



**NOTE**

All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters. Unless otherwise specified, dimensions have a tolerance of  $\pm 0.13$  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 Power Drawer Vertical Printed Circuit (PC) Board Receptacles and Panel-Mount Plugs with both the “snap-in” and hardware mount versions. The connectors have blade to blade centerline spacing of 3.0 mm.

Mini Power Drawer Vertical PC Board Receptacles feature ACTION PIN\* Contacts. These contacts are designed with a press fit and eliminate the need for soldering. This product consist of contacts which are installed in 3- through 10-position plug connector housings. The contacts will accept a wire range size of 20-18 AWG.

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.

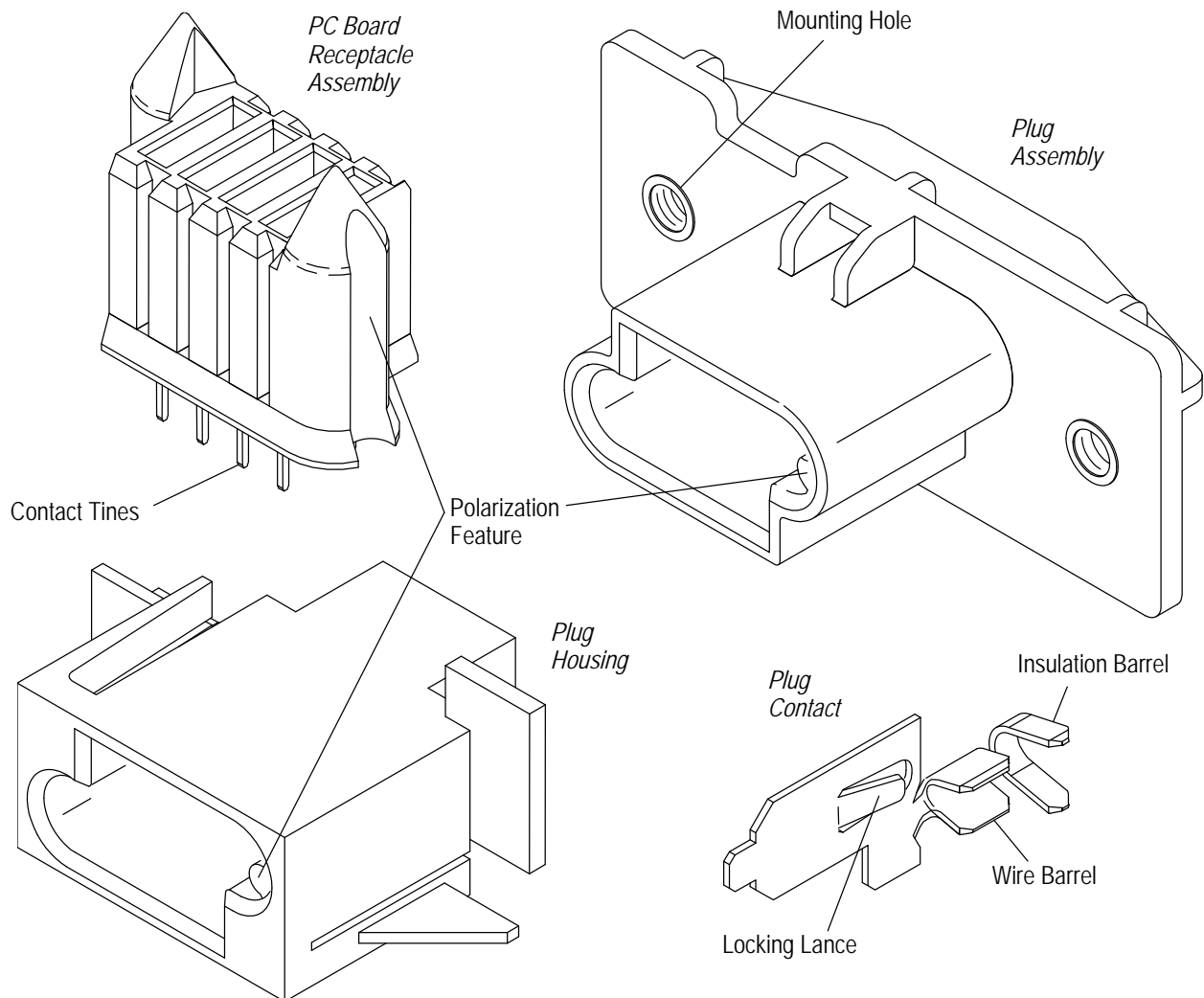


Figure 1

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## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

- Updated document to corporate requirements
- New logo

### 2.2. Customer Assistance

Reference Product Base Part Number 1489715 and Product Code H088 are representative numbers of Mini Power Drawer Vertical PC Board Receptacles and Panel-Mount Plugs. Use of these numbers will identify the product line and help you to obtain product and tooling information. Such information can be obtained through a local TE Representative, by visiting our website at [www.te.com](http://www.te.com), or by calling PRODUCT INFORMATION or the TOOLING ASSISTANCE CENTER at the numbers at the bottom of page 1.

### 2.3. Drawings

Customer drawings for specific products 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 in soldering. This manual provides information on various flux types and characteristics along 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

Design Objective 108-1998 provides expected product performance requirements and test information.

### 2.6. Instructional Material

The following list includes available 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                   |
| 408-8040               | Heavy Duty Miniature Quick-Change Applicators (Side-Feed Type)         |
| 408-8059               | General Preventive Maintenance for Applicators                         |
| 408-8607               | PRO-CRIMPER* III Hand Tool Assembly 91363-1 with Die Assembly 91363-2  |
| 408-8639               | Extraction Tool 1583190-1  |
| 408-9816               | Handling of Reeled Products  |
| 409-5128               | Basic AMP-O-LECTRIC* Model "K" Terminating Machines                    |
| 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-[ ]                       |

## 3. REQUIREMENTS

### 3.1. Storage

#### A. Ultraviolet Light

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

#### B. Shelf Life

The connectors should remain in the anti-static shipping tubes until ready for use to prevent deformation to the connectors. The connectors should be stored at normal room temperatures with low humidity, and used on a first in, first out basis to avoid storage contamination that could adversely affect signal transmissions.

