

**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 Universal MATE-N-LOK housings, contacts, and printed circuit (pc) board headers. The housings are available in 1- through 15-circuit versions and are intended for use in wire-to-wire (panel mounted or free hanging) or wire-to-board applications. The vertical pin and socket headers are available in 2- through 15-circuit versions and are intended for board-to-wire applications. The right-angle pin and socket headers are available in 2- through 8-circuit in-line versions and are intended for board-to-wire applications.

When corresponding with Tyco Electronics 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.

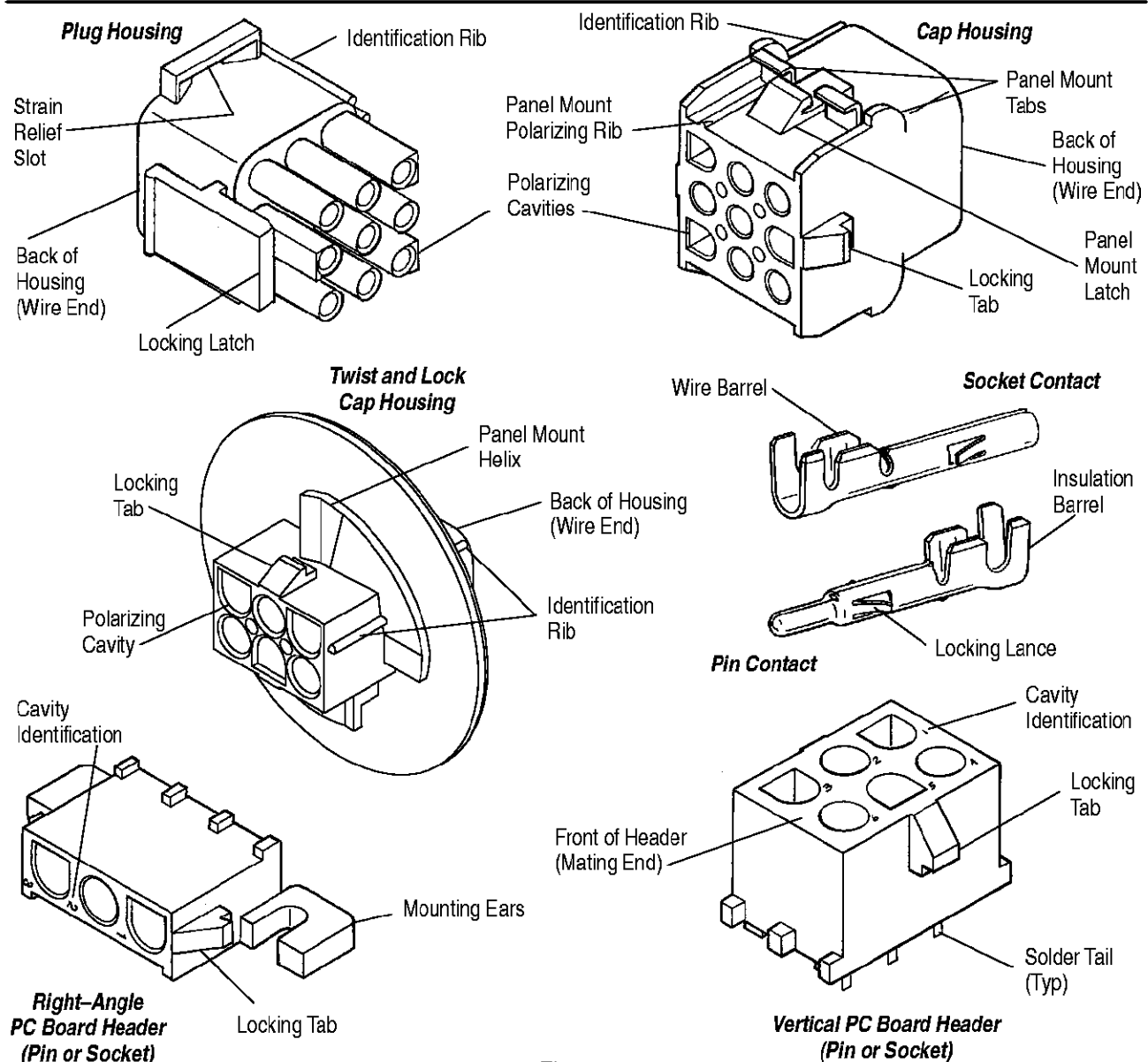


Figure 1

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

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 0990–0399–03

- Updated document to corporate requirements
- Added text to note in Paragraph 3.2.A

### 2.2. Customer Assistance

Reference Base Part Number 480702 and Product Code 1318 are representative numbers of the Universal MATE–N–LOK product line. Use of these numbers will identify the product line and expedite your inquiries through a Tyco Electronics service network established to help you obtain product and tooling information. Such information can be obtained through a local Tyco Electronics Representative (Field Service Engineer, Field Applications Engineer, etc.) or, after purchase, by calling the Product Information Center 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 Drawing takes priority if there is a conflict with this specification or any other technical documentation supplied by Tyco Electronics.

### 2.4. Specifications

Product Specifications 108–1031 (for connectors), and 108–1053 (for headers), provides product performance requirements and test result information.

### 2.5. Instructional Material

The following list includes available instruction sheets (408–series) that provide assembly procedures for product, and 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>
408–2095	Hand Crimping Tool 69710–1
408–3295	Preparing Reel of Contacts for Application Tooling
408–3320	Universal MATE–N–LOK Strain Relief Assembly and Keying Plug
408–4371	Extraction Tool 318851–1
408–6927	Design Recommendations for Printed Circuit (PC) Board Support Fixture
408–7300	MATE–N–LOK Contact and Housing Selection Charts
408–7424	Checking Terminal Crimp Height or Gaging Die Closure
408–7714	Universal MATE–N–LOK Connectors
408–7984	Insertion Tool 455830–1
408–8040	Heavy Duty Miniature Quick–Change Applicators (Side–Feed Type)
408–8053	Conversion Guide for Miniature Quick–Change Applicators
408–8059	General Preventive Maintenance for Applicators
408–8547	CERTI–CRIMP* II Straight Action Hand Tools
408–9433	Crimping Die Assemblies 58380–1 and 58380–2
408–9591	Hand Crimping Tool 58439–1
408–9816	Handling of Reeled Products
409–5128	Basic AMP–O–LECTRIC* Model “K” Terminating Machines and Accessories
409–5842	AMP–O–LECTRIC Model “G” Terminating Machines 354500–[ ]
409–5852	AMPOMATOR* CLS III–G Lead–Making Machine 122500–[ ]
409–5866	AMPOMATOR CLS IV Lead–Making Machine 217500–[ ]
409–5870	Crimp Quality Monitors (CQM) for AMPOMATOR CLS IV Lead–Making Machines
409–5878	AMPOMATOR CLS IV+ Lead–Making Machine 356500–[ ]
409–10016	Entry Level Terminator (ELT) Machine 1338600–[ ]
409–10027	Stripping Modules 1490500 and 1490502
409–10029	Stripping Modules 1490501 and 1490503

**2.6. 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. Storage**

**A. Ultraviolet Light**

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

**B. Reel Storage**

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

**C. Shelf Life**

Each connector is packaged and shipped in an individual antistatic tube container or tape and reel. To prevent damage to the housings and contact solder tines, the connectors should remain in the container until ready for installation. Also, to prevent possible storage contamination and ensure maximum solderability, the connectors should be used on a first in, first out basis.

**D. Chemical Exposure**

Do not store contacts near any of the following chemicals as they may cause stress corrosion.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfides	Nitrites	Tartrates

**NOTE** *Where the above environmental conditions exist, phosphor-bronze contacts are recommended instead of brass if available.*

**3.2. Wire**

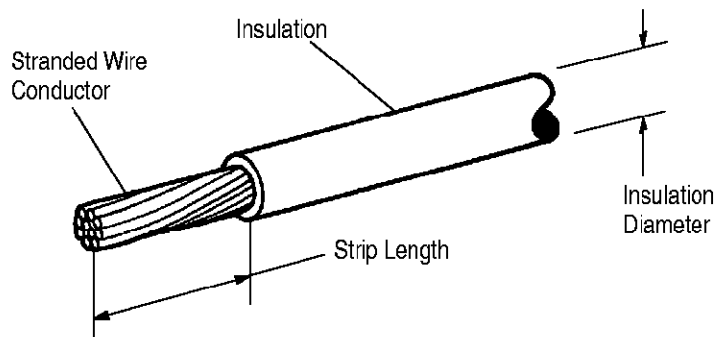
**A. Wire Selection**

The contacts will accept stranded wires ranging in size from 10 to 30 AWG. Wire insulation diameter shall have minimum and maximum dimensions according to the wire sizes indicated in Figure 2. Reasonable care shall be taken during the stripping operation to ensure the conductor is not nicked, scraped, or cut.

