

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 ± 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 the application of AMPINNERGY WTB Connectors. These plug, and vertical and right-angle receptacle connectors are available in 2 through 8 positions, single row with contact spacing on 11.18 mm [.440 in.] centerlines. The plugs accept two sizes (18-16-14 and 12-10) of dual-beam crimp type contacts, and the receptacles contain pre-installed solder type contacts. The first position (marked as Position 1 on contact stop) can be used as a make-first, break-last ground. The receptacles have standoffs to allow easy pc board cleaning after the soldering operation and mounting flanges for attaching to the pc board and panel. The connectors have polarizing features to prevent error-free mating and, in addition, the polarizing post on vertical receptacles assists in proper positioning on the pc board. The locking features prevent the connectors from accidentally disengaging. The connectors can be placed on the pc (printed circuit) board manually or by automatic robotic equipment.

When corresponding with TE Connectivity 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.

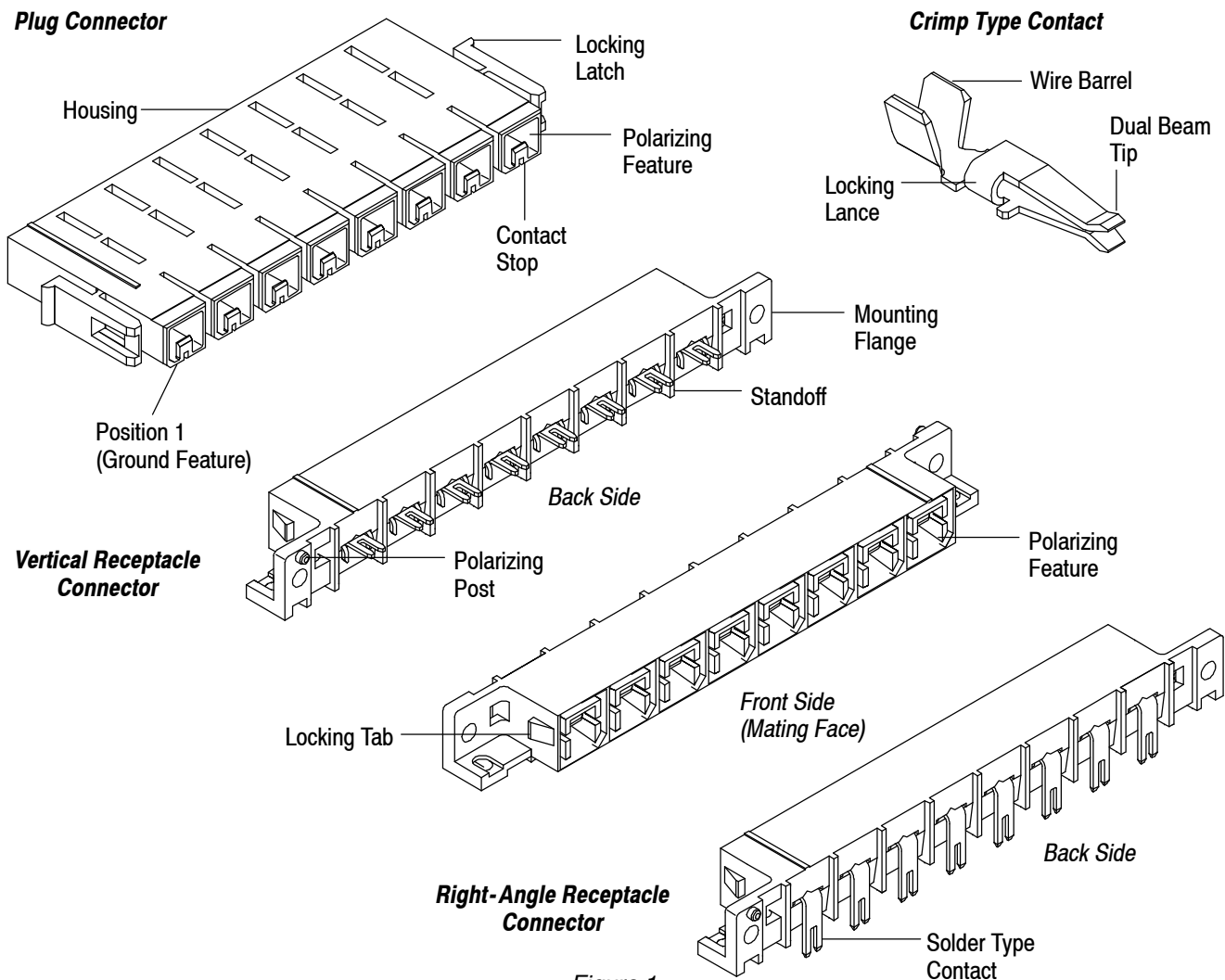


Figure 1

2. REFERENCE MATERIAL

2.1. Revision Summary

- Updated document to corporate requirements.

2.2. Customer Assistance

Product Part Number 556881 and Product Code 3451 are representative of the AMPINNERGY WTB 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 TE Representative or, after purchase, by calling the Tooling Assistance Center 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 by TE, call product information at the number at the bottom of page 1.

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

Product Specification 108-1349 provides product performance and test information.

