

**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  $\pm 0.13$  [.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.

Housings are available in 1-, 2-, and 3-circuit positions for free-hanging applications only and 2-, 3-, 4-, 6-, 9-, 12-, and 15-circuit positions for panel mounting or free-hanging applications. Hermaphroditic housings are available in 2-, 3-, and 4-circuit configurations for free-hanging applications. Vertical pc board pin headers are available in 2-, 3-, 4-, 6-, 8-, 9-, 10-, 12-, 14-, 15-, 16-, 18-, 20-, 22-, and 24-circuit configurations.

Right-angle pc board pin headers are available in 2-, 3-, 4-, 6-, 8-, 10-, 12-, 14-, 16-, 18-, 20-, 22-, and 24-circuit configurations. Vertical pc board Blind Mate headers are available in 4-, 6-, 8-, 9-, 10-, 12-, and 15-circuit configurations.

When corresponding with Tyco Electronics personnel, use the terminology provided on this specification to help facilitate your inquiry for information. Basic terms and features of components are provided in Figure 1.

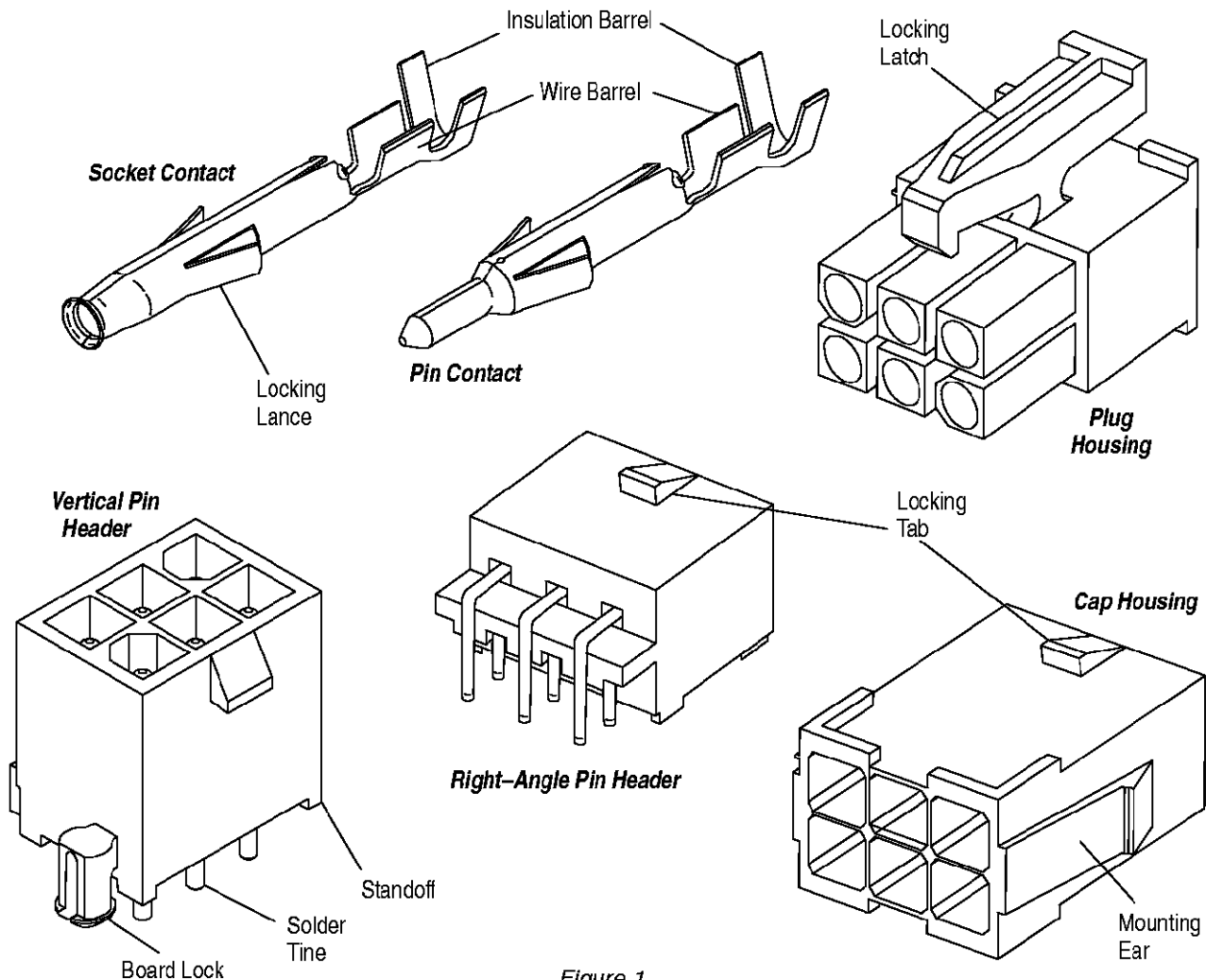


Figure 1

## 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:

Per EC 0990-0665-02:

- Updated document to corporate requirements
- Added new instruction sheet 408-8547 to Paragraph 2.4 and deleted 408-4149
- Changed insulation diameter, wire barrel crimp height, wire barrel crimp width, and insulation barrel crimp width for applicators and hand tools in Figure 3
- Deleted superseded hand tool 90711-2 and replaced it with 91522-1 in Figure 9

### 2.2. Customer Assistance

Reference base part number 770166 and product code 1311 are representative numbers 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 Tyco Electronics Representative (Field Sales Engineer, Field Applications Engineer, etc.) or, after purchase, by calling the Tooling Assistance Center or the AMP FAX/Product Information number at the bottom of page 1.