**NOTE** *Contacts accept stranded wire only. Not intended for solid wire.*

**B. Wire Preparation**

The wire strip length shall be according to the wire sizes as indicated in Figure 2.



**Note:** Not to Scale

Figure 2 (cont'd)

**AUTOMATIC MACHINE WIRE CRIMP DIMENSIONS**

WIRE			WIRE BARREL		INSULATION BARREL CRIMP WIDTH
SIZE (AWG)	INSULATION DIAMETER RANGE	STRIP LENGTH ±0.38 [.015]	CRIMP HEIGHT ±0.05 [.002]	CRIMP WIDTH	
30	0.81 to 1.45 [.032 to .057]	4.06 [.160]	0.71 [.028]	1.40 [.055]	2.29 [.090]
28			0.71 [.028]		
26			0.76 [.030]		
24	1.02 to 2.54 [.040 to .100]	4.37 [.172]	0.96 [.038]	1.78 [.070]	2.54‡ [.100]
22			1.02 [.040]		
20			1.09 [.043]		
18			1.22 [.048]		
20	1.52 to 3.30 [.060 to .130]	4.37 [.172]	1.19 [.047]	2.29 [.090]	3.30 [.130]
18			1.32 [.052]		
16			1.50 [.059]		
14			1.75 [.069]		
20	3.30 to 5.08 [.130 to .200]	4.37 [.172]	1.19 [.047]	2.29 [.090]	5.08 [.200]
18			1.32 [.052]		
16			1.50 [.059]		
14			1.75 [.069]		
2 @ 18			1.60 [.063]		
18	3.30 to 5.08 [.130 to .200]	4.37 [.172]	1.50 [.059]	2.29 [.090]	5.08 [.200]
16			1.68 [.066]		
14			1.93 [.076]		
12	5.08 [.200] Max.	6.76 [.266]	1.96 [.077]	3.56 [.140]	—
10			2.41 [.095]		

**HAND TOOL WIRE CRIMP DIMENSIONS**

WIRE			WIRE BARREL		INSULATION BARREL CRIMP WIDTH
SIZE (AWG)	INSULATION DIAMETER RANGE	STRIP LENGTH ±0.38 [.015]	CRIMP HEIGHT ±0.05 [.002]	CRIMP WIDTH	
30	0.81 to 1.45 [.032 to .057]	4.06 [.160]	0.71 [.028]	1.40 [.055]	2.29 [.090]
28			0.71 [.028]		
26			0.71 [.028]		
24	1.02 to 2.54 [.040 to .100]	4.37 [.172]	1.02 [.040]	1.78 [.070]	2.54 [.100]
22			1.02 [.040]		
20			1.17 [.046]		
18			1.17 [.046]		

‡For part numbers 770210-1 and 770211-1, insulation barrel crimp width should be 3.30 [.130].

Figure 2 (cont'd)

HAND TOOL WIRE CRIMP DIMENSIONS					
SIZE (AWG)	WIRE		WIRE BARREL		INSULATION BARREL CRIMP WIDTH
	INSULATION DIAMETER RANGE	STRIP LENGTH $\pm 0.38$ [.015]	CRIMP HEIGHT $\pm 0.05$ [.002]	CRIMP WIDTH	
20	1.52 to 3.30 [.060 to .130]	4.37 [.172]	1.27 [.050]	2.29 [.090]	3.30 [.130]
18			1.27 [.050]		
16			1.60 [.063]		
14			1.60 [.063]		
20	3.30 to 5.08 [.130 to .200]	4.37 [.172]	1.24 [.049]	2.29 [.090]	5.08 [.200]
18			1.24 [.049]		
16			1.60 [.063]		
14			1.60 [.063]		
12	5.08 [.200] Max.	6.76 [.266]	2.11 [.083]	3.56 [.140]	—
10			2.44 [.096]		

Figure 2 (end)

### 3.3. Crimped Contact Requirements

The contact shall be located in desired tooling and crimped according to the instructions packaged with that tooling. See Section 5, TOOLING, of this document for details on tooling options and instructional materials.

**NOTE** Wire insulation shall NOT be cut or broken during the crimping operation, nor shall the insulation be crimped into the contact wire barrel. Reasonable care should be taken by tooling operators to provide undamaged wire terminations.

**NOTE** Wire stripping tool jaws may leave corrugated indentations on the surface of the wire insulation. This is especially severe with cross-linked polyethylene (high temperature) insulation. If these indentations occur at the location of the wire seal, leakage may result. Insulation surface within 8.89 mm from the tip of the contact must be smooth and free of indentations. See Figure 3.

#### A. Wire Barrel Crimp

The crimp applied to the wire portion of the contact is the most compressed area and is most critical in ensuring optimum electrical and mechanical performance of the crimped contact. The contact wire barrel crimp height must be within the dimension provided in Figure 2.

#### B. Effective Crimp Length

For optimum crimp effectiveness, the crimp must be within the area shown in Figure 3 and must meet the crimp dimensions provided in Figure 2. Effective crimp length shall be defined as that portion of the wire barrel, excluding bellmouth(s), fully formed by the crimping tool. Instructions for adjusting, repairing, and inspecting tools are packaged with the tools. See Section 5, TOOLING.

#### C. Bellmouths

Front and rear bellmouths shall be evident and conform to the dimensions given in Figure 3.

#### D. Cutoff Tabs

The cutoff tab shall be cut to the dimensions shown in Figure 3.

#### E. Burrs

The cutoff burr shall not exceed the dimensions shown in Figure 3.

#### F. Wire Barrel Flash

The wire barrel flash shall not exceed the dimensions shown in Figure 3, Section X-X.