2.6. Instructional Material

Instruction sheets (408-series) provide assembly procedures for product, operation, maintenance and repair of tooling, and customer manuals (409-series) provide setup, operation, and maintenance of tooling. Documents available which pertain to this product are:

408-2095	Hand Crimping Tool 69710-1
408-2498	Crimping Head Cross-Reference for Pneumatic Tools
408-3198	Inspection of AMPINNERGY System Power Contacts
408-3236	Installation of AMPINNERGY Wire-to-Board Connectors
408-3295	Preparing Reel of Contacts for Application Tooling
408-4190	C-Head Pneumatic Adapter 318161-1
408-4507	Extraction Tool 91308-1
408-7424	Checking Terminal Crimp Height or Gaging Die Closure
408-8040	Heavy Duty Miniature Quick-Change Applicators (Side-Feed Type)
408-8053	Miniature Quick Change Applicators
408-9640	Crimp Quality Monitor Applicators for Side-Feed and End-Feed Applications
408-9685	Extraction Tool 844751-2
408-9807	Crimping Die Assemblies 58490-1 and 58491-1
408-9816	Handling of Reeled Products
408-9905	Crimping Die Assemblies 58492-1 and 58493-1
409-5128	Basic AMP-O-LECTRIC* Model "K" Terminating Machines and Accessories
409-5842	AMP-O-LECTRIC Model "G" Terminating Machine 354500-[]
409-5862	626 Pneumatic Tool Assemblies 189721-2 and 189722-2
409-5878	AMPOMATOR* CLS IV+ Lead-Making Machine 356500-[]

3. REQUIREMENTS

3.1. Material

Plug housings are made of polycarbonate. Receptacle housings are made of polyphthalamide. The crimp type contacts are made of copper plated with tin. The solder type contacts are made of copper alloy plated with tin.

3.2. Storage

A. Ultraviolet Light

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

B. Reel Storage

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

C. Shelf Life

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

D. Chemical Exposure

Do not store connectors near any chemicals listed below as they may cause stress corrosion cracking in the contacts.

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

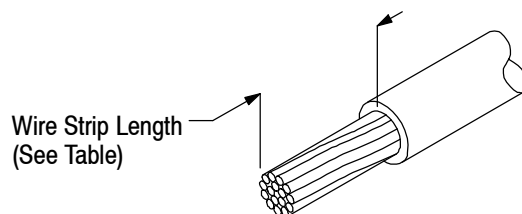
3.3. Wire Selection and Preparation

The crimp type contacts accept stranded copper wire sizes 18 through 10 AWG. The wire must be stripped to the dimension provided in Figure 2.



Do not nick, scrape, or cut the wire conductor during the stripping operation.

Note: Not to Scale



WIRE SIZE (AWG)	WIRE STRIP LENGTH	
	HAND TOOL	POWER UNIT
18-14	6.99-7.87 [.275-.310]	5.54-6.35 [.218-.250]
12-10	7.87-8.66 [.310-.341]	6.35-7.14 [.250-.281]

Figure 2

3.4. Crimped Contact Requirements



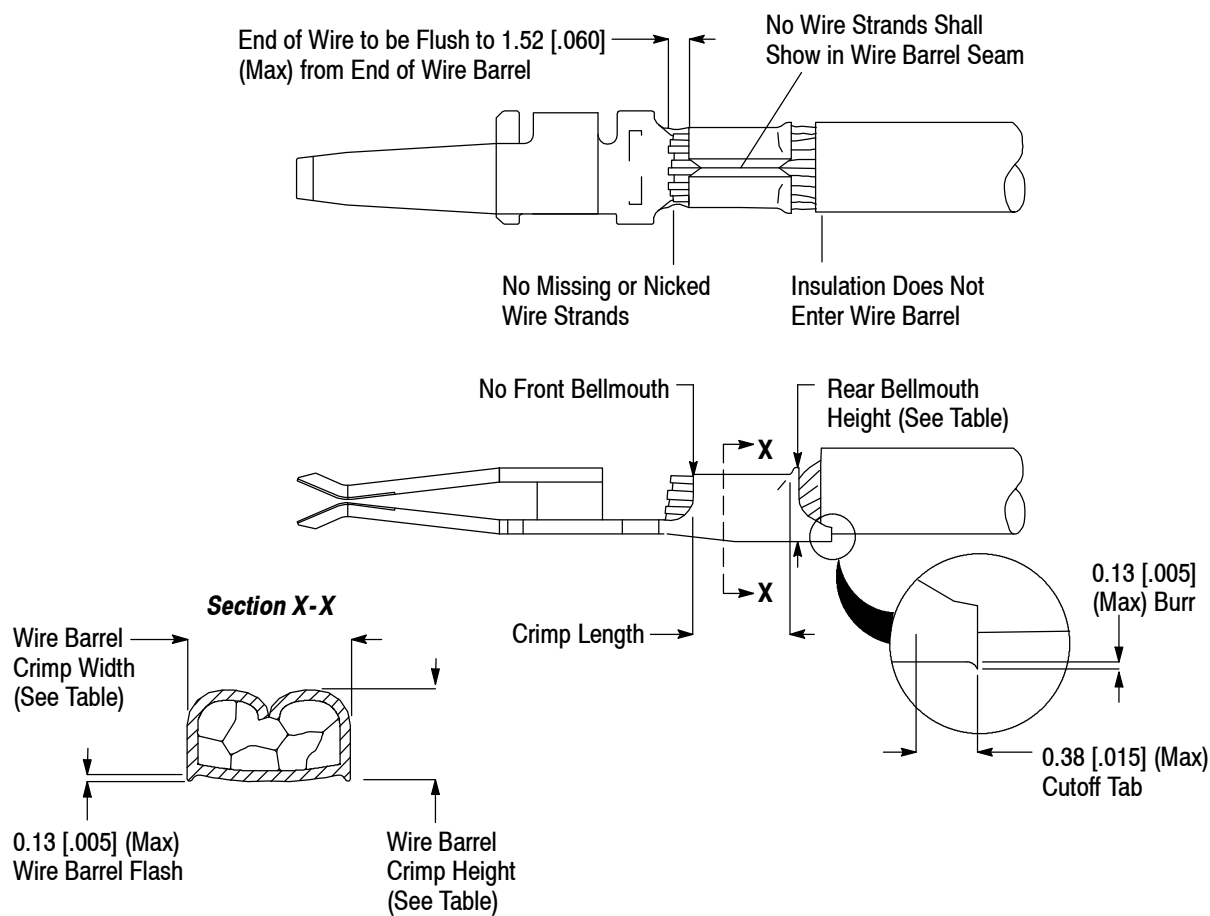
Wire insulation shall NOT be cut or broken during the crimping operation, nor shall the insulation be crimped into the contact wire barrel. Reasonable care should be taken to provide undamaged wire terminations.