### C. Reeled Contacts

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

### D. Chemical Exposure

Do not store housings assemblies near any chemicals listed below, as they may cause stress corrosion cracking in the components.

|          |            |          |                 |          |                  |
|----------|------------|----------|-----------------|----------|------------------|
| Alkalies | Ammonia    | Citrates | Phosphates      | Citrates | Sulfur Compounds |
| Amines   | Carbonates | Nitrites | Sulfur Nitrites |          | Tartrates        |

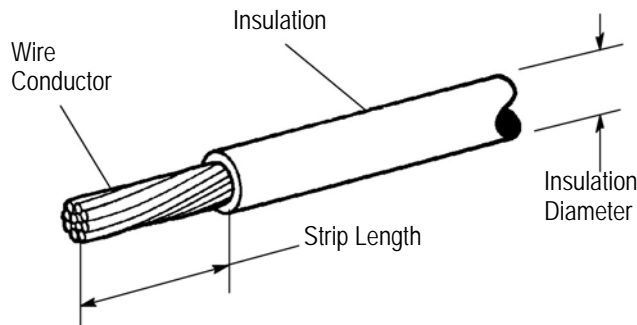
**i** **NOTE**  
Where the above environmental conditions exist, phosphor-bronze contacts are recommended instead of brass if available.

### 3.2. Wire Selection and Preparation

The contacts will accept a wire size range 20-18 AWG, and are to be terminated to stranded wire. Figure 2 lists the insulation diameter range, strip length, and crimp height as determined by the wire size.

**!** **CAUTION**  
When stripping the wire, care must be taken to avoid scraping, nicking, or cutting the conductor. Care must also be used when handling the wire during stripping and crimping to prevent cracking or breaking of the conductor and insulation.

**i** **NOTE**  
Each crimp dimension represents the functional range of a wire/contact combination. There are tool designs available to meet various application requirements. The developed crimp configuration is unique for each tool design and is acceptable provided the crimp height is within the functional range. For crimp dimensions of a specific tool, refer to instruction sheet packaged with manual tools and applicator log packaged with power tools.



Note: Not to Scale

| WIRE SIZE RANGE, mm <sup>2</sup> [AWG] | INSULATION DIAMETER RANGE | WIRE STRIP LENGTH | WIRE BARREL CRIMP HEIGHT |
|--|---------------------------|-------------------|--------------------------|
| 0.30-0.80 [18-20]                      | 2.0-3.1                   | 2.4-3.2           | 1.359-1.461              |

Figure 2

### 3.3. Crimped Contact Requirements

The contact shall be located in desired tooling and crimped according to the instructions packaged with that tooling, if available. See Section 5, TOOLING, of this document for details on tooling options and instructional materials. Figure 3 shows a typical contact as it should appear after crimping.

**i** **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.

#### 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.

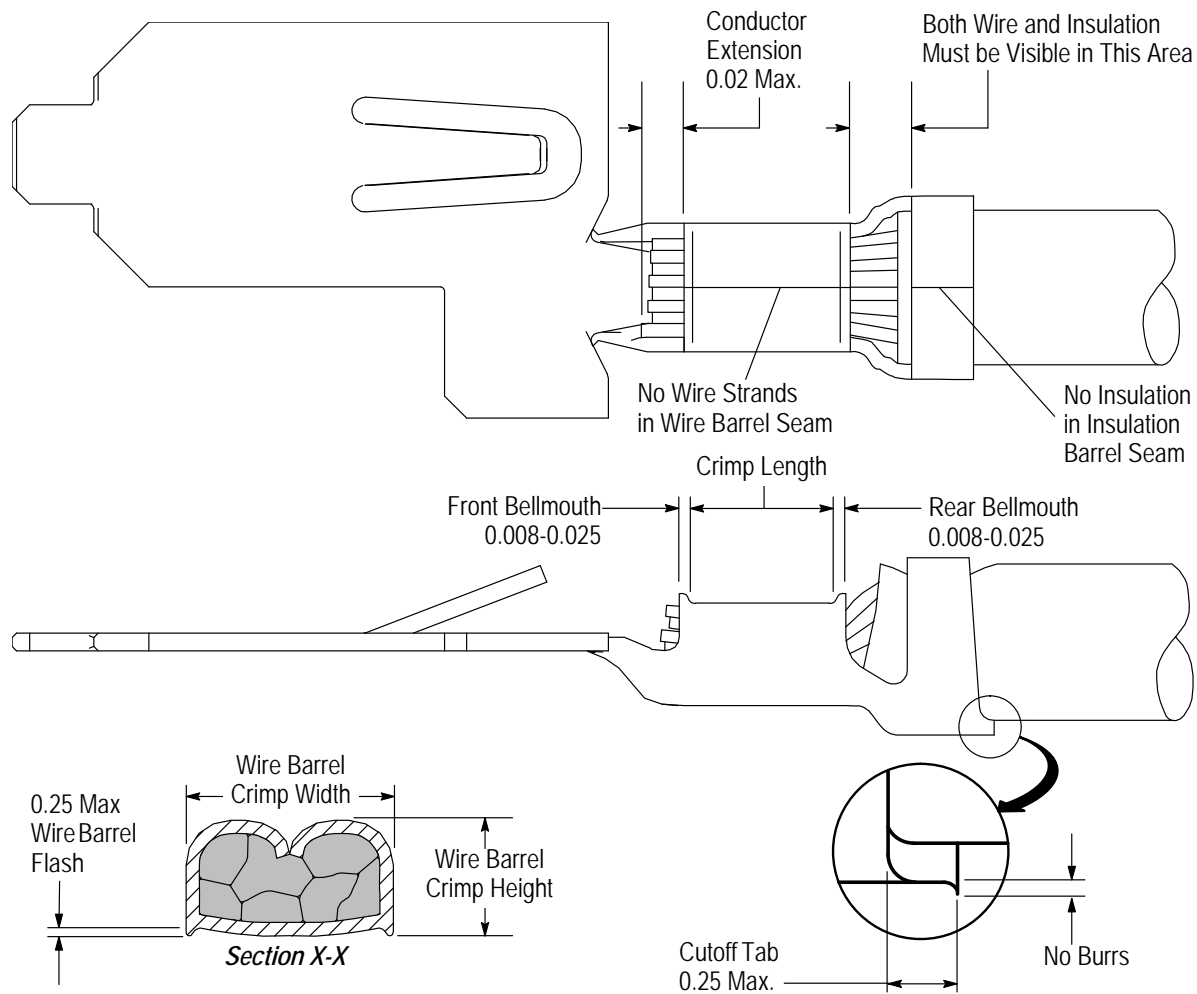


Figure 3

### B. Effective Crimp Length

For optimum crimp effectiveness, the crimp must be within the area shown and must meet the crimp dimensions provided in Figure 3. 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.