### 2.3. Drawings

Customer Drawings for specific products are available from the responsible Tyco Electronics Engineering Department via the service network. The information contained in the Customer Drawings takes priority if there is a conflict with this specification or with any other technical documentation supplied by Tyco Electronics.

### 2.4. Instructional Material

Design Objective 108-5138 provides expected product performance for Mini-Universal MATE-N-LOK Connectors (94V-O) while Design Objective 108-5151 provides expected performance for Mini-Universal MATE-N-LOK Connectors (94V-2).

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

<u>Document Number</u>	<u>Document Title</u>
408-3234	Mini-Universal MATE-N-LOK Connectors
408-4118	Extraction Tool 189727-1
408-4137	Straight Action Hand Tool 90707-1
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
408-9965	PRO-CRIMPER* II Hand Crimping Tool 90870-1
409-5128	AMP-O-ELECTRIC* Model "K" Terminating Machine
409-5842	AMP-O-ELECTRIC Model "G" Terminating Machine 354500-[ ]
409-5852	AMPOMATOR* CLS III-G Lead-Making Machine 122500-[ ]
409-5878	AMPOMATOR CLS IV+ Lead-Making Machine 356500-[ ]

### 2.5. Manuals

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. Panel Mount Layout

Figure 2 provides the dimensions required for panel mounting the connectors.

NO. OF CKTS	PANEL THICKNESS MAX.	DIMENSIONS			
		A	B	C	D
2	0.79-2.01 [.031-.079]	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 2

### 3.2. Wire Selection and Preparation

Contacts are available for the wire sizes specified in the table in Figure 3. Insulation shall be stripped for a length of 3.20 to 3.71 mm [.126 to .146 in.] for one-wire crimping and 3.50 to 3.99 mm [.138 to .157 in.] for two-wire crimping. Reasonable care shall be taken not to nick, scrape, or cut any strands during the stripping operation.

### 3.3. Contact Crimping

Contacts accept stranded wire only. Strip form contacts are designed to be crimped with a miniature applicator in a semi-automatic or automatic machine. Loose piece contacts are designed to be crimped with a hand crimping tool. Refer to the table in Figure 9 for the appropriate hand tools and applicators. Refer to Paragraph 2.4, Instructional Material, for information on crimping procedures.

### 3.4. Crimp Requirements

**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. See Section 5, TOOLING.

AUTOMATIC MACHINE WIRE CRIMP DIMENSION				
WIRE (Stranded Only)		WIRE BARREL CRIMP		INSULATION BARREL CRIMP WIDTH (REF)
SIZE (AWG)	INSULATION DIAMETER	HEIGHT ±.05 [.002]	WIDTH	
30	.88-1.27 [.035-.050]	0.50 [.020]	1.06 [.042]	1.78 [.070]
28		0.55 [.022]		
26		0.60 [.024]		
26	1.20-1.75 [.047-.069]	0.63 [.025]●	1.22 [.048]	2.03 [.080]
24		0.69 [.027]		
22		0.78 [.031]		
22	1.50-2.79 [.059-.110]	0.81 [.032]	1.57 [.062]	2.79 [.110]
20		0.91 [.036]		
18		1.07 [.042]		
22 (x 2)	1.70 [.067] (x 2) Max.	0.91 [.036]		
20	2.0-3.20 [.079-.126]	1.07 [.042]	1.78 [.070]	3.56 [.140]
18		1.21 [.048]		
16		1.30 [.051]		
20 (x 2)	1.91 [.075] (x 2) Max.	1.30 [.051]		

●When crimping tin-coated 26 AWG wire (0.15 mm [.006 in.] dia., 7-strands) control crimp height to +0.03/-0.05 mm [+0.001/-0.002 in.].

Figure 3 (cont'd)