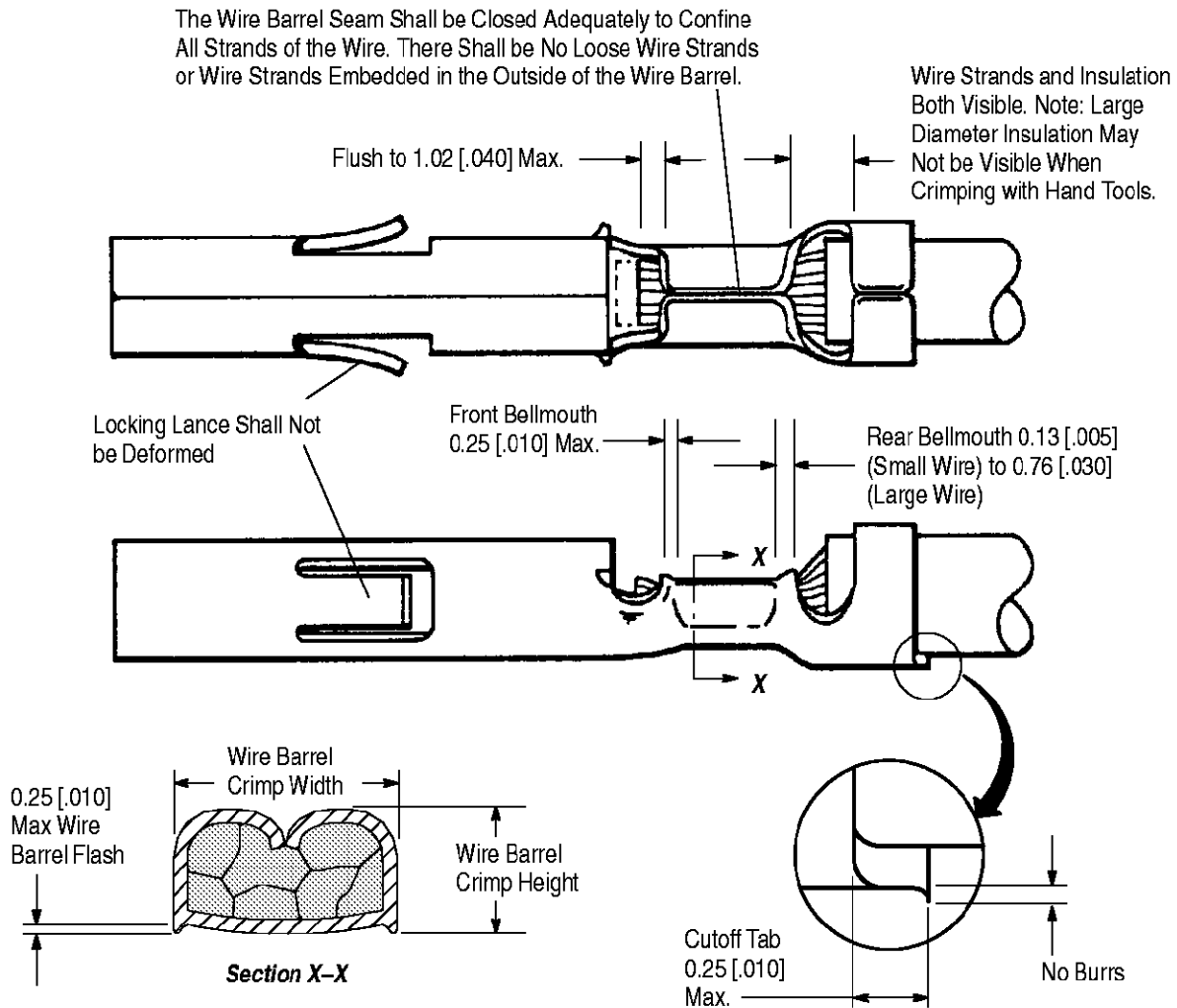


Figure 3

### G. Insulation Barrel Crimp

The insulation barrel shall grip the insulation firmly without cutting into it. Care must be taken to prevent cutting, nicking, or scraping of the insulation. Insulation crimp shall comply to width and height provided in Figure 2.

### H. Wire Location

The wire conductor and insulation must be visible in the transition area between the wire and insulation barrels as shown in Figure 3.

### I. Conductor Extension

The conductor may extend beyond the wire barrel to the maximum shown in Figure 3.

### J. Wire Barrel Seam

The wire barrel seam must be closed with no evidence of loose wire strands visible in the seam as shown in Figure 3.

### K. Twist and Roll

There shall be no twist, roll, deformation or other damage to the mating portion of the crimped contact that will impair usage of the contact. See Figure 4.

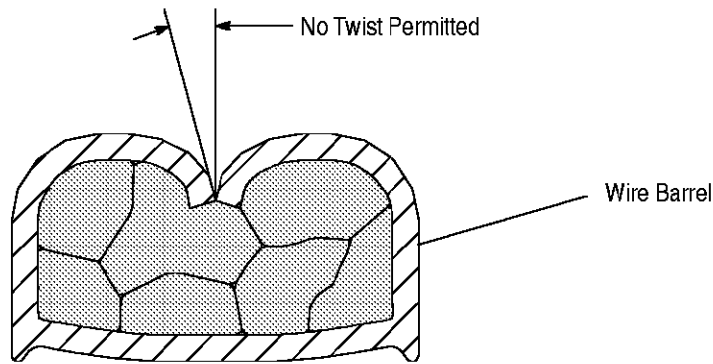


Figure 4

**L. Straightness/Alignment**

The force applied during crimping may cause some bending between the crimped wire barrel and the mating portion of the contact. The axial concentricity of the crimped wire barrel shall fall into an area defined by a 4.19 mm [.165 in.] diameter circle whose center is the centerline of the contact. The axial concentricity of the crimped insulation barrel shall fall into an area defined by a 5.59 mm [.220 in.] diameter circle whose center is the centerline of the contact. Such deformation is acceptable within the limits provided in Figure 5.

**NOTE** *Periodic inspections must be made to ensure crimped contact formation is consistent as shown.*

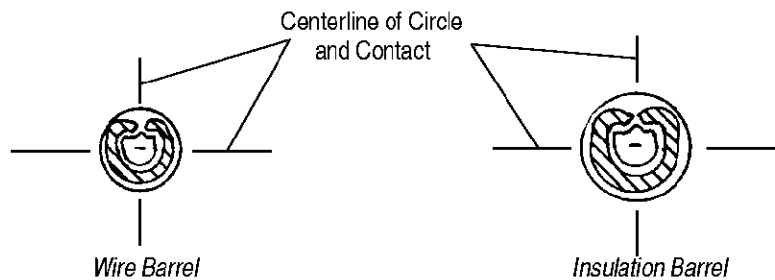


Figure 5

**3.4. Housings**

A connector assembly consists of a plug and a cap connector. A connector consists of a housing (plug or cap) with a specified number of crimp contacts (pin and/or socket). Mating connectors may be a plug and a cap, or a plug and a pc board header, so long as both have an identical number of circuits with a pin contact mating with a socket contact. Both the plug and cap housings have individually numbered cavity identification on the BACK (wire end), plus an identification rib on the SIDE indicating the No. 1 cavity. The housings feature polarizing cavities on the mating end and are intermateable with Universal MATE-N-LOK II connectors. The plug housing has two locking latches and the cap housing has two locking tabs. The housings are designed for free hanging or panel mounting applications (refer to Paragraph 3.8, Panel Cutout).

**A. Assembly**

Crimped pin and socket contacts shall be manually inserted in either the plug or cap housing, or they may be intermixed in each housing to provide multiple keying combinations. See Figure 6.

**NOTE** *Insertion Tool 455830-1 (408-7984) is available for inserting contacts crimped to small wire sizes.*

**B. Disassembly**

Extraction Tool 318851-1 (408-4371) is designed for removing pin and socket contacts from plug and cap housings. See Figure 6.

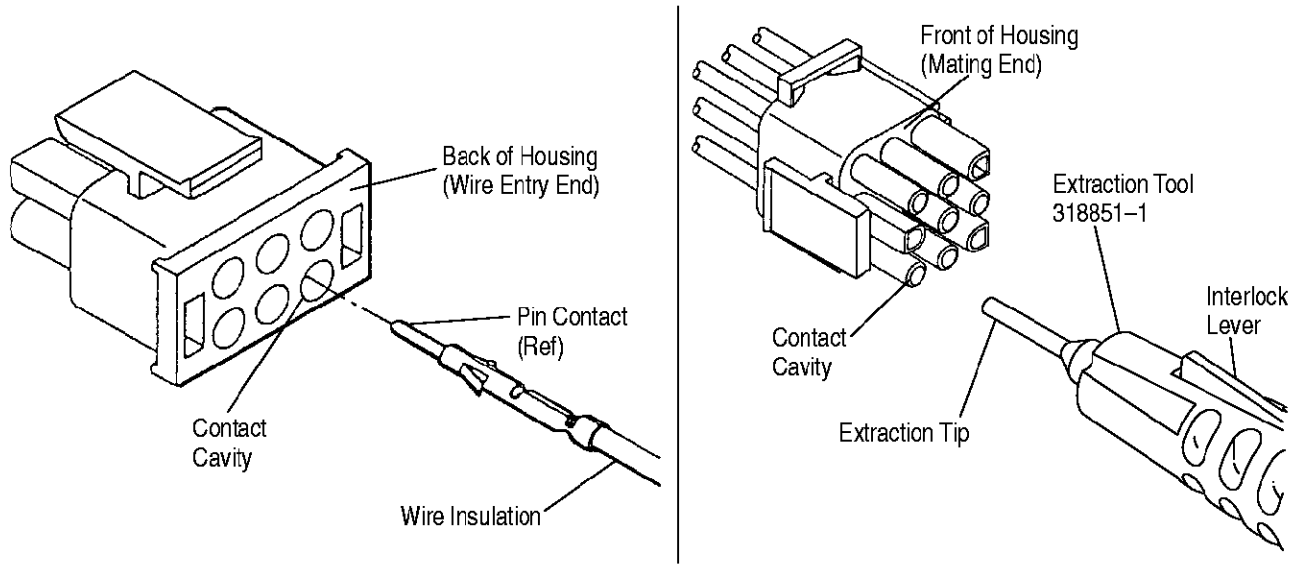


Figure 6

### 3.5. Headers

The pc board headers are supplied preloaded with solder tail pin contacts or solder tail socket contacts. Vertical pin and socket headers are available in 2 through 15 circuits. Right-angle pin and socket headers are available in 2 through 8 circuits. All headers feature individually numbered cavity identification on the FRONT (mating end). The headers also feature polarizing cavities and locking tabs. The headers are designed to be mounted on a pc board (refer to Paragraph 3.9, Printed Circuit Board Layout).