### G. Insulation Barrel Crimp

The insulation barrel shall grip the insulation firmly. A slight cut in the insulation by the insulation barrel is permissible as this causes no problems in actual use. Insulation crimp shall comply to width and height provided in Figure 3.

**H. Wire Location**

The wire conductor and insulation must be visible in the transition area between the wire and insulation barrels.

**I. Conductor Extension**

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

**J. Wire Barrel Seam**

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

**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.

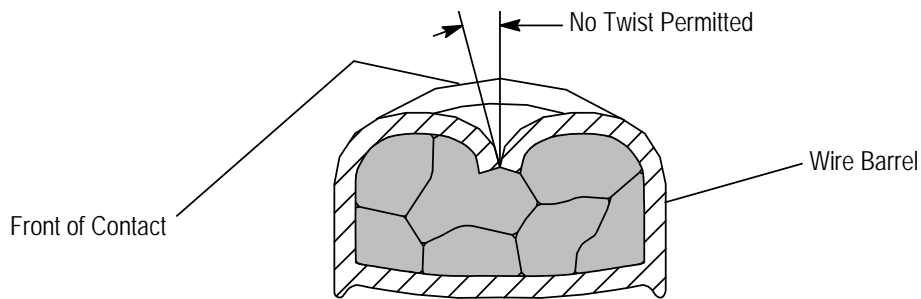


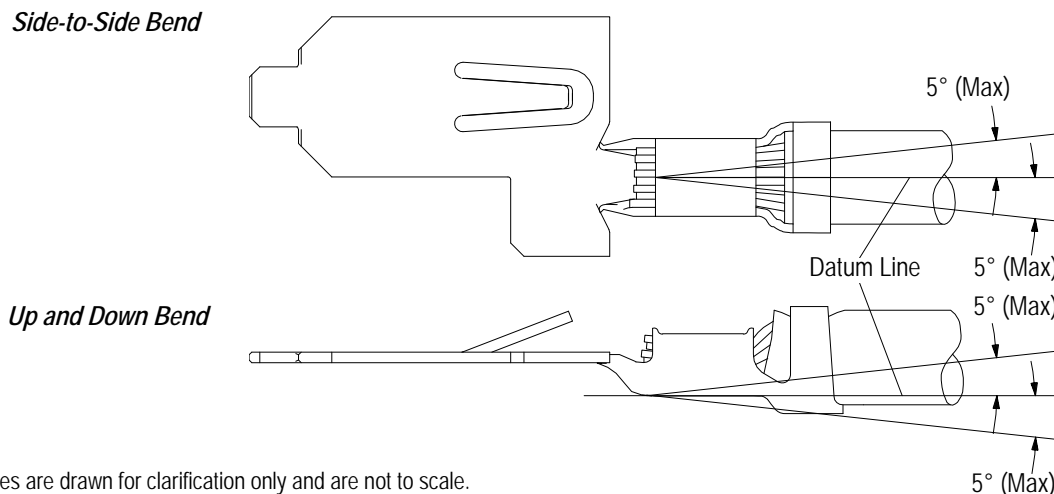
Figure 4

**L. Straightness**

The force applied during crimping may cause some bending between the crimped wire barrel and the mating portion of the contact. Such deformation is acceptable within the limits provided in Figure 5.

1. The up and down bend of the crimped contact, including cutoff tab and burr, shall not be bent above or below the datum line more than the amount shown.
2. The side-to-side bend of the contact may not exceed the limits provided.

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

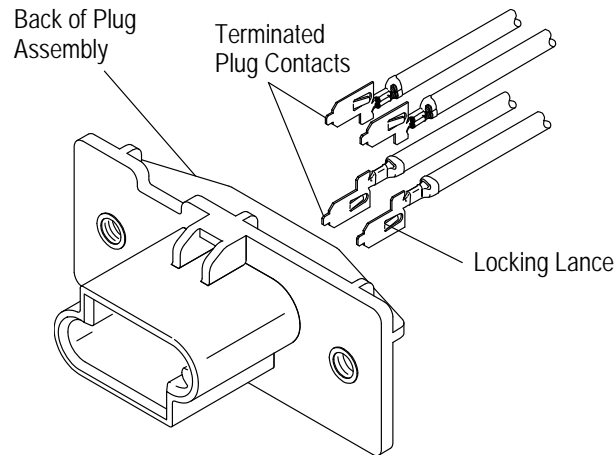


**NOTE:** Angles are drawn for clarification only and are not to scale.

Figure 5

### 3.4. Placement of Crimped Contact in Housing

The contact must be inserted in the back of the plug housing or plug assembly and snapped into place. Install the contact so the wire barrel will be located in the largest opening of the contact cavity. When fully inserted, the locking lances will engage the housing and prevent backing out during mating of the connector. After inserting contact into housing, pull back lightly on the wire to ensure contact is fully seated. See Figure 6.



**NOTE:** Orientation of plug contacts in plug housing or plug assembly differs from row-to-row.

Figure 6

### 3.5. Connector Assembly

The plug and receptacle connectors will mate according to the polarization designed in the housings. See Figure 7.

**NOTE:** PC board and terminated contacts removed for clarity.

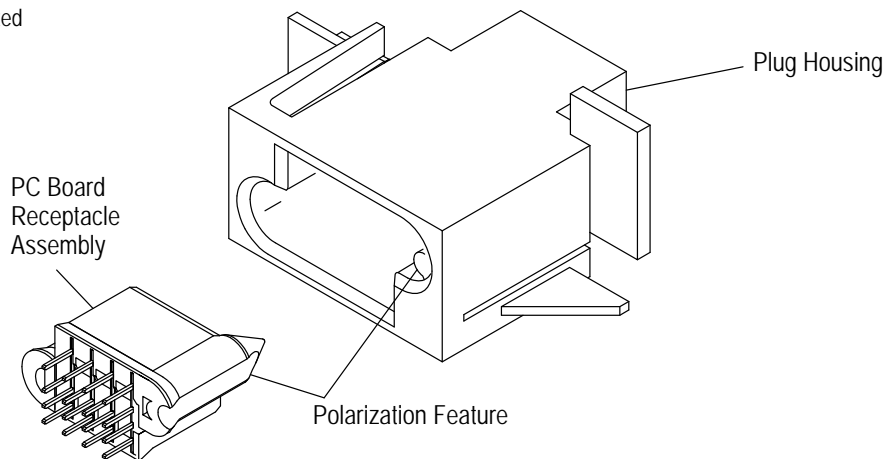


Figure 7

### 3.6. Wire Bend Radius

TE Engineering recommends that individual cables should be dressed to a bend radius of at least ten times the cable outside diameter. Likewise, cable bundles should be dressed to a bend radius of at least ten times the diameter of the bundle.