A. Crimp Height

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 crimp height must be within the dimensions provided in Figure 3.

B. Crimp Length

Effective crimp length shall be defined as that portion of the wire barrel, excluding bellmouths, fully formed by the crimping tool. For optimum effectiveness, the crimp must be within the area shown in Figure 3.



WIRE SIZE (AWG)	WIRE BARREL CRIMP		REAR BELLMOUTH HEIGHT
	HEIGHT	WIDTH	
18	2.26-2.16 [.089-.085]	3.56 [.140]	2.97-2.46 [.117-.097]
16	2.36-2.26 [.093-.089]		3.07-2.57 [.121-.101]
14	2.54-2.44 [.100-.096]		3.25-2.74 [.128-.108]
12	2.97-2.87 [.117-.113]	4.57 [.180]	3.68-3.18 [.145-.125]
10	3.33-3.23 [.131-.127]		4.04-3.53 [.159-.139]

Figure 3

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.

C. Bellmouths

There shall be no front bellmouth. The rear bellmouth shall be evident and conform to the dimensions given in Figure 3.

D. Cutoff Tab and Burr

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

E. Wire Barrel Flash

The wire barrel flash shall not exceed the dimensions shown in Figure 3.

F. Conductor Location

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

G. Wire Barrel Seam

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

H. Twist and Roll

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

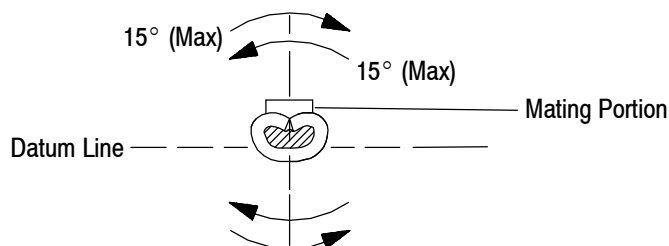


Figure 4

I. Straightness

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

(a) Up and Down

The crimped contact, including cutoff tab and burr, shall not be bent above or below the datum line more than the amount shown in Figure 5.

(b) Side-to-Side

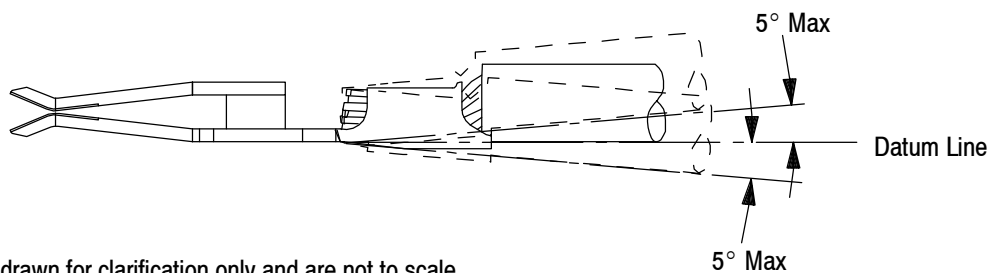
The side-to-side bending of the contact may not exceed the limits provided in Figure 5.

NOTE

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



Up and Down



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

Side-to-Side

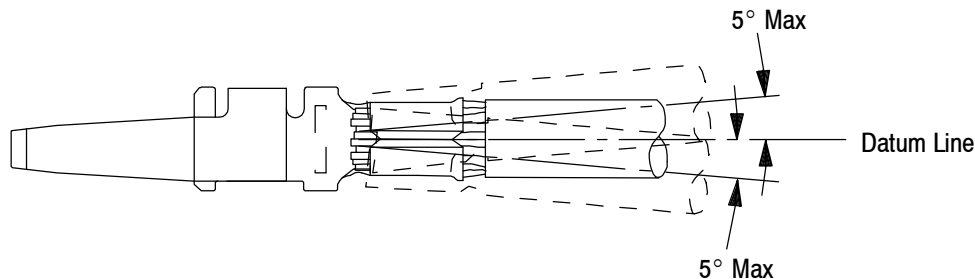


Figure 5

3.5. Strain Relief

When bending or forming wires, hold the wire bundle at least 6.35 mm [.250 in.] beyond the back of the housing before bending in any direction. If the installation is to be subject to bending forces, strain relief should be provided on the wire bundle approximately 25.4 mm [1.00 in.] from the back of the housing.



Do not bend unsupported wires as this may cause strain on the contacts inside the housing.

3.6. Placement of Crimped Contact in Connector

The contact must be inserted into the back of the plug and snapped into place. When fully inserted, the contact locking lance will engage the internal housing latch 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.