### 3.6. Strain Relief Assembly

The strain relief assembly is designed to relieve the stress of the wires on the contacts. There are two strain relief versions (open and enclosed). The open version is available for 2 through 15 circuit plug housings. The enclosed version is available for 2 through 15 circuit plug or cap housings. The enclosed version features an attached insert for smaller wire bundles. Adapters are required when installing an enclosed strain relief assembly onto a cap housing. Two identical strain reliefs are inserted into slots in the back of the connector (or adapter) and are secured together with two No. 6 pan head self-tapping screws. See Figure 7.

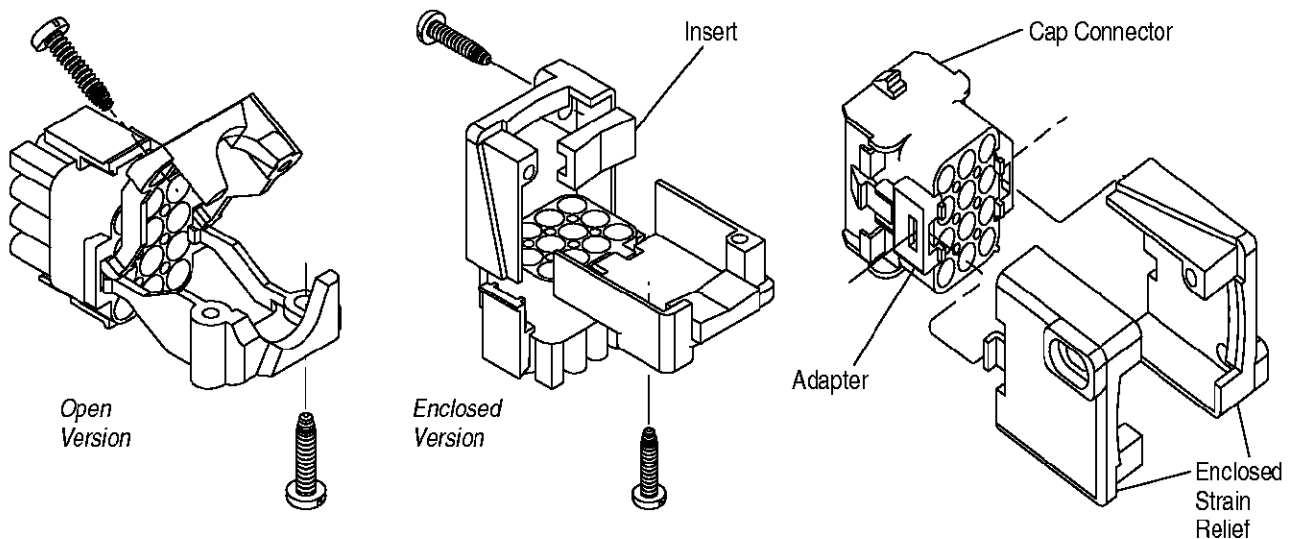


Figure 7



### 3.7. Keying Plugs

Keying plugs provide additional polarization for the connectors. The keying plug may be inserted into the front of the plug or the cap connector. See Figure 8.

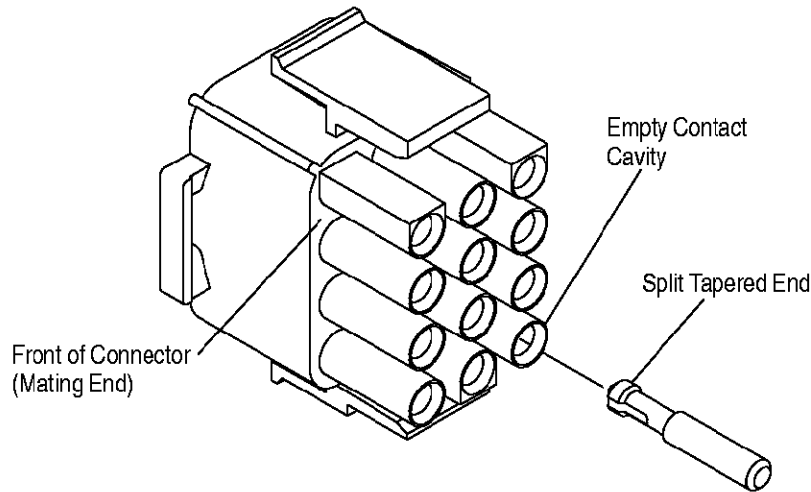


Figure 8

### 3.8. Test Connectors

Plug and cap test connectors mate with respective assembled plug and cap connectors and headers to test the electrical circuit. The test connectors are preloaded with spring loaded contacts that will mate with pin or socket contacts in the connector. The 2.13 mm [.084 in.] dia pin that extends out the BACK of the housing will accept Universal MATE-N-LOK socket contacts. See Figure 9.

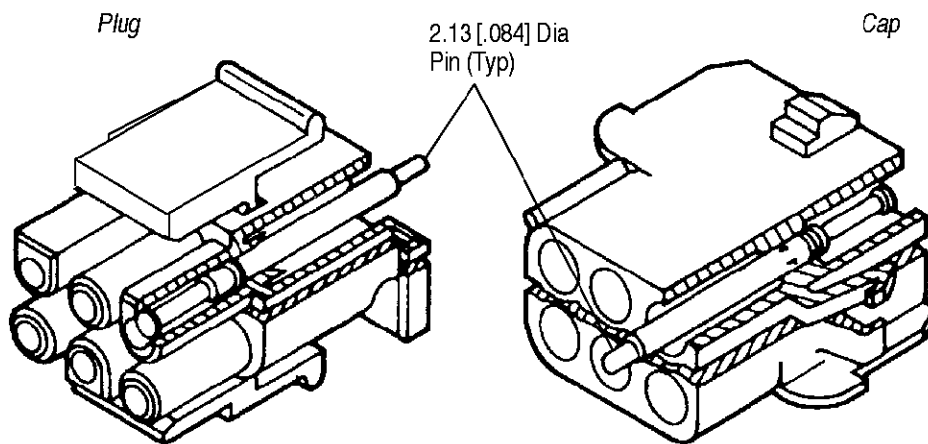


Figure 9

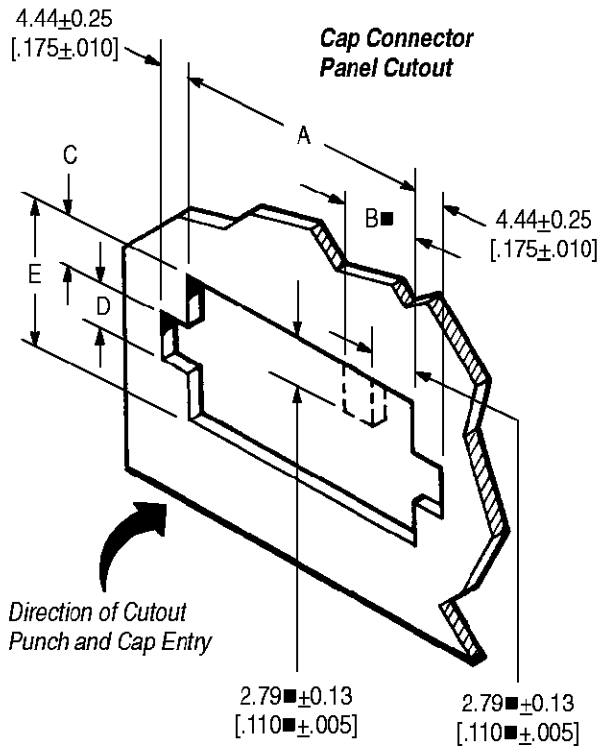
**NOTE**

*Test connectors have a 5 ampere maximum current rating per circuit.*

### 3.9. Panel Cutout

Cap connector panel mounting cutouts shall be as indicated in Figure 10. (No mounting hardware is required.)