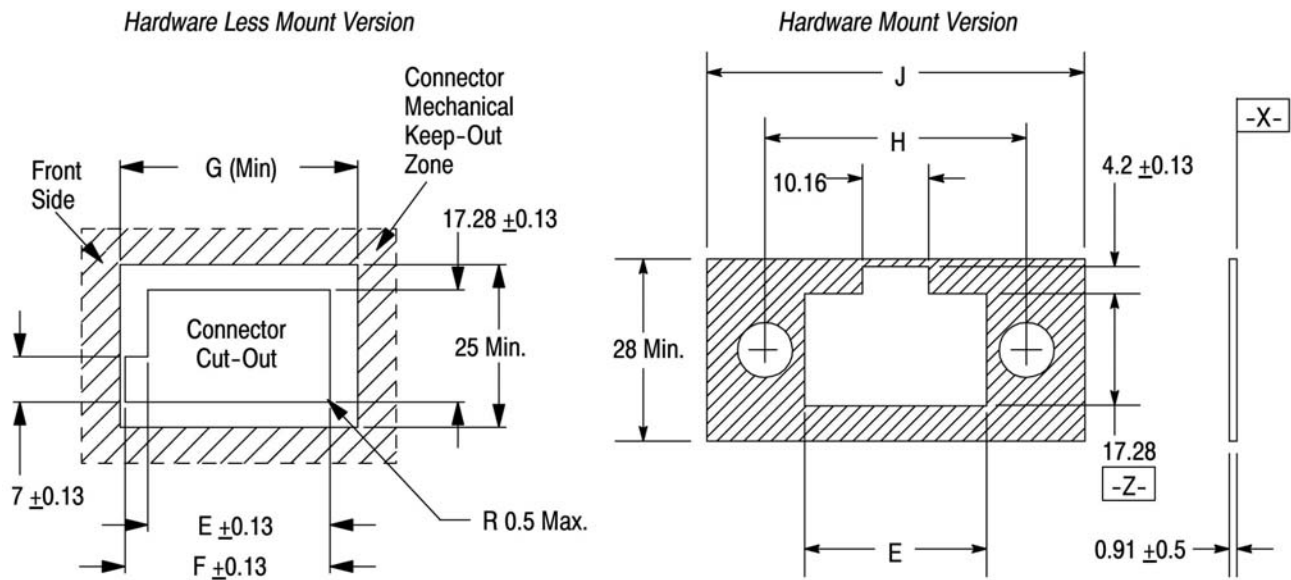
### 3.7. Panel Cutout

#### A. Hardware Less Mount Version

Mini Power Drawer Connector panel cutouts shall be as indicated in Figure 8. No mounting hardware is required. The plug housing features flexible mounting latches for insertion into the panel. Push the plug connector through the panel - in the same direction as the cutout was made - until it snaps in place.

## B. Hardware Mount Version

Mini Power Drawer Connector panel cutouts shall be as shown in Figure 8. The plug housing features threaded inserts, which allow mounting by means of a shoulder screw. Push the plug housing through the panel cutout. Panel thickness is  $0.91 \pm 0.05$  mm. Apply shoulder screws from front face of the housing and tighten to a maximum torque of  $1.69 \text{ N}\cdot\text{m}$  [15 in-lbs].



| POSITIONS | DIM "E" | DIM "F" | DIM "G" | DIM "H" | DIM "J" |
|-----------|---------|---------|---------|---------|---------|
| 3         | 25.0    | 28.5    | 33.5    | ---     | ---     |
| 4         | 28.0    | 31.5    | 36.5    | 40.24   | 58.2    |
| 5         | 31.0    | 34.5    | 39.5    | ---     | ---     |
| 6         | 34.0    | 37.5    | 42.5    | ---     | ---     |
| 7         | 37.0    | 40.5    | 45.5    | ---     | ---     |
| 8         | 40.0    | 43.5    | 48.5    | ---     | ---     |
| 9         | 43.0    | 46.5    | 51.5    | ---     | ---     |
| 10        | 46.0    | 49.5    | 54.5    | ---     | ---     |

Figure 8

## 3.8. Connector Features

### A. Characteristics

Mini Power Drawer Connectors are available as a wire-to-board connector system designed for power applications. The housings are polarized to prevent miss-mating. The vertical receptacles molded-in guide pins provide blind-mateability.

### B. Materials

Mini Power Drawer Housings are made of high-temperature thermoplastic. The contacts are phosphor bronze or copper nickel silicon, and plated at the contact surface with gold over nickel. The ACTION PIN Contact area is tin-lead over nickel.

## 3.9. Alignment

Proper alignment is essential to ensure full engagement of mating connectors and also to ensure the contacts are not bent or otherwise damaged during mating and unmating. For alignment tolerances, see Figure 9.

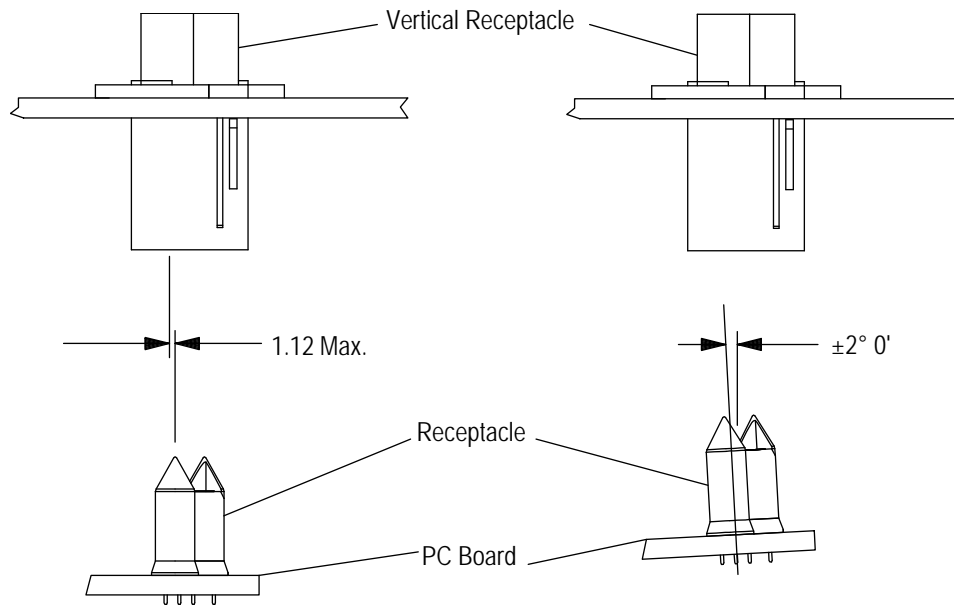


Figure 9

### 3.10. Mating Dimensions

Full mating of the connectors is necessary to ensure a good connection. The dimension from the surface of the pc board to the panel should be as shown in Figure 10.