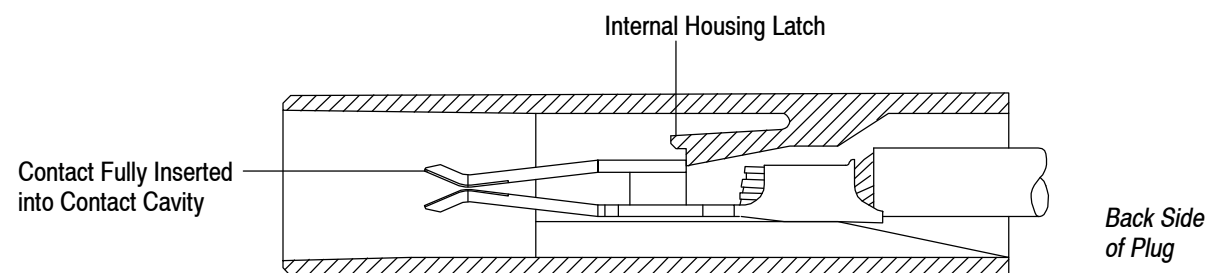


Figure 6

3.7. Make-First, Break-Last Ground Feature

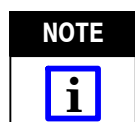
The first position (Position 1) on the plug can be used as a make-first, break-last ground. The depth of the dual-beam contact is deeper in this position, which causes that contact to mate first when mating the connectors.

3.8. Mating Connectors



Connectors should be handled only by the housing to avoid deformation, contamination, or damage to the contact solder tines.

The plug has integral locking latches that should be fully seated and latched to the receptacle after mating. The receptacle features locking tabs for positive latching to the mating plug. The dimension needed to ensure full mating of connectors must be considered when determining location and panel considerations when mounting receptacles. The mated dimension of the receptacle to the plug is provided in Figure 7.



Plugs will mate only with the appropriate receptacles; for example, a 4-position plug will not mate with an 8-position receptacle, it will only mate with a 4-position receptacle.

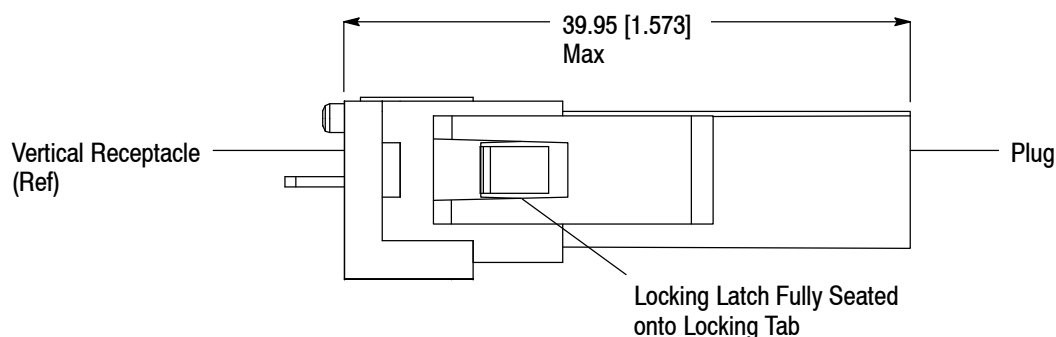


Figure 7

3.9. Polarization

The shape of the contact cavities on the mating face of the plug and the mating face of the receptacle prevent the accidental inversion of the mating connectors. In addition, the polarizing post on the vertical receptacle assists in proper positioning on the pc board.

3.10. PC Board

A. Material and Thickness

The board material shall be glass epoxy (FR-4, G-10). The pc board thickness range shall be 1.58 mm [.062 in.] to 3.175 mm [.125 in.]. Board thickness may vary depending upon the application, however, contact solder tine length is important for wave soldering operations. It is recommended that a minimum of 1.02 mm [.040 in.] of the contact solder tine should protrude through the pc board.

NOTE

Contact the Product Information Center or the Tooling Assistance Center at the 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 0.03 mm [.001 in.] over the length of the receptacle.

C. Trace Size, Thickness, and Spacing

The trace width and thickness (and whether it is double-sided using plated-through holes) has a significant effect on the performance of the connector system. In general, the board traces should be equivalent to the wire size used on the mating half of the connector. Size of board tracings is dependent on the intended operating voltage of the system.