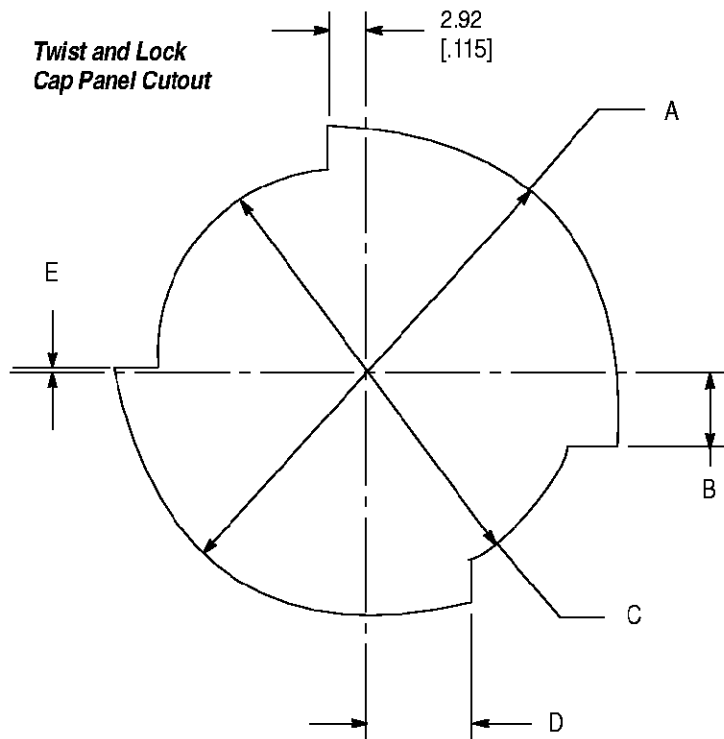
The cap housing features flexible mounting latches for insertion into the panel. Push the cap connector through the panel – in the same direction as the cutout was made – until it snaps in place.



NUMBER OF CIRCUIT POSITIONS	DIMENSIONS				
	A ±0.13 [.005]	B <sup>■</sup> ±0.25 [.010]	C ±0.25 [.010]	D ±0.25 [.010]	E ±0.13 [.005]
2	14.35 [.565]	6.35 [.250]	2.41 [.095]	8.64 [.340]	13.46 [.530]
3	20.70 [.815]				
4	27.05 [1.065]				
6	14.35 [.565]	6.98 [.275]	12.19 [.480]	26.16 [1.030]	
9	20.70 [.815]				
12	27.05 [1.065]				
15	33.40 [1.315]				

■ Optional panel cutout dimensions for cap and panel polarization.

Panel Thickness – .762 [.030] to 2.286 [.090]



DIMENSION	POSITION SIZE	
	6 and 9	12
"A"	34.67 [1.365]	40.13 [1.580]
"B"	4.70 [.185]	6.15 [.242]
"C"	29.08 [1.145]	34.54 [1.360]
"D"	7.37 [.290]	8.08 [.318]
"E"	0.25 [.010]	1.98 [.078]

Figure 10

The Twist and Lock cap housing features a round helix for insertion into the panel. Refer to the panel cutout dimensions as shown in Figure 10.

The Twist and Lock panel cutout is polarized to ensure proper installation of the connector. Align the pin 1 indicator rib with the short side polarization opening of the panel and push the cap connector through the panel. Twist the connector clockwise until firmly seated. The panel thickness may vary between 0.76 and 2.29 mm [.030 and .090 in.]. In order to prevent foam leakage, the maximum amount of “gap” between the connector flange and the panel is 0.25 mm [.010 in.]. Refer to Figure 11.

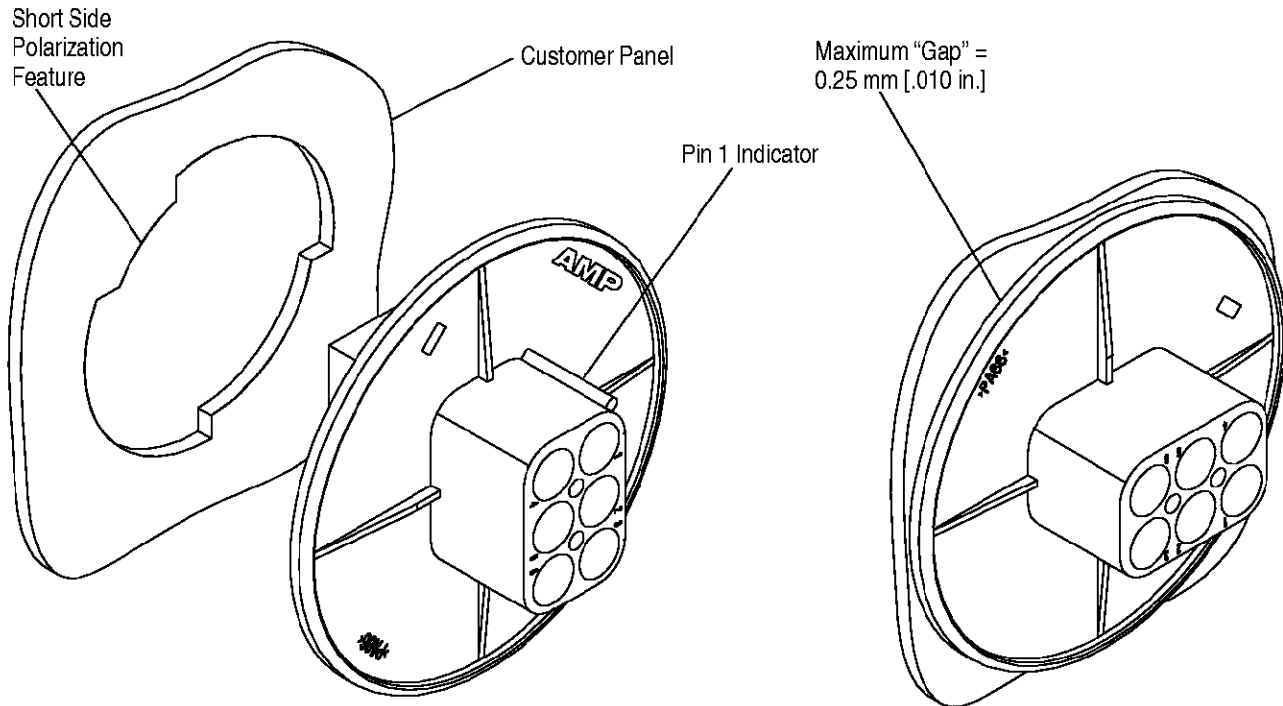


Figure 11

### 3.10. PC Board

#### A. Material and Thickness

1. Board material will be glass epoxy (FR-4, G-10).
2. The connector headers can be installed on pc boards up to 1.57 [.062] thick for standard tails, and 3.18 [.125] for long tails. Board thickness may vary depending upon the application. Contact the Product Information Center or the Tooling Assistance Center number listed at the bottom of page 1 for suitability of other board materials or thicknesses.

#### B. Tolerance

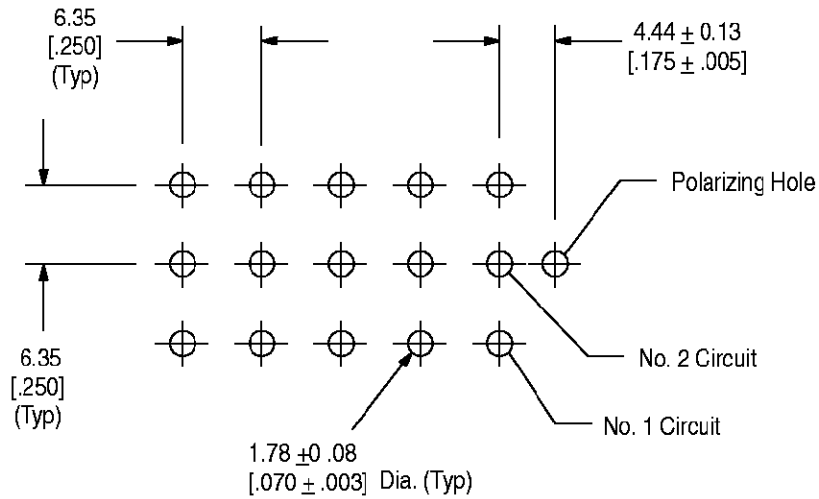
Maximum allowable bow of the pc board shall be 0.25 [.010] over the length of the socket.