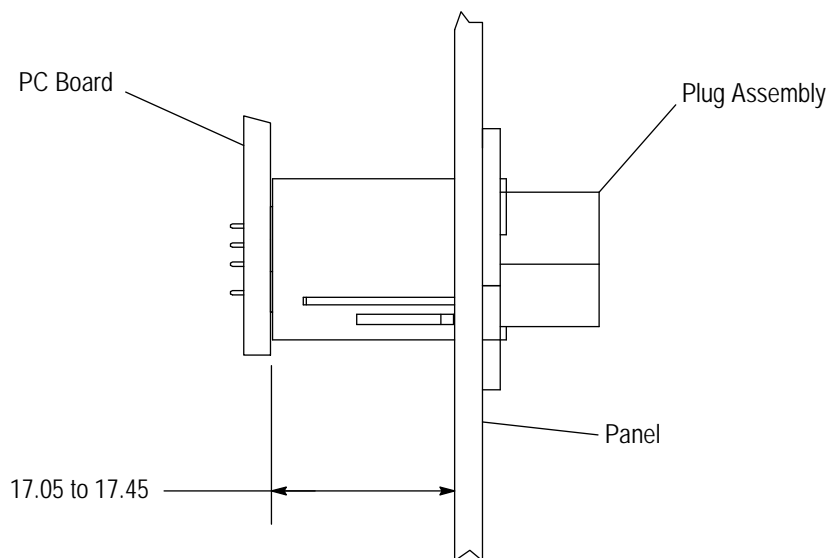


Figure 10

### 3.11. PC Board Requirements

#### A. PC Board Thickness

The vertical receptacle connectors with compliant pin contacts require a pc board with a minimum thickness of 2.13 mm.

#### B. PC Board Circuit Pattern Layout

The pc board layout patterns for the placement of Mini Power Drawer Vertical PC Board Receptacles are provided in Figure 11.



The vertical receptacle ACTION PIN contact tines are arranged in such a way that the connector can only be placed on the pc board in one orientation. This is because the tines are not symmetrical about the centerline of the housing.

**i** **NOTE**  
For applications requiring the minimum installation force for the connector, the pc board through-hole size should be in the high end of the allowable tolerance.

**i** **NOTE**  
Figure 11 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 TE Representative or refer to the telephone numbers at the bottom of page 1.

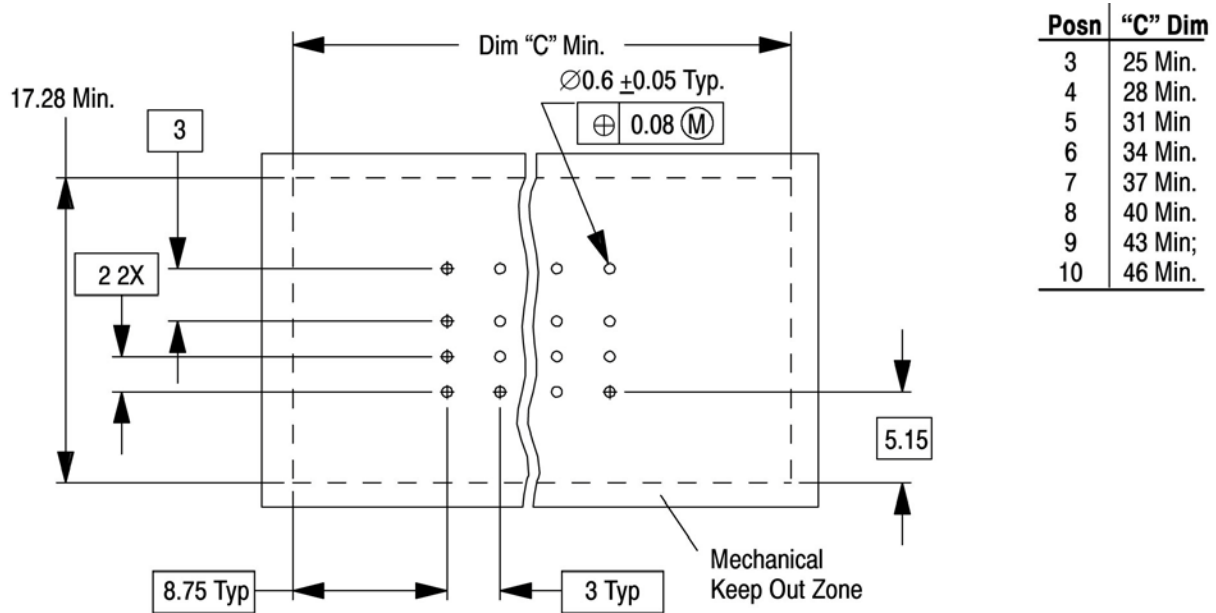


Figure 11

### 3.12. Contact Hole Configuration

The contact holes in the pc board for all connectors must be prepared to the dimensions specified in Figure 12.