**HAND TOOL WIRE CRIMP DIMENSIONS**

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

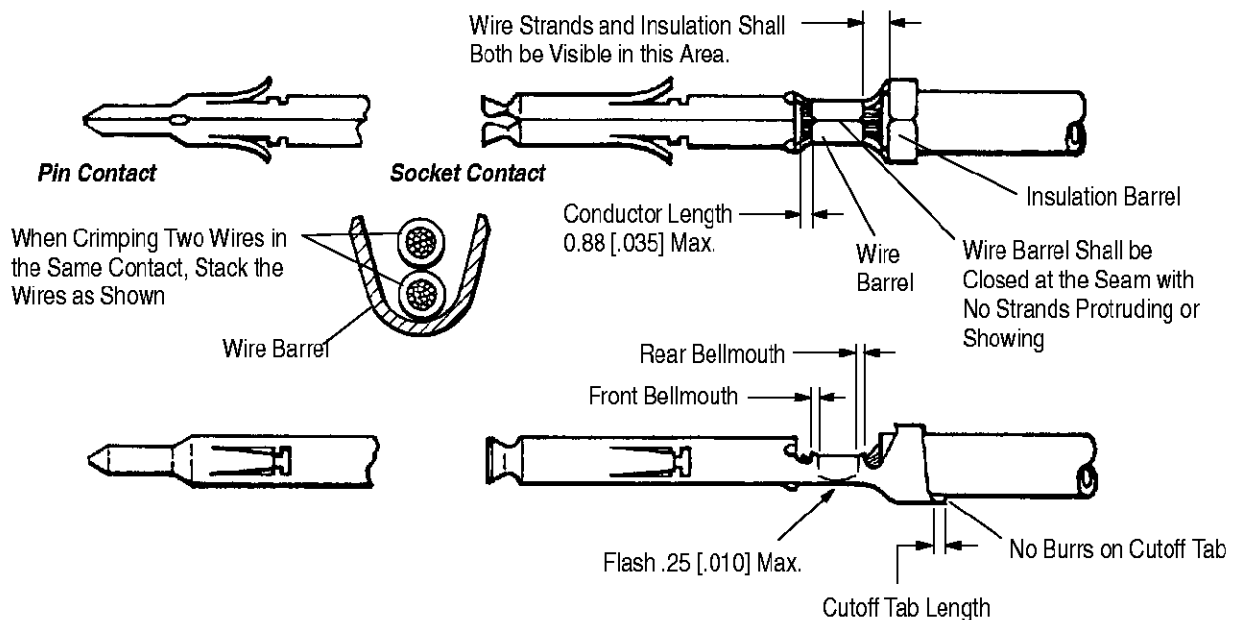


Figure 3 (end)

**A. Carrier Cutoff**

The carrier cutoff tab length shall not exceed 0.50 mm [.020 in.] as shown in Figure 3.

**B. Crimp Height**

The wire barrel and insulation barrel crimp height and width information is found in the table in Figure 3.

**C. 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.

**D. Rear Bellmouth**

The rear bellmouth shall be 0.10 to 0.51 mm [.004 to .020 in.] for contact crimped by applicator and 0.10 mm [.004 in.] minimum for those crimped by hand tool.

**E. Conductor Location**

The end of the conductor shall be flush with the front end of the wire barrel or protrude 0.89 mm [.035 in.] maximum after crimping.

**F. Locking Lance**

The locking lance shall not be deformed.

**G. Straightness**

The contact, including the cutoff tab, shall not be bent above or below the datum line more than the amount shown in Figure 4.

**H. Twist and Roll**

There shall be no twist or roll in crimped portion that will impair usage of the contact. See Figure 4.