#### C. PC Board Layout

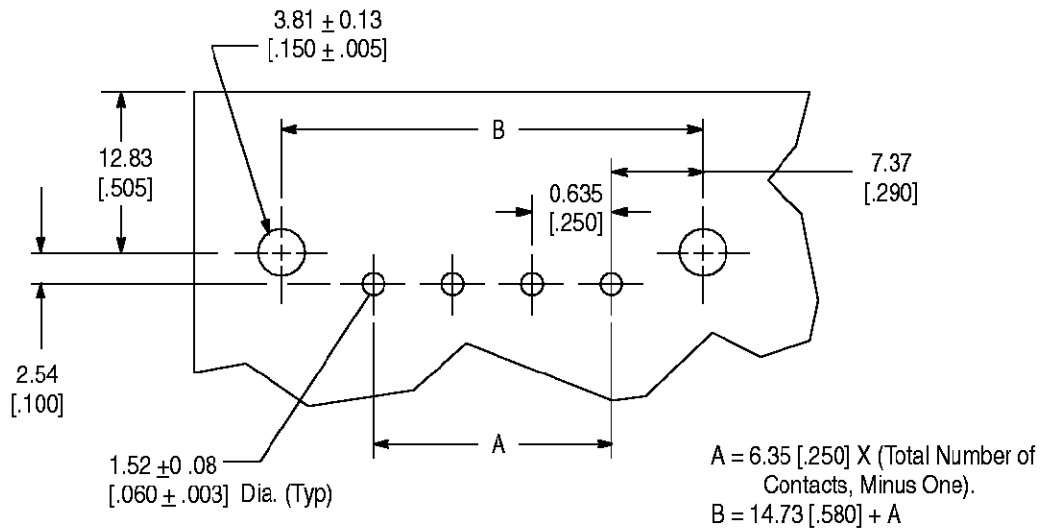
The mounting and contact holes in the pc board must be precisely located to ensure proper placement and optimum performance of the connector header. Design the pc board using the dimensions provided in Figure 12. The layout shows the top (component) side of the board.

**NOTE**

Figure 12 represents a **typical** pc board layout for this product. For dimensions and hole pattern layout for specific product, obtain the appropriate customer drawing through your Tyco Electronics Representative or refer to the telephone numbers at the bottom of page 1.



Vertical PC Board Header Layout (15 Position Ref)



Right-Angle PC Board Header Layout

Figure 12

### 3.11. Contact Hole Configuration

The contact holes in the pc board must be prepared as specified in Figure 13.

**NOTE:** The drilled hole diameter must be sized so that the diameter of the finished hole after plating meets the dimensions as shown.

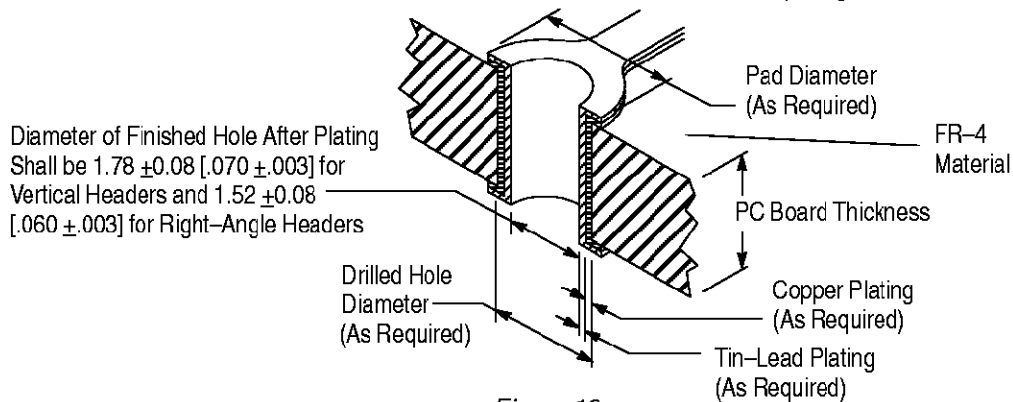


Figure 13

**3.12. Soldering**

**A. Soldering Guidelines**

Universal MATE–N–LOK Connector Headers can be soldered using wave or equivalent soldering techniques. The temperatures and exposure time shall be within the ranges specified in Figure 14. We recommend using SN60 or SN62 solder for these socket assemblies.

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

\*\* Wave Temperature

Figure 14

**NOTE**

Manual 402–40 provides some guidelines for establishing soldering practices. Refer to Paragraph 2.6, Manuals.

**B. Fluxing**

The contact 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 number at the bottom of page 1 for consideration of other types of flux. Some fluxes that are compatible with these sockets are provided in Figure 15.

FLUX TYPE	ACTIVITY	RESIDUE	COMMERCIAL DESIGNATION	
			KESTER	ALPHA
Type RMA (Mildly Activated)	Mild	Noncorrosive	185/197	611
Center (Activated)	Medium	May be Corrosive	1544, 1545, 1547	711, 809, 811

Figure 15

**C. 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 sockets. The sockets will be unaffected by any of these solvents for 5 minutes at room temperature.

Cleaners must be free of dissolved flux and other contaminants. We recommend cleaning with the pc board on its edge. If using an aqueous cleaner, we recommend standard equipment such as a soak–tank or an automatic in–line machine. See Figure 16.

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

Figure 16

**DANGER**

*Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Trichloroethylene and Methylene Chloride can be used with no harmful affect to the sockets; however, Tyco Electronics Corporation 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 Product Information number at the bottom of page 1.*

**D. Drying**

When drying clean assemblies and pc boards, air drying of is recommended. Temperature for the sockets should not exceed 105° C [221° F] for a period of five minutes with no degradation to the connector components. Degradation of the sockets could result from extreme temperatures.

**E. Checking Installed Socket**

All solder joints should conform to those specified in Test Specification 109–11.

**3.13. Repair/Replacement**

Damaged crimped contacts or housings must be removed, discarded, and replaced with new components. Use an extraction tool to remove individual contacts from connectors for replacement or for relocation to another housing cavity. Extraction Tool 318851–1 is used to extract contacts from the connectors.

**CAUTION**

*If a damaged contact is evident before the contacts are inserted into the housing, cut the wire in back of the contact and re–terminate the wire end. If the contact or housing is damaged after insertion, remove the contact with the extraction tool and cut the wire in back of the contact and re–terminate wire end.*

**CAUTION**

*When removing connector headers from pc boards, reasonable care should be taken to remove the headers straight and in–line in relation to the pc boards. In free–hanging applications, the wires must be supported during removal to prevent excess strain on the contacts. Improper removal could result in damage to the wires, housing, contacts, or pc board.*

**4. QUALIFICATIONS**

The Universal MATE–N–LOK Connectors are Listed by Underwriters Laboratories Inc. (UL) under File Number E28476, Certified to CSA International under File LR7189, and designed and tested to meet VDE 3980/continuous surveillance.

**5. TOOLING**

This section provides a selection of tools for various application requirements. Modified designs and additional tooling concepts may be available to meet other application requirements. A list of tooling recommendations and instructional material packaged with the tooling covering the full wire size range is provided in Figure 17.

**NOTE**

*Tool Engineers have designed machines for a variety of application requirements. For assistance in setting up prototype and production line equipment, contact Tool Engineering through your local Tyco Electronics Representative or call the Tooling Assistance Center number at the bottom of page 1.*

- **Robotic Equipment**

The robotic equipment must have a true position accuracy tolerance of 0.25 [.010] to properly locate the connectors for insertion. This includes gripper and fixture tolerances as well as equipment repeatability.

- **Board Supports**

A pc board support must be used to prevent bowing of the pc board during the placement of a connector on the board. It should have flat surfaces with holes or a channel wide enough and deep enough to receive the contact solder tails and boardlocks or other attaching hardware during installation of the connector on the board.

- **Applicators**

Applicators are designed for the full wire size range of strip–fed, precision formed contacts, and provide for high volume, heavy duty production requirements. The applicators can be used in bench or floor model power units.

**NOTE**

Each applicator is shipped with a metal identification tag attached. DO NOT remove this tag or disregard the information on it. Also, a packet of associated paperwork is included in each applicator shipment. This information should be read before using the applicator; then it should be stored in a clean, dry area near the applicator for future reference. Some changes may have to be made to the applicators to run in all related power units. Contact the Tooling Assistance Center number at the bottom of page 1 for specific changes.