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

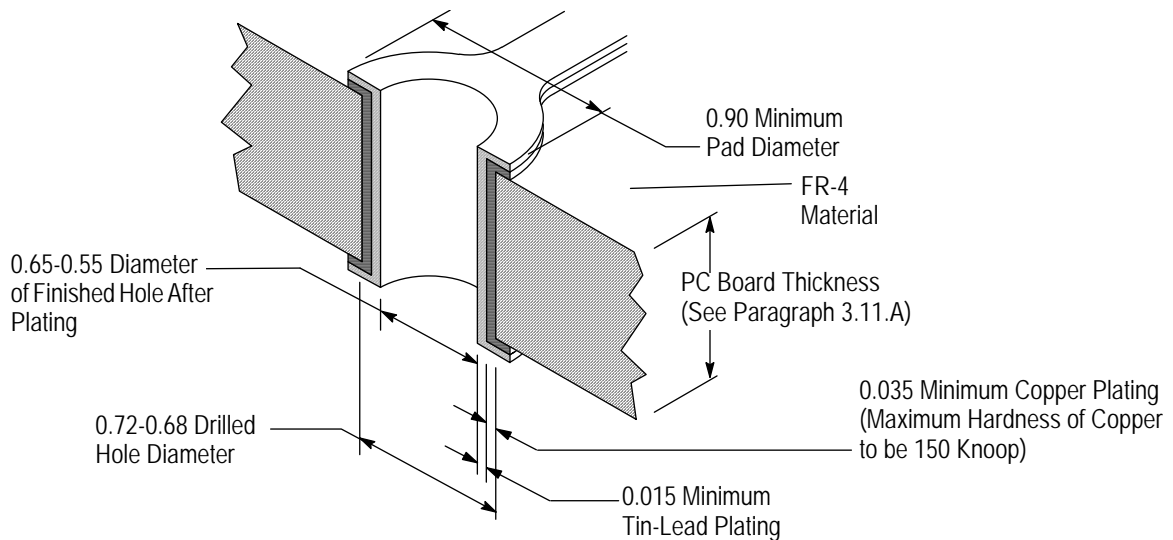


Figure 12

### 3.13. Special Handling

#### A. Initial Positioning

Mini Power Drawer Vertical PC Board Receptacles may be applied to a pc board either by hand or by robotic equipment. See Section 5, TOOLING.

Connectors should be gripped by the housing only and not by the contacts. When placing a connector into a pc board, all contact tines should be aligned and inserted into the pc board simultaneously to prevent twisting or bending of the contacts. If using robotic equipment, a total equipment accuracy of  $\pm 0.13$  mm, including the gripper and fixture tolerance and equipment repeatability, is required.

#### B. Seating Connectors

Seating force must be applied evenly on the connectors to prevent deformation or other damage to the contacts and housings. When installing receptacle connectors, the insertion force must be simultaneously applied to the shoulders of each contact at the bottom of the slots on the exterior of the housing. Each contact blade requires 356 N (80 lbs.) of force to apply. For example, a 10-position connector may require up to 3560 N (800 lbs.) of force to apply.

### 3.14. Soldering

#### A. Flux Selection

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 phone number at the bottom of page 1 for consideration of other types of flux. Some fluxes that are compatible with these receptacle assemblies are provided in Figure 13.

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

Figure 13

#### B. Soldering Guidelines

Mini Power Drawer Vertical PC Board Receptacles can be soldered using a variety of soldering techniques. The temperatures and exposure time shall be within the ranges specified in Figure 14. We recommend using SN60 or SN62 solder.



**NOTE**

Manual 402-40 provides some guidelines for establishing soldering practices. Refer to Paragraph 2.4, Manuals.

| SOLDERING PROCESS | TEMPERATURE                      | TIME (At Max Temperature) |
|-------------------|----------------------------------|---------------------------|
| Wave              | 260°C [500°F] (Wave Temperature) | 5 Seconds                 |

Figure 14

#### 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 receptacle assemblies for the time and temperature specified. See Figure 15.



**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 receptacle assemblies; however TE 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.

KESTER and ALPHA are trademarks of their respective owners.



**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.

| 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 | 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 15

**D. Drying**

When drying cleaned assemblies and printed circuit boards, make certain that temperature limitations are not exceeded: -105°C [221°F] max for a period of 5 minutes for standard temperature products. Excessive temperatures may cause receptacle assembly degradation. Values may vary with different types of automatic cleaning equipment. See the equipment manufacturers recommendations.

**E. Checking Installed Connector**

All solder joints should conform to those specified in TE Test Specification 109-11. The connector must seat on the pc board to the dimensions shown in Figure 16.

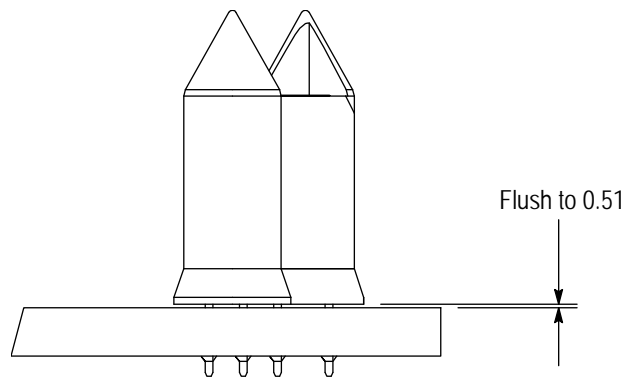


Figure 16

**3.15. Repair/Replacement**

**A. Panel-Mount Plugs**

Use Extraction Tool 1583190-1 to remove individual contacts from the panel-mount plug for replacement or relocation to another housing cavity. See Figure 17. Reset the locking lances to the original spread before reusing contacts. Damaged or worn contacts may be replaced, provided there is sufficient slack, after re-stripping the wire, to insert the new contact into the panel-mount plug. Do not re-terminate the old contact. Refer to Section 5, TOOLING.

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

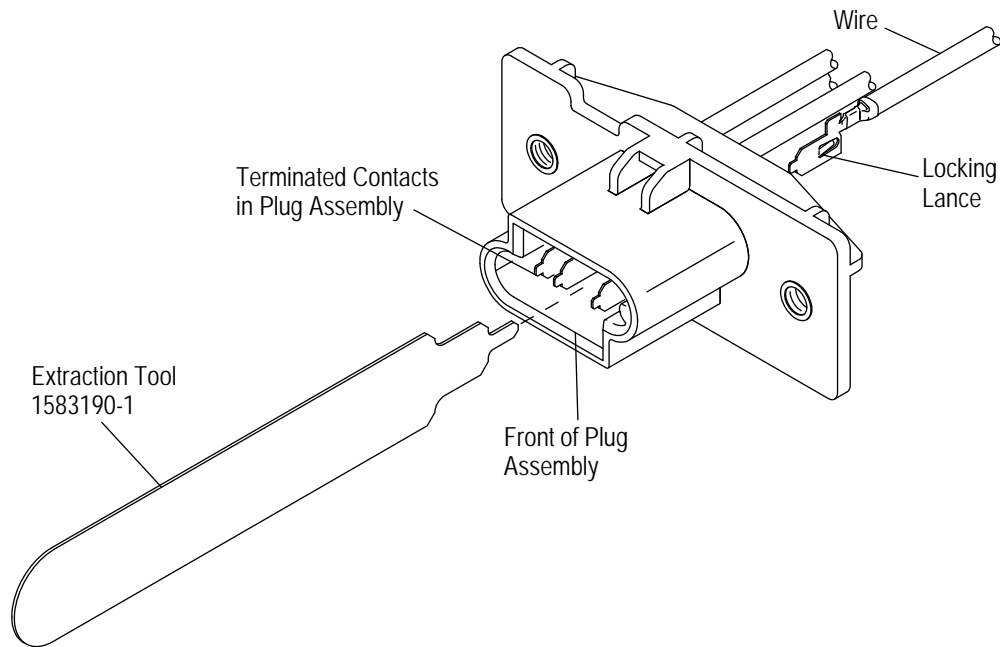


Figure 17

## B. Vertical Receptacles

Damaged contacts cannot be removed from modules. The entire module will have to be removed from the pc board and replaced with a new one. Soldered vertical receptacles may be removed from the pc board by standard desoldering methods.

Place the motherboard/backplane on a fixture providing support all around the housing to be removed. Make sure the fixture will not interfere with or damage any other components on the pc board. Apply an even force to all contact pins with a pushbar and machine capable of applying 267 N [60 lbs.] per contact blade. For example, a 10-position connector may require up to 2670 N [600 lbs.] of force to remove it. See Figure 18.

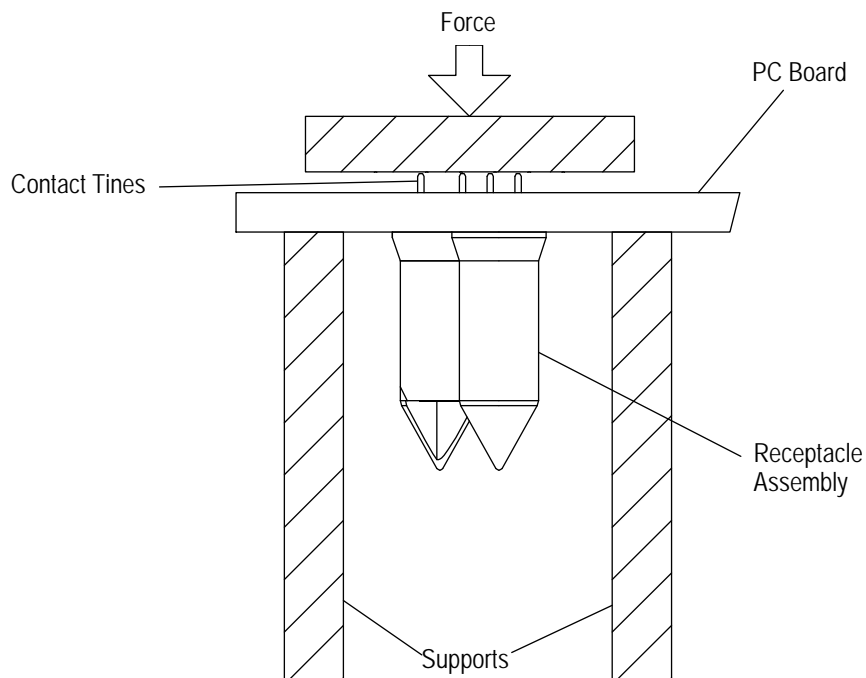


Figure 18

## 4. QUALIFICATIONS

Mini Power Drawer Vertical PC Board Receptacles and Panel-Mount Plugs have not yet been submitted for agency approvals.

## 5. TOOLING

A listing of tooling recommendations covering the full wire size range is provided in Figure 19. The listing includes hand tools for manual application of loose piece contacts, and semi-automatic and automatic machines for power assisted application of strip form contacts. Modified designs and additional tooling concepts may be available to meet other application requirements. For additional information, contact one of the service groups at the bottom of page 1.



### NOTE

*TE 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 TE Representative or call the Tooling Assistance Center number at the bottom of page 1.*

### • Hand Crimping Tools

Hand crimping tools that accommodate the full wire size range are designed for prototype and low-volume applications such as repair of damaged contacts.

### • 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.

### • Robotic Equipment

Robotic equipment for placement of connectors on a pc board must have a true position accuracy of 0.13 mm to ensure proper location and insertion of the contact pins. This includes gripper and fixture tolerances as well as equipment repeatability. It must use the connector datum surface to ensure reliable connector placement. If you need assistance in setting up prototype or production line equipment, contact TE Tooling Engineering through your local TE Representative or call the Tooling Assistance Center number at the bottom of page 1.

### • Push Bar

Commercially available bar stock with a flat surface large enough to cover the top surface of the vertical receptacle and capable of transmitting 7.9 N [35 lbs] per pin can be used as a push bar to insert the compliant pin contacts in the pc board. The same type tooling can be used to remove damaged right-angle connectors from a pc board by pressing evenly on the compliant end of the contacts.

### • PC Board Support

A pc board support must be used to prevent bowing of the pc board during insertion of the solder tine connectors. It should have a flat surface with holes or a channel large enough to receive the contact tines during installation. Contact TE for information about Board Support 217602.

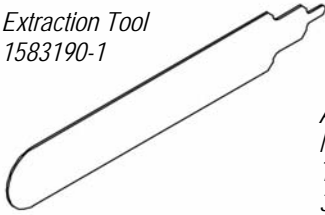
### • Housing Support

A housing support with sides and ends as close as possible to the receptacle housing is recommended for removing damaged receptacle connectors from pc boards.

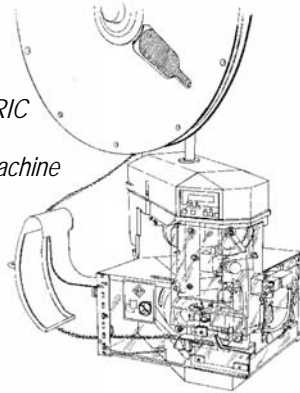
### • Extraction Tools

Extraction Tools are designed to release the locking lance inside the connector housing without damaging the housing or contacts.

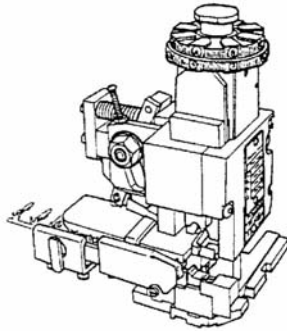
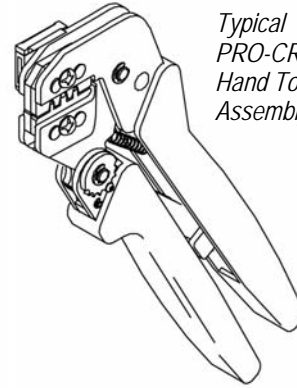
Extraction Tool  
1583190-1



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

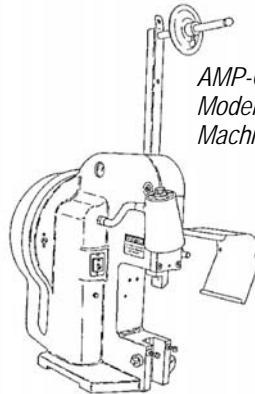


Typical  
PRO-CRIMPER  
Hand Tool with Die  
Assembly

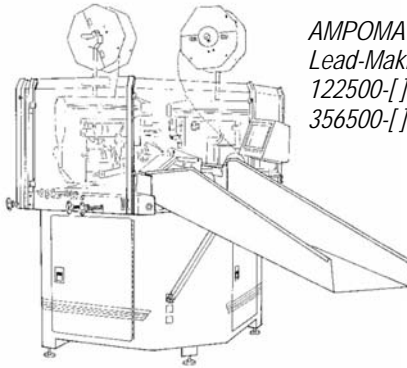


Typical Heavy Duty  
Mini (HDM) Applicator  
(408-8040)

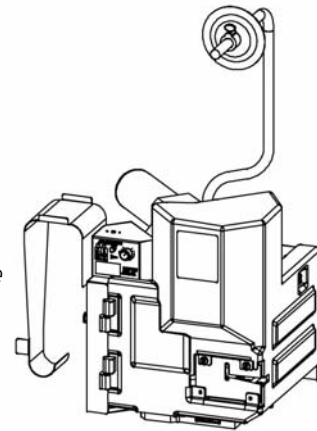
AMP-O-LECTRIC  
Model "K" Terminating  
Machine 565435-5



AMPOMATOR CLS  
Lead-Making Machines  
122500-[]; 217500-[];  
356500-[]



ELT Machine  
1338600-[]

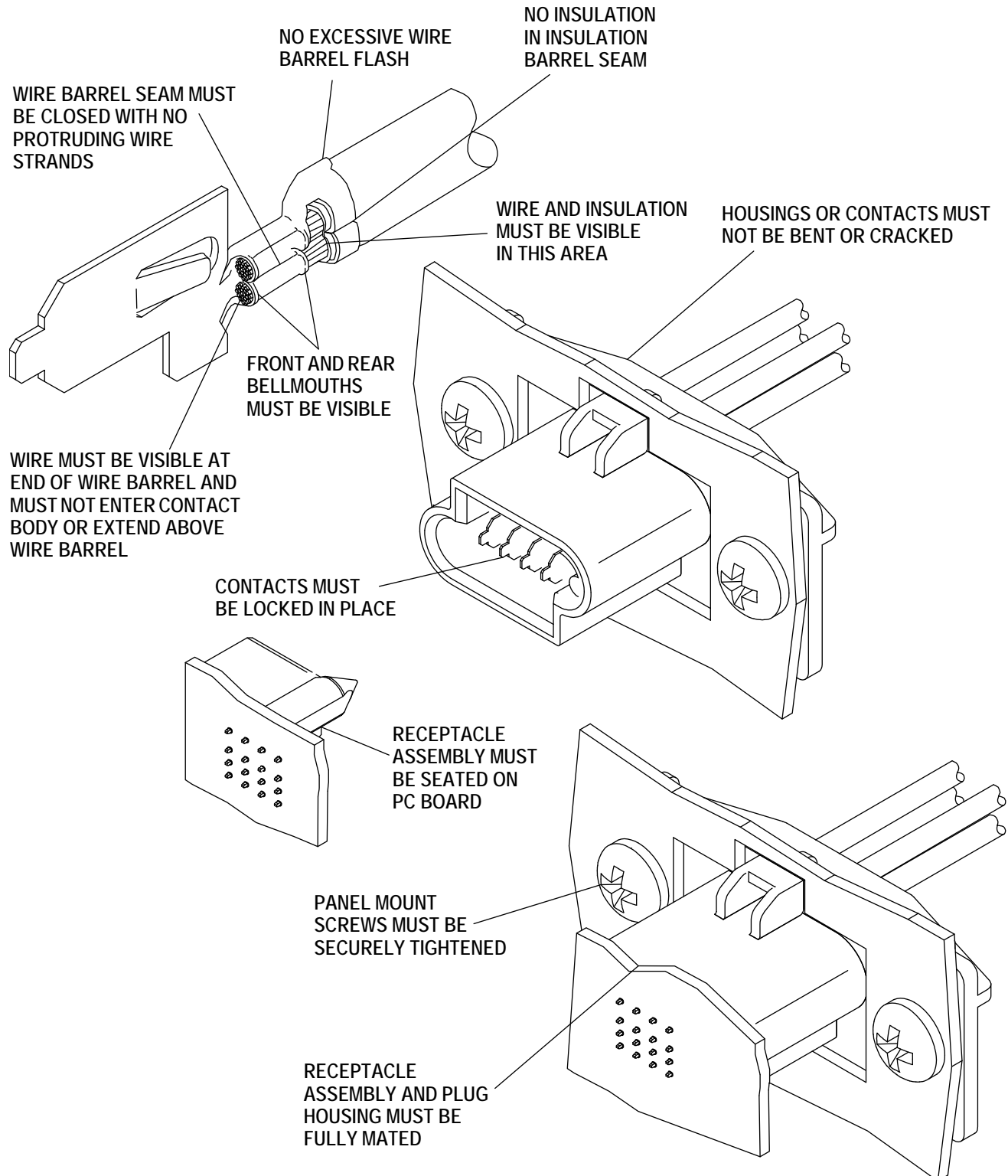


| WIRE SIZE,<br>mm <sup>2</sup> [AWG] | INSULATION<br>DIAMETER<br>RANGE | APPLICATION TOOLING      |                              |                         |                                  |
|-------------------------------------|---------------------------------|--------------------------|------------------------------|-------------------------|----------------------------------|
|                                     |                                 | APPLICATOR<br>(408-8040) | POWER UNIT<br>(DOCUMENT)     | HAND TOOL<br>(408-8607) | EXTRACTION<br>TOOL<br>(408-8639) |
| 0.30-0.80<br>[20-18]                | 2.0-3.1                         | 1385248-1                | 122500-2, -3<br>(409-5852)   | 91363-1                 | 1583190-1                        |
|                                     |                                 |                          | 217500-1, -2<br>(409-5866)   |                         |                                  |
|                                     |                                 |                          | 356500-1, -2<br>(409-5878)   |                         |                                  |
|                                     |                                 | 1385248-2                | 354500-1<br>(409-5842)       |                         |                                  |
|                                     |                                 |                          | 565435-5<br>(409-5128)       |                         |                                  |
|                                     |                                 |                          | 1338600-3, -4<br>(409-10016) |                         |                                  |
| 1385248-3                           | 354500-1<br>(409-5842)          |                          |                              |                         |                                  |

Figure 19

## 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 20. VISUAL AID**