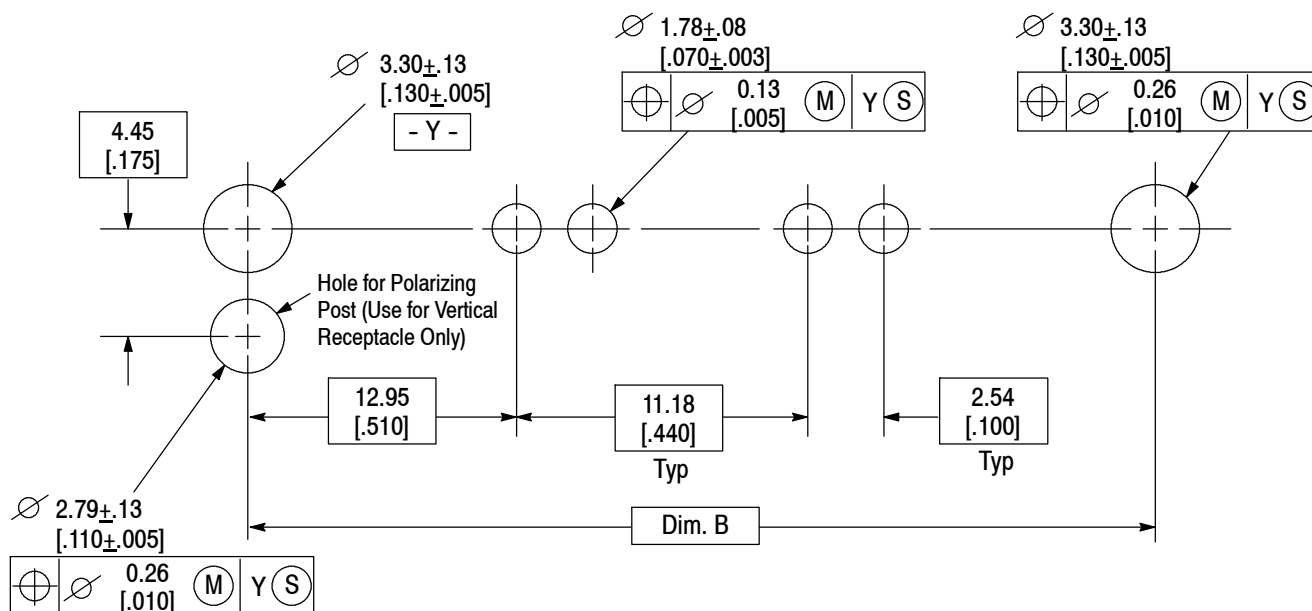
NOTE

Contact the Product Information Center or the Tooling Assistance Center at the number listed at the bottom of page 1 for technical assistance on specialized board designs and applications.

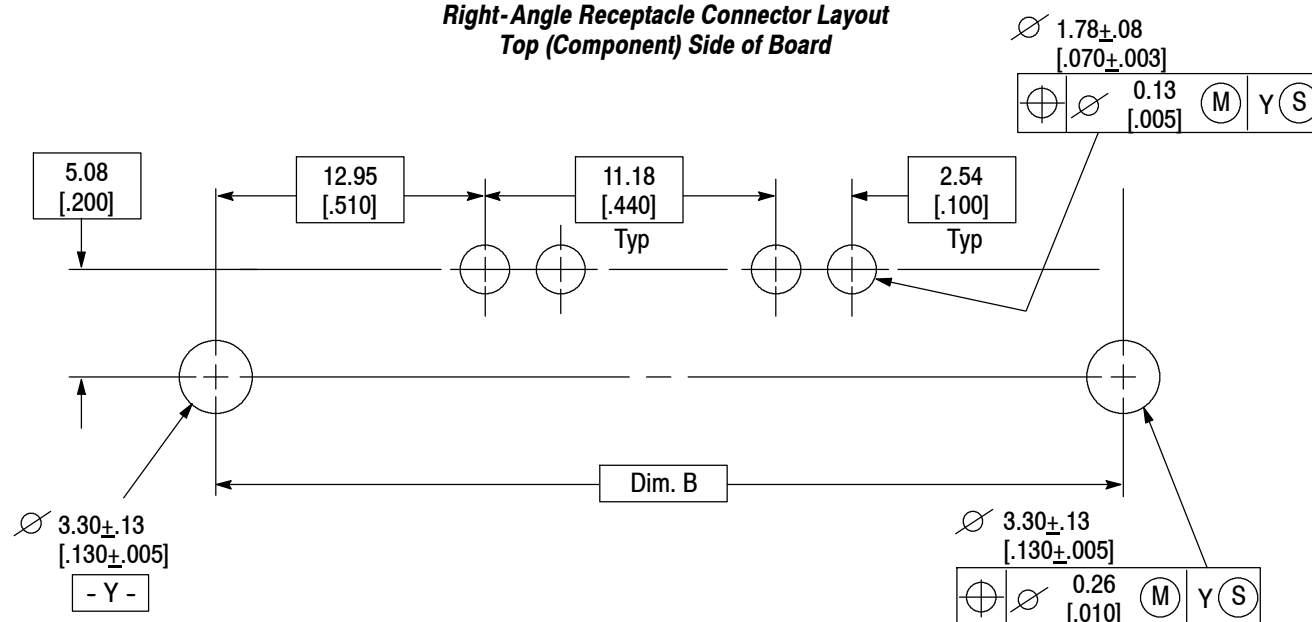
D. Layout

The mounting holes and contact holes in the pc board must be precisely located to ensure proper placement and optimum performance of the connector. Design the board using the dimensions provided in Figure 8.

Vertical Receptacle Connector Layout Top (Component) Side of Board



Right-Angle Receptacle Connector Layout Top (Component) Side of Board



CONNECTOR SIZE (Number of Positions)	DIMENSION B
2	39.62 [1.560]
3	50.80 [2.000]
4	61.98 [2.440]
5	73.15 [2.880]
6	84.33 [3.320]
7	95.50 [3.760]
8	106.68 [4.200]

Figure 8

E. Contact Holes

The holes in the pc board for the contact tines must be drilled and plated through to specific dimensions. See Figure 9.