- **Power Units**  
A power unit is an automatic or semi-automatic device used to assist in the application of a product. Power unit includes the power source used to supply the force or power to an applicator.
- **Hand Tools**  
Hand crimping tools are designed for prototype, low-volume applications, and repair.
- **Extraction Tools**  
Extraction Tools are designed to release the contact inside the connector housing without damaging the housing or contacts. Refer to Instruction Sheet 408-4371 for information on Extraction Tool 318851-1.
- **Insertion Tools**  
Insertion Tools are designed for contacts crimped to small fragile wire. They are designed to stabilize the contact during insertion. Refer to Instruction Sheet 408-7984 for information on Insertion Tool 455830-1.

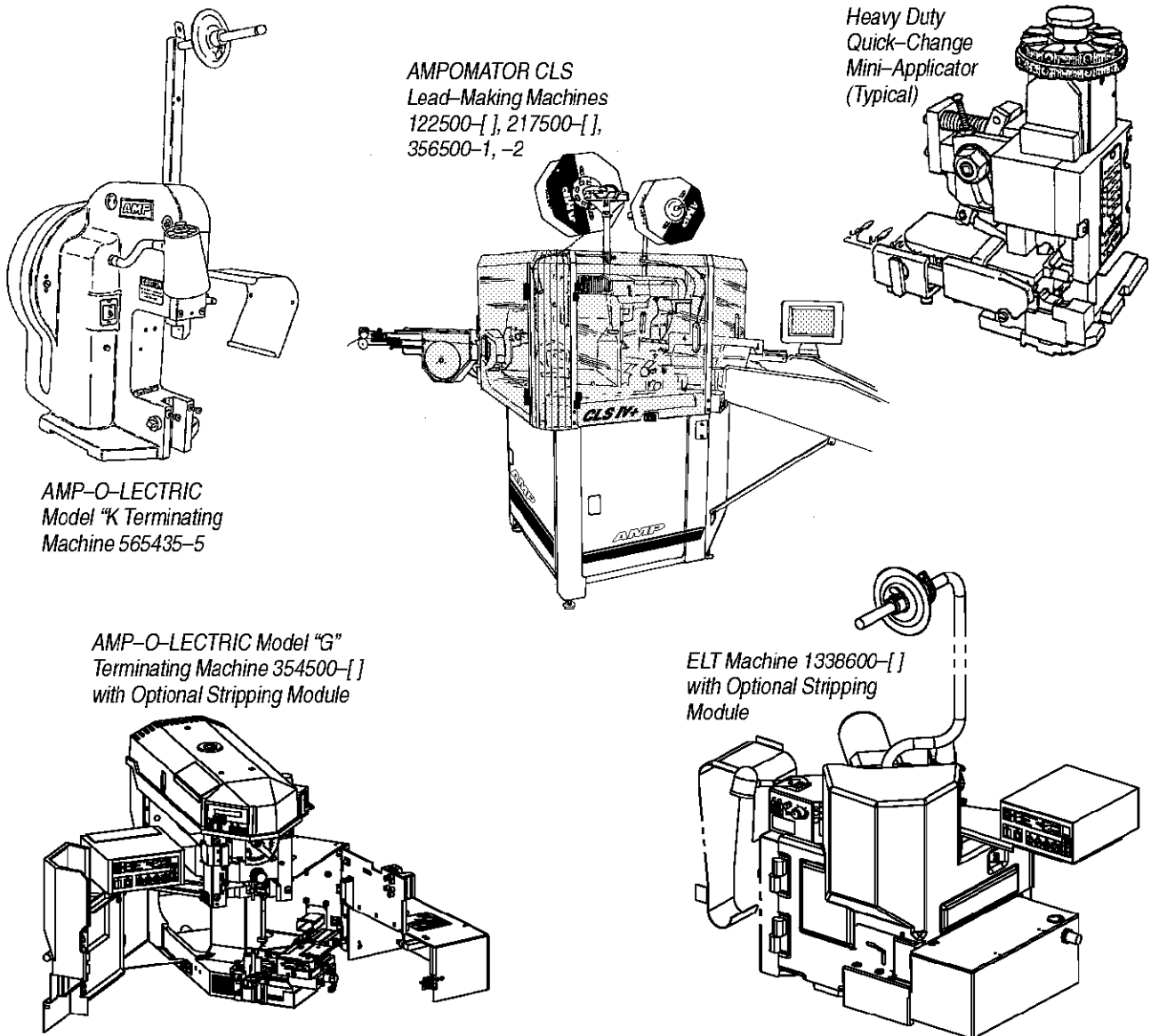
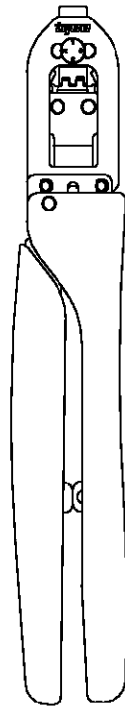
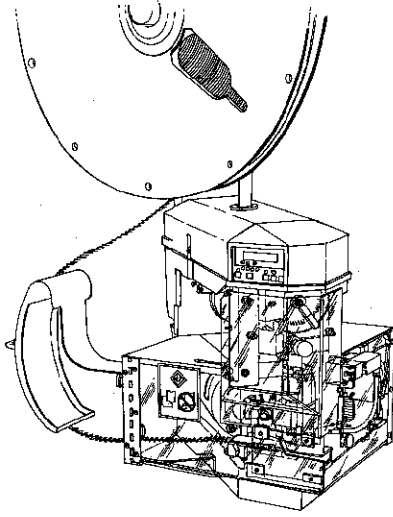
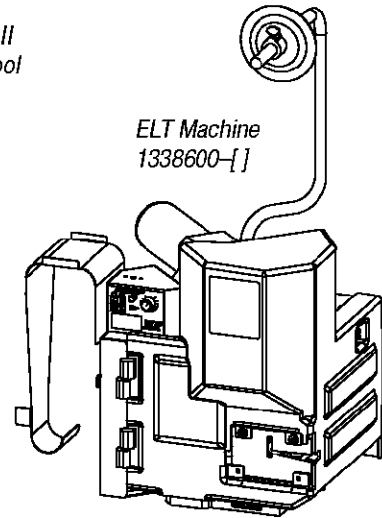


Figure 17 (cont'd)

AMP-O-LECTRIC  
Model "G" Terminating  
Machine 354500-[ ]

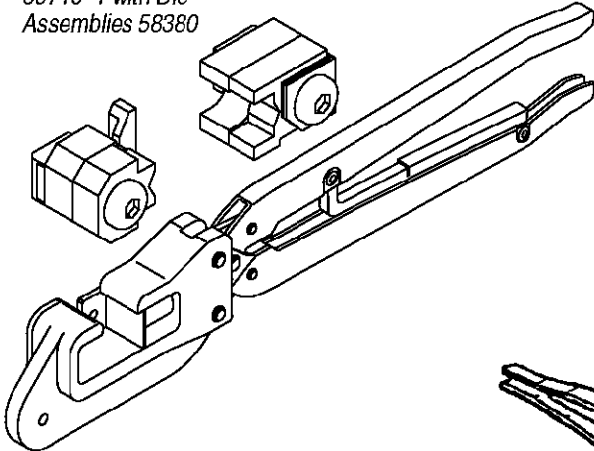


Typical CERTI-CRIMP II  
Straight Action Hand Tool

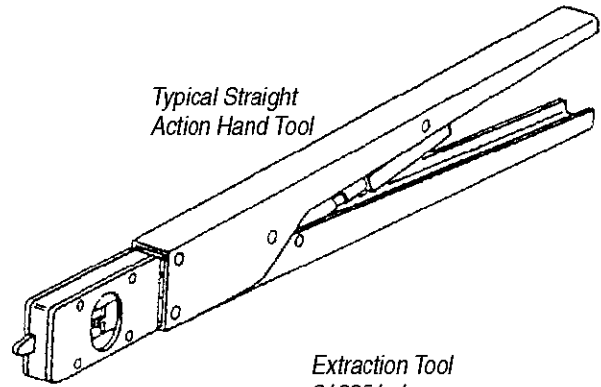


ELT Machine  
1338600-[ ]