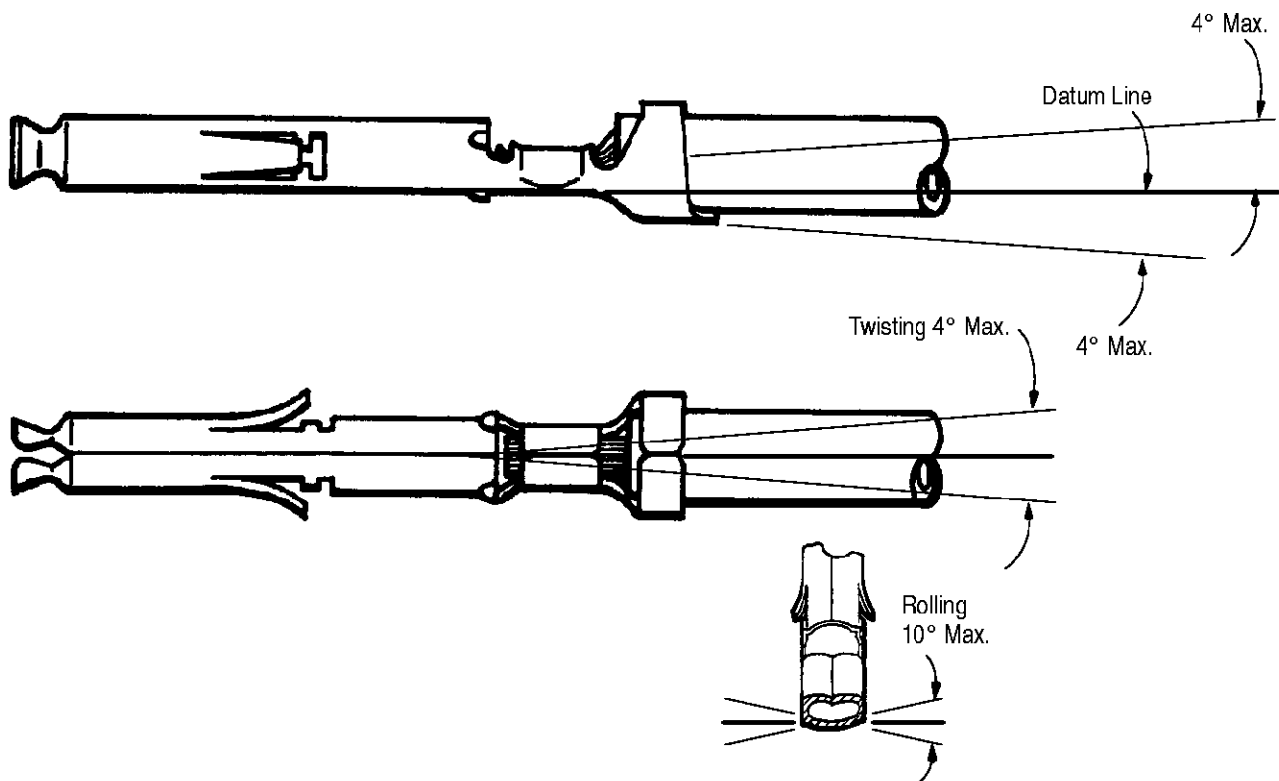


Figure 4

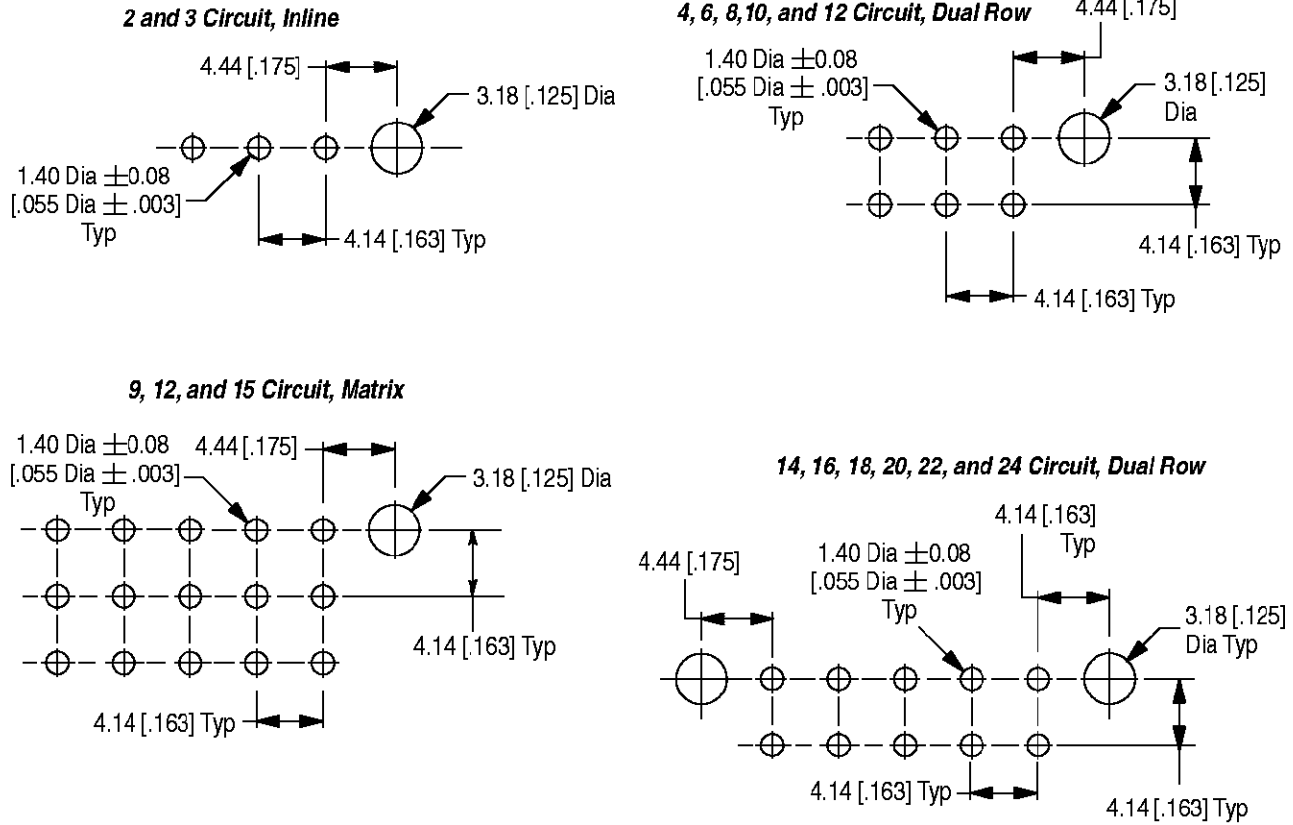
**3.5. Assembly Procedures**

Insert a crimped contact (pin or socket) by aligning it with the desired contact cavity in the BACK (wire side) of the housing. Grasp the wire – directly behind the insulation barrel – and push the contact straight into the cavity until it bottoms (an audible click). Pull back lightly on the wire to be sure the contact is locked in place. Refer to Instruction Sheet 408-3234.

**3.6. PC Board Layout**

The right angle and vertical pin header pc board layout must be precisely located to ensure proper placement and optimum performance. Design the pc board using the dimensions provided in Figure 5. The pc board thickness shall be 1.57 mm [.062 in.]. PC boards of thickness 2.36 mm [.093 in.] can also be used, but the plastic housing boardlock will function only as a press fit.

**Layouts for Vertical PC Board Header Assemblies**



**Layouts for Right-Angle PC Board Header Assemblies**

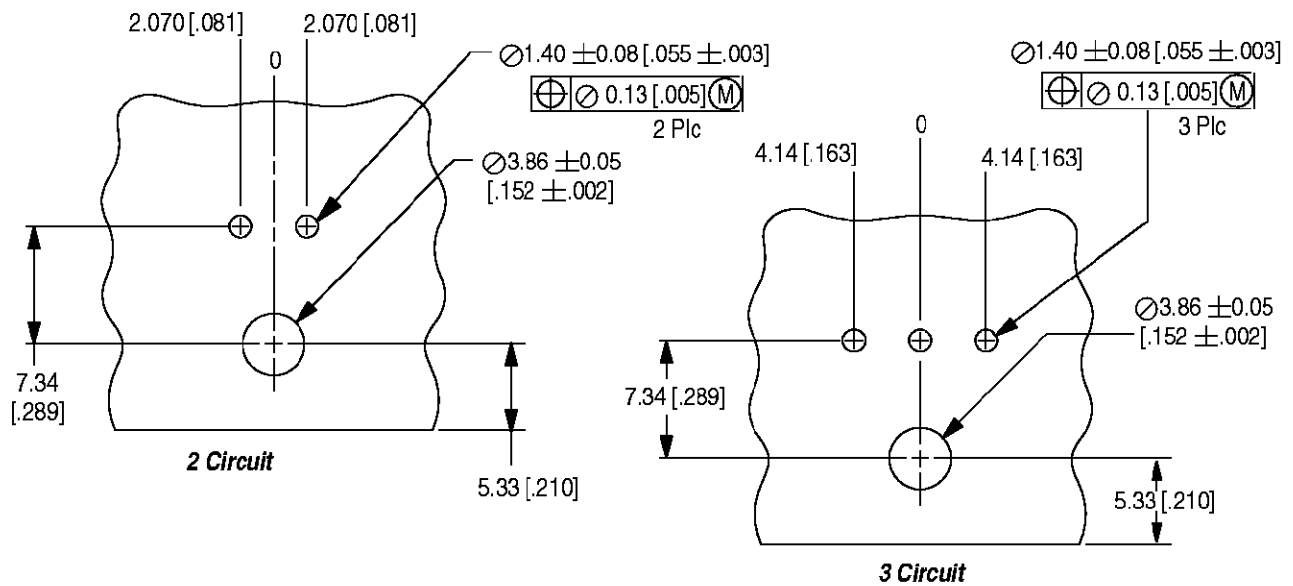


Figure 5 (cont'd)

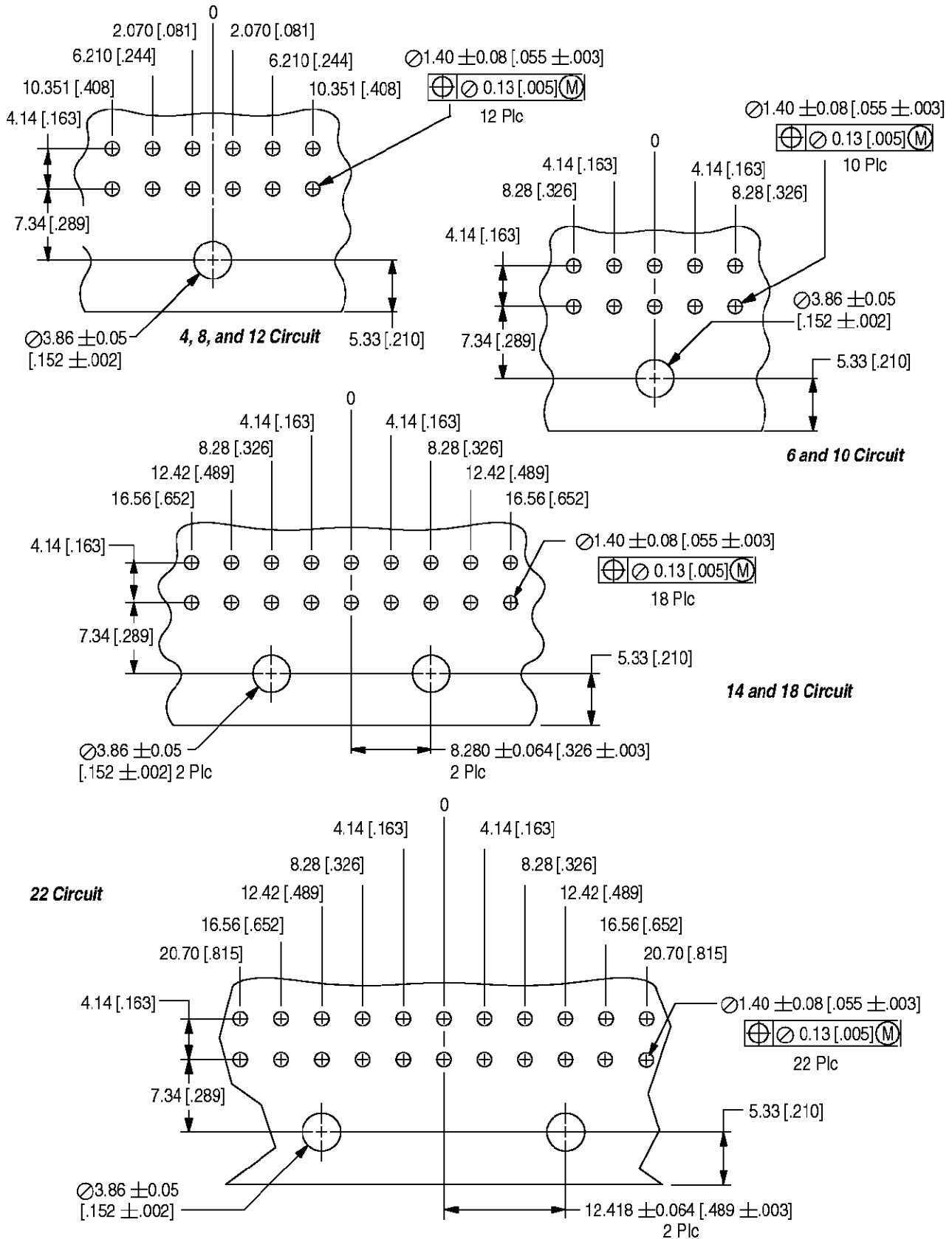


Figure 5 (cont'd)

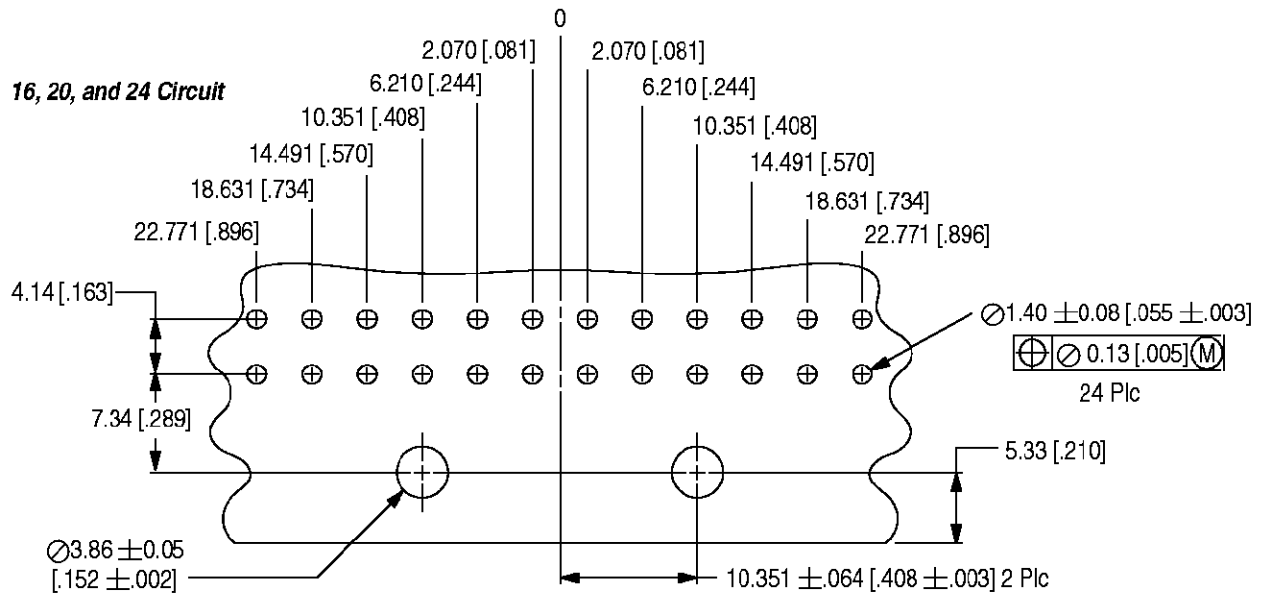


Figure 5 (end)

### 3.7. Soldering

#### A. Flux Selection

Header 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 phone number at the bottom of page 1 for consideration of other types of flux. Some fluxes that are compatible with these connectors are provided in Figure 6.

FLUX TYPE	ACTIVITY	RESIDUE	COMMERCIAL DESIGNATION	
			KESTER <sup>®</sup>	ALPHA <sup>■</sup>
Type RMA (Mildly Activated)	Mild	Noncorrosive	186	611

<sup>®</sup> Product of Kester Solder Co.

<sup>■</sup> Product of Alphametals Inc.

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. The following is a listing of common cleaning solvents that will not affect the connectors for the time and temperature specified. See Figure 7.

**DANGER**

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.

**NOTE**

If you have a particular solvent that is not listed, contact the Tooling Assistance Center or Product Information number at the bottom of page 1.

#### C. Drying

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



CLEANER		TIME (Minutes)	TEMPERATURES (Maximum)	
NAME	TYPE		CELSIUS	FAHRENHEIT
Alpha 2110■	Aqueous	1	132	270
Bioact EC-7◆	Solvent	5	100	212
Butyl Carbitol●	Solvent	1	Room Ambient	
Isopropyl Alcohol	Solvent	5	100	212
Kester 5778⚡	Aqueous	5	100	212
Kester 5779⚡	Aqueous	5	100	212
Loncoterge 520●	Aqueous	5	100	212
Loncoterge 530●	Aqueous	5	100	212
Terpene Solvent	Solvent	5	100	212

■ Product of Fry's Metals, Inc.    ◆ Product of Petroferm, Inc.    ● Product of Union Carbide Corp.    ⚡ Product of Litton Systems, Inc.

Figure 7

**D. Soldering Guidelines**

Mini-Universal MATE-N-LOK headers and pc boards can be soldered using wave soldering techniques. Refer to Manual 402-40. The temperatures and exposure time shall be within the ranges specified in Figure 8.

SOLDERING PROCESS	TEMPERATURE		TIME (At Max Temperature)
	CELSIUS	FAHRENHEIT	
WAVE SOLDERING	260⚡	500⚡	5 Seconds

⚡Wave temperature

Figure 8

**3.8. Polarization, Keying, Engagement, and Disengagement**

**A. Polarization**

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

**B. Keying**

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

**C. Engagement**

The plug and cap must have an identical number of circuit positions. Polarizing features must be properly oriented. Insert cap connector straight toward plug connector until it bottoms and the positive locking latch and locking tab engage. The same technique can be used for the header-plug assembly.

**D. Disengagement**

For panel-mounted and free-hanging assemblies, pinch the lock on the plug housing and pull straight out.

**3.9. 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, is shown in Figure 10.

**3.10. Repair/Replacement**

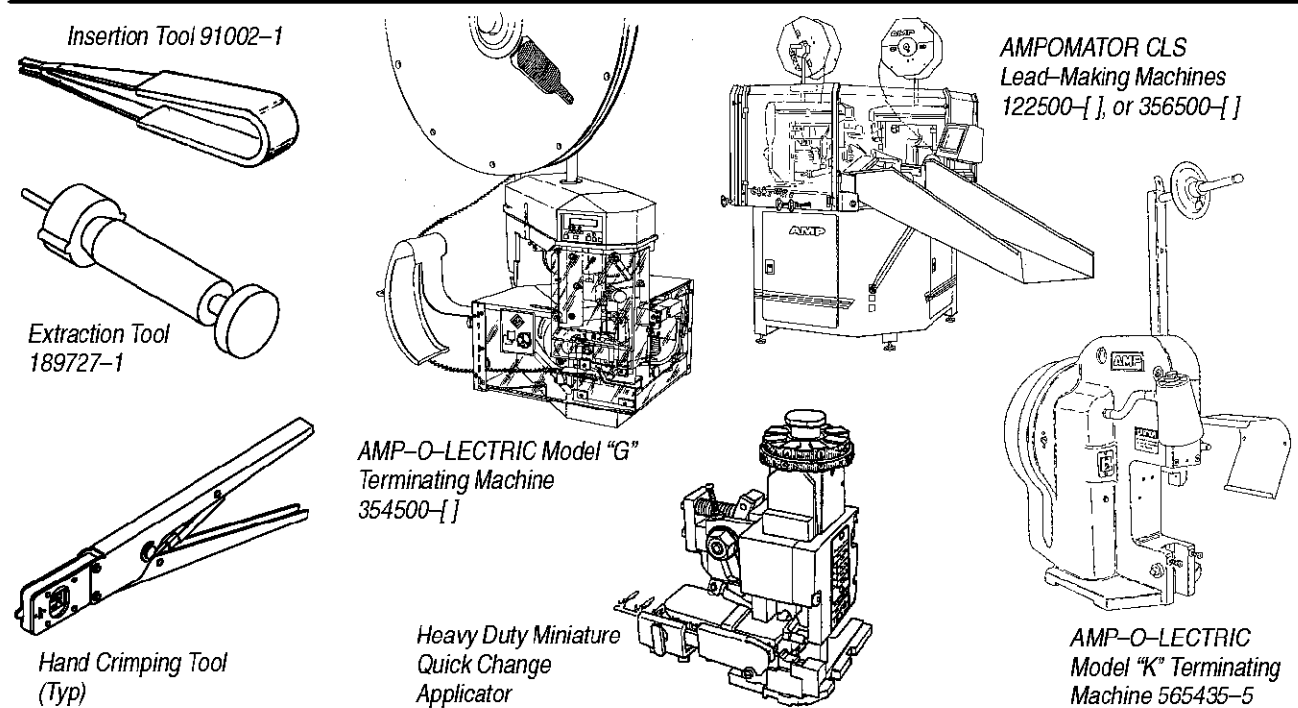
Damaged, worn, or improperly crimped contacts and damaged housings must not be used. Such components should be removed, discarded, and replaced with new components.

**4. QUALIFICATIONS**

Mini-Universal MATE-N-LOK Connectors are recognized by Underwriters Laboratories Inc. under UL File number E28476 and certified by Canadian Standards Association under CSA File number LR7189.

**5. TOOLING** (Figure 9)

An insertion tool is not usually required for inserting contacts into housings. However, Insertion Tool 91002-1 (408-7347) is available for inserting contacts crimped to small wire or when the wire bundle is too large for hand insertion. Extraction Tool 189727-1 (408-4118) is designed for removing both pin and socket contacts from the connectors.

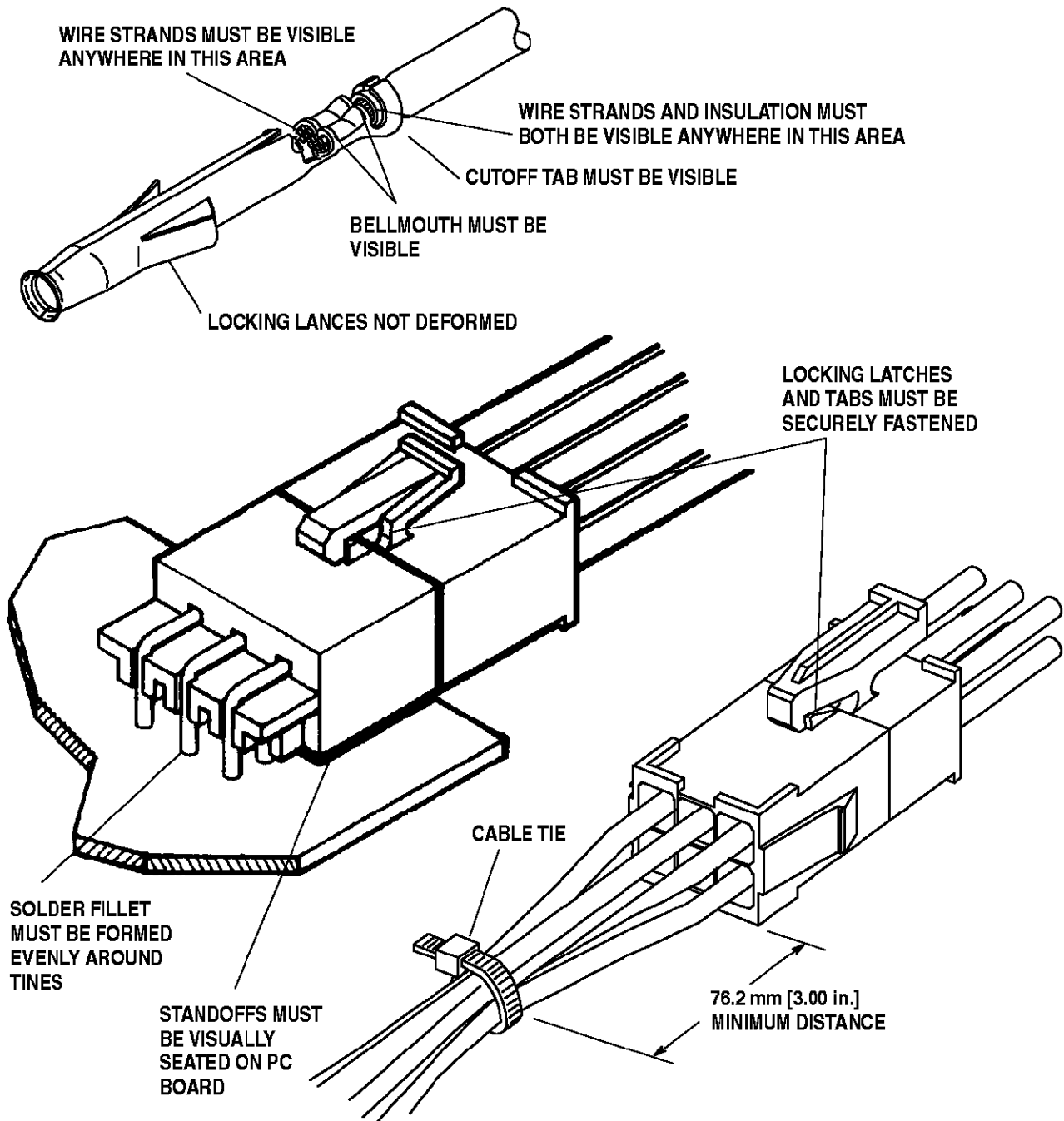


WIRE		APPLICATOR (408-8040)	POWER UNIT (DOCUMENT)	HAND TOOL (DOCUMENT)
SIZE (AWG)	INSULATION DIAMETER			
30	0.88-1.52 [.035-.060]	567418-1	122500-2, -3 (409-5852) 356500-1, -2 (409-5878)	90870-1 (408-9965) or 90717-2 (408-4443)
28		567418-2	354500-1 (409-5842)	90710-2 (408-4148)
26			565435-5 (409-5128)	
26	1.20-1.75 [.047-.069]	567066-3	122500-2, -3 (409-5852) 356500-1, -2 (409-5878)	90710-2 (408-4148)
24		567066-4	354500-1 (409-5842)	
22			565435-5 (409-5128)	
22	1.50-2.79 [.059-.110]	567067-1	122500-2, -3 (409-5852) 356500-1, -2 (409-5878)	91522-1 (408-8547)
20		567067-2	354500-1 (409-5842)	
18			565435-5 (409-5128)	
22 (X2)	1.70 [.067] (x 2) Max.			
20	2.00-3.20 [.079-.126]	567251-2	354500-1 (409-5842) 565435-5 (409-5128)	90707-1 (408-4137)
18		567251-3	354500-1 (409-5842)	
16			354500-[] (409-5842)	
20 (X2)	1.91 [.075] (x 2) Max.			

Figure 9

**6. VISUAL AID**

Figure 10 provides illustrations which are to be used by production personnel to ensure properly applied product. The views suggest requirements for good applications. Applications considered visually incorrect should be inspected using the information in the main body of this document.



**FIGURE 10. VISUAL AID**