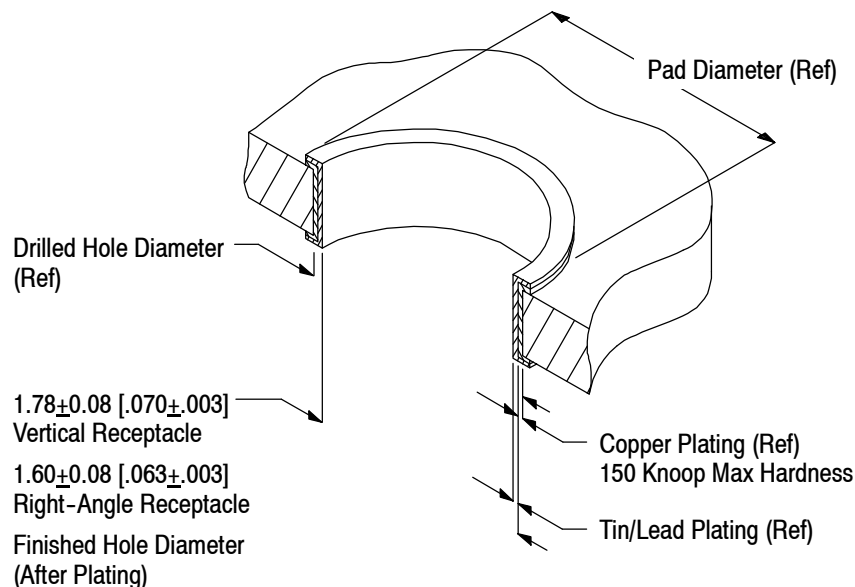


Figure 9

3.11. Connector Placement

NOTE



The receptacle should be handled only by the housing to prevent deformation or other damage to the contact solder tines.

The receptacle contact solder tines must be aligned with the appropriate holes in the pc board. All solder tines must start into the board before seating the receptacle on the pc board.

3.12. Mounting Connector to PC Board

The receptacle must be secured to the pc board prior to soldering with commercially available No. 6 $\times \frac{3}{16}$ -in. self-threading screws, or 4-40 screws, lockwashers and nuts through the mounting flanges using a maximum torque of .56 N•m [5 in. lbs] must be used. See Figure 10.

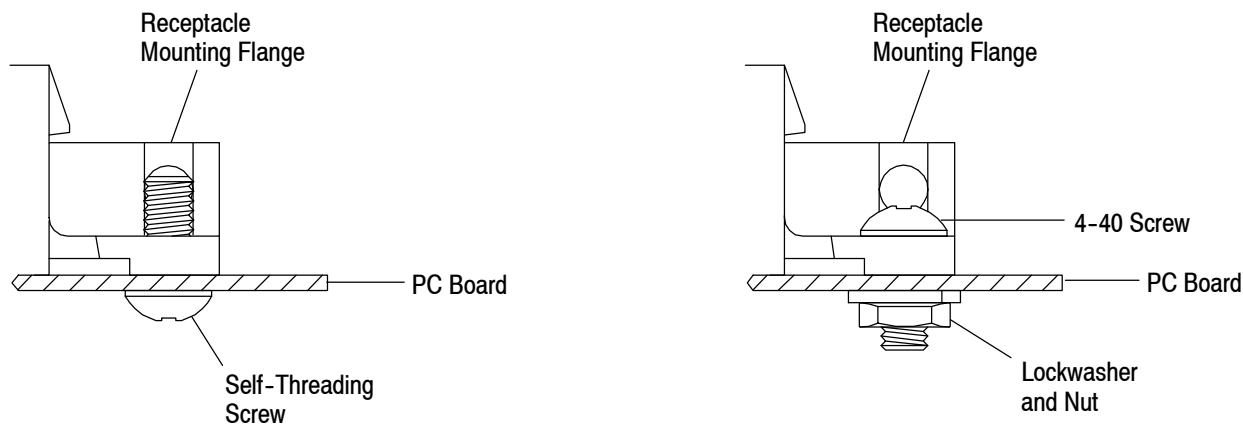


Figure 10

3.13. Soldering

A. Flux Selection

Contact solder tines must be fluxed prior to soldering. Flux must be compatible with the wave solder line, manufacturing, safety, and health guidelines. Flux that is compatible with these connectors are provided in Figure 11.

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

Figure 11

B. Process

The receptacles should be soldered using wave, non-focused infrared (IR) reflow, or equivalent soldering technique. TE recommends using SN60 or SN62 solder for these connectors. The temperature and time to which the housing is subjected is specified in Figure 12.

SOLDERING PROCESS	TEMPERATURE (Max)	TIME
Wave	260°C [500°F]	5 Seconds
Vapor Phase	215°C [419°F]	5 Minutes
Infrared Reflow (IR)	230°C [446°F]	5 Minutes

Figure 12

NOTE



Due to the many variables involved with reflow processes (component density, location, orientation, etc.), it is recommended that the user conduct trial runs under actual manufacturing conditions to ensure product/process compatibility. Call TE Engineering for baseline reflow parameters.

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 connectors for the time and temperature specified. See Figure 13.

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

Figure 13

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. TE does not recommend using Trichloroethylene and Methylene Chloride because of harmful occupational and environmental effects. Both are carcinogenic (cancer-causing).

NOTE



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

D. Drying

When drying cleaned assemblies and pc boards, make certain that temperature limitations do not exceed 0° to 220°C [32° to 428°F] for standard temperature products. Excessive temperatures and dwell time may cause housing degradation.

3.14. Checking Installed Connector

All solder joints should conform to those specified in Workmanship Specification 101-21 and all other requirements specified in this document. The receptacle must be seated on the pc board to the dimension shown in Figure 14.