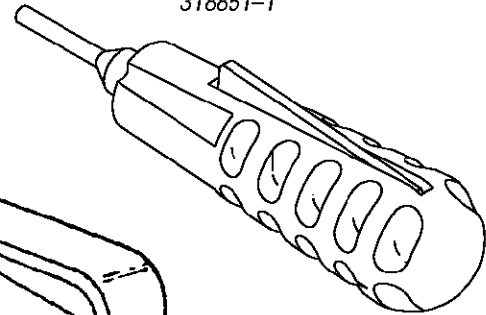
Hand Crimping Tool  
69710-1 with Die  
Assemblies 58380



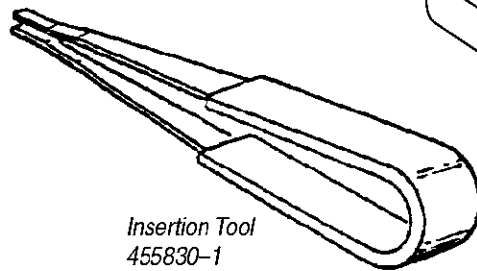
Typical Straight  
Action Hand Tool



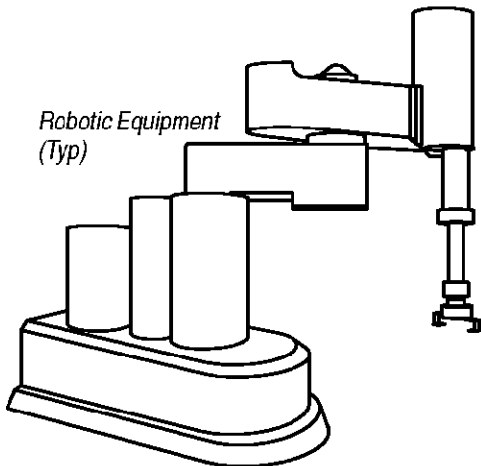
Extraction Tool  
318851-1



Insertion Tool  
455830-1



Robotic Equipment  
(Typ)



PC Board Support  
(Customer Supplied)

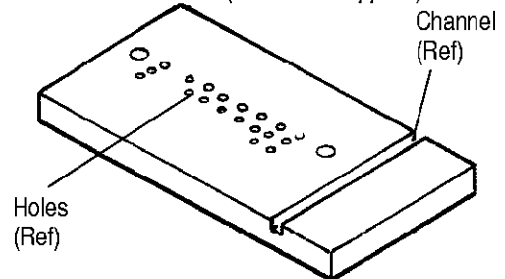


Figure 17 (cont'd)



WIRE SIZE (AWG)	INSULATION DIAMETER RANGE	HAND TOOL (DOCUMENT)	APPLICATOR (408-8040)	POWER UNIT (DOCUMENT)
30-26	0.81-1.45 [.032-.057]	58439-1 (408-9591)	466616-2	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)
24-18	1.02-2.54 [.040-.100]	91510-1 (408-8547)	466320-1	122500-2, -3 (409-5852)
				217500-1, -2 (409-5866)
				356500-1, -2 (409-5878)
			466320-2 567216-2† 567216-3†	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)
20-14	1.52-3.30 [.060-.130]	91500-1 (408-8547)	687763-1	122500-2, -3 (409-5852)
				217500-1, -2 (409-5866)
				356500-1, -2 (409-5878)
			687763-2	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)
20-18	3.30-5.08 [.130-.200]	91508-1 (408-8547)	—	—
20-14	3.30-5.08 [.130-.200]	—	687926-1	122500-2, -3 (409-5852)
				217500-1, -2 (409-5866)
				356500-1, -2 (409-5878)
			687926-2	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)
2@18	3.30-5.08 [.130-.200]	—	1385264-2	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)
18-14	3.30-5.08 [.130-.200]	—	466588-1	122500-2, -3 (409-5852)
				217500-1, -2 (409-5866)
				356500-1, -2 (409-5878)
			466588-2	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)
16-14	3.30-5.08 [.130-.200]	91506-1 (408-8547)	—	—
12-10	5.08 [.200] Max.	69710-1† (408-2095)	466597-1	122500-2, -3 (409-5852)
				217500-1, -2 (409-5866)
				356500-1, -2 (409-5878)
			466597-2	354500-1 (409-5842)
				565435-5 (409-5128)
				1338600-3, -4 (409-10016)

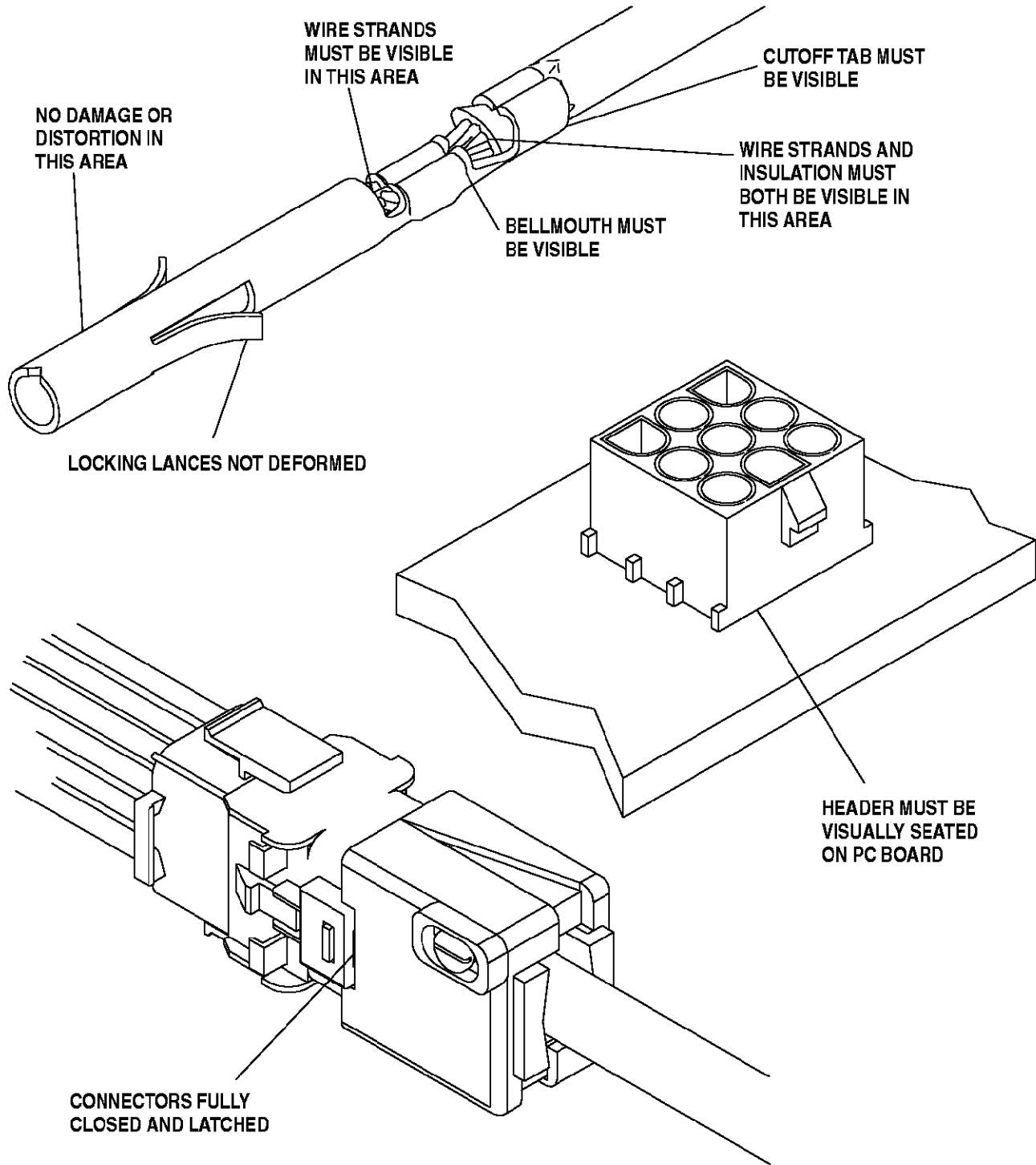
†Hand tool 69710-1 uses die set 58330-1 for 12 AWG and die set 58380-2 for 10 AWG. Refer to Instruction Sheet 408-9433.

‡Applicators used with product part numbers 770210-1 and 770211-1.

Figure 17 (end)

**6. VISUAL AID**

Figure 18 shows a typical application of 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 18. VISUAL AID**