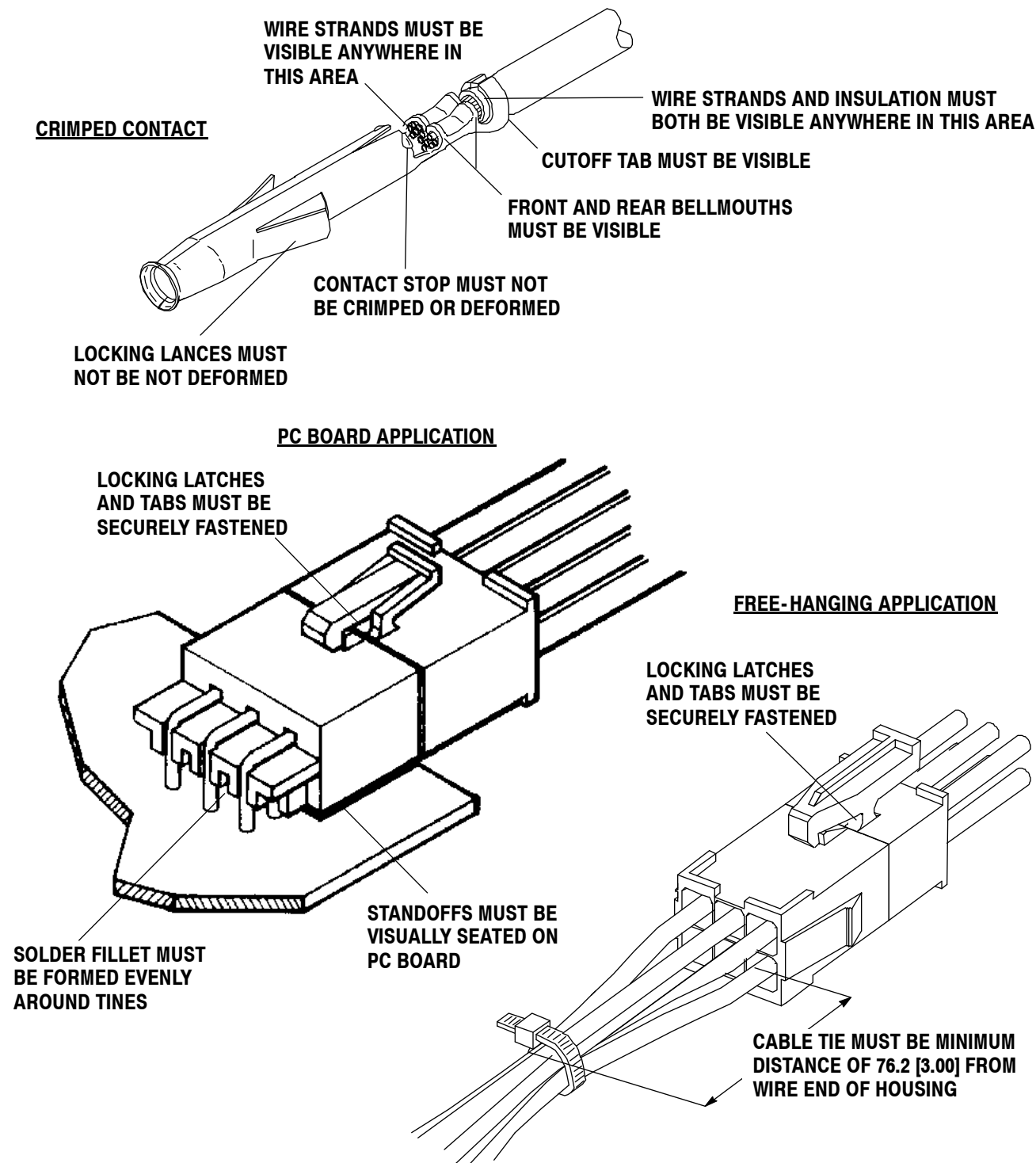


FIGURE 10. VISUAL AID