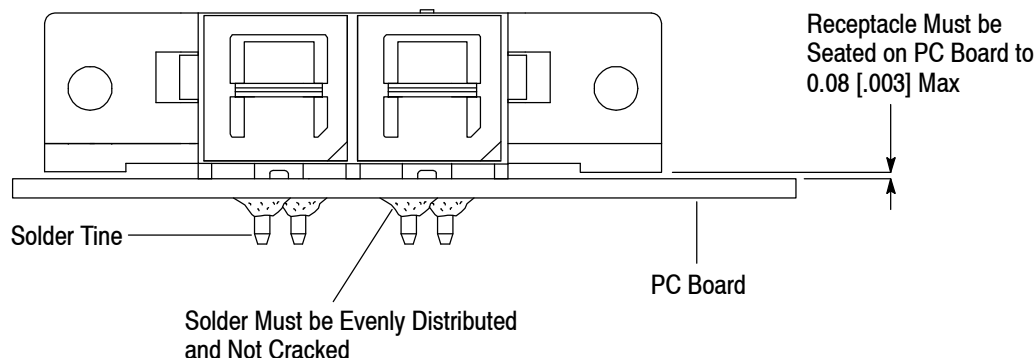


Figure 14

3.15. Connector Spacing

Care must be used to avoid interference between adjacent connectors and other components. The minimum allowable distance between receptacles to ensure proper mating is provided in Figure 15.

NOTE



The information provided is for manual placement of receptacles. If robotic equipment is used, other space allowances will be required for the grippers.

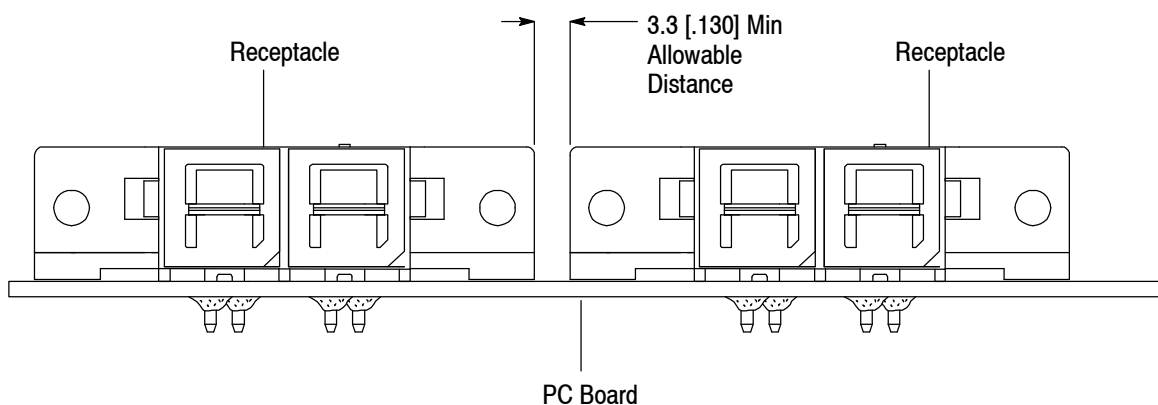
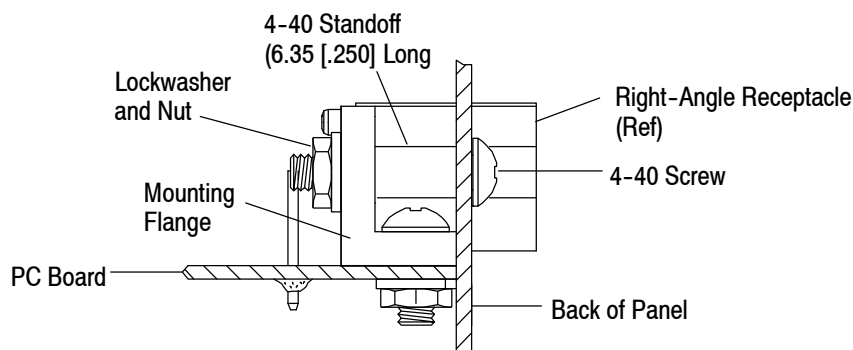


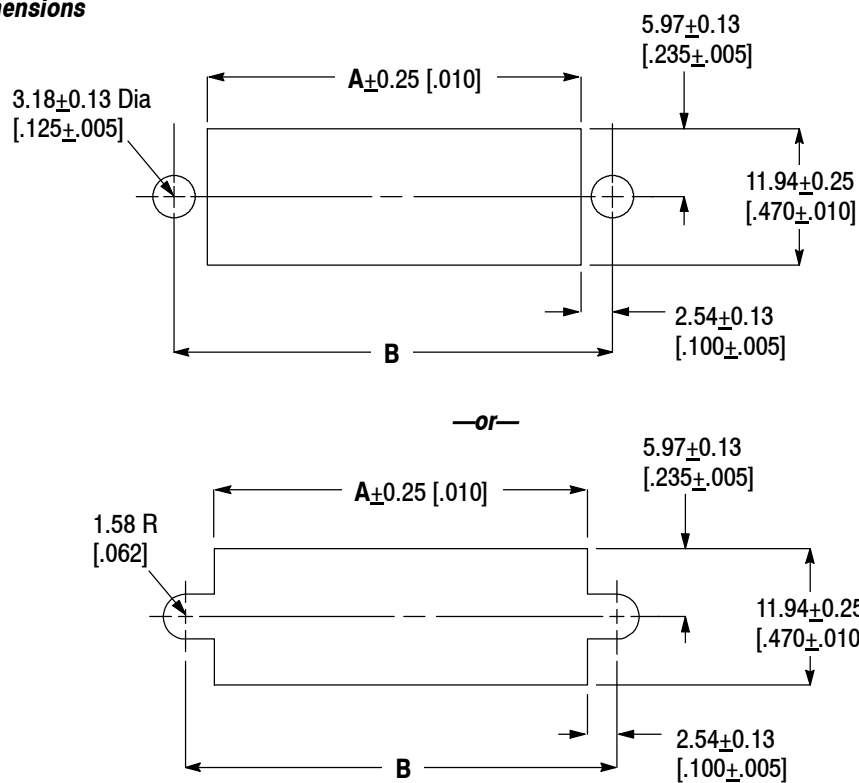
Figure 15

3.16. Panel Mounting

After the receptacle is secured to the pc board, the receptacle can be mounted to the back of the panel using commercially available 4-40 standoffs, 4-40 screws, lockwashers, and nuts. For required panel mounting dimensions, refer to Figure 16.



Panel Mounting Dimensions



CONNECTOR SIZE (Number of Positions)	DIMENSION	
	A	B
2	34.54 [1.360]	39.62 [1.560]
3	45.72 [1.800]	50.80 [2.000]
4	56.90 [2.240]	61.98 [2.440]
5	68.07 [2.680]	73.15 [2.880]
6	79.25 [3.120]	84.33 [3.320]
7	90.42 [3.560]	95.50 [3.760]
8	101.60 [4.000]	106.68 [4.200]

Figure 16

3.17. Special Applications

For special applications (selectively-loaded connectors, contact paralleling, etc.) not covered in the current-carrying capability curve and modifier chart found in Product Specification 108-1349, contact the Product Information number at the number at the bottom of page 1.

3.18. Repair

Damaged receptacles may be removed from the pc board by standard de-soldering methods. The connectors must be unmated by rocking them apart. It is recommended that one end should be free, but should not be pulled more than 5° before rocking the same end back. This will release the opposite end, and the two connectors will be freed or separated.

Damaged or worn contacts may be replaced provided there is sufficient slack, after restripping the wire, to insert the new contact into the plug. An extraction tool must be used to remove individual contacts from plugs (receptacle contacts are not removable). Refer to Section 5 for tooling information.

4. QUALIFYING SUPPORT

AMPINNERGY WTB Connectors are Listed by Underwriters Laboratories Inc. (UL) in File E28476, and Certified to CSA International in File LR7189-239.

5. TOOLING

Hand tools for manual application of loose piece contacts, and semi-automatic and automatic machines for power assisted application of strip form contacts are available to cover the full wire size range. Tooling part numbers and instructional material packaged with the tooling are shown in Figure 17.

NOTE



Modified designs and additional tooling concepts may be available to meet other application requirements. TE Tool Engineers have designed machines for a variety of application requirements. For assistance in setting up prototype and production line equipment, contact TE Tool Engineering through your local TE Representative or call the Tooling Assistance Center at the number at the bottom of page 1.

NOTE



AMP-O-ELECTRIC Model "K" Terminating Machine 565435-5 has been superseded by the Model "G" Terminating Machine 354500-1 for new applications. For existing applications, the Model "K" can still be used.

5.1. Robotic Equipment

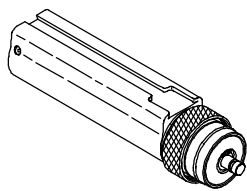
Robotic equipment for placement of the receptacles on a pc board must have a true position accuracy of 0.25 mm [.010 in.] to ensure proper location and insertion of the contact solder tines. This includes gripper and fixture tolerances as well as equipment repeatability. It must use the receptacle datum surface to ensure reliable placement.

5.2. PC Board Support

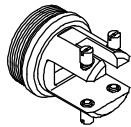
A pc board support must be used to prevent bowing of the pc board during insertion of the receptacle. It should have a flat surface with holes or a channel large enough to receive the contact solder tines during installation.

5.3. Extraction Tool

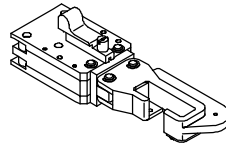
Extraction tools are designed to release the contact locking lance from the internal housing latch without overstressing the contact or housing latch when removing contacts from connectors.



626 Pneumatic Tooling
Assemblies 189721-2 and
189722-2 (409-5862)



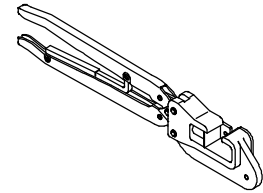
Tool Holder Assembly
189928-1
(408-2498)



C-Head Pneumatic
Adapter 318161-1
(408-4190)

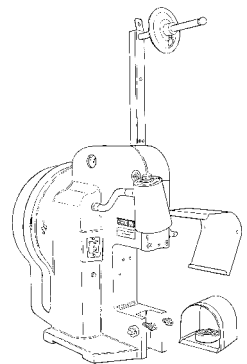


Crimping Die
Assembly
(See Table)

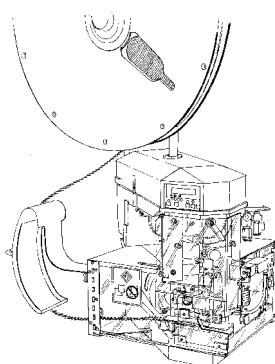


Hand Crimping
Tool 69710-1
(408-2095)

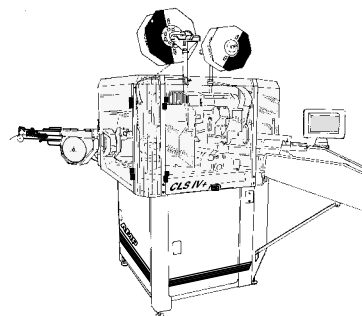
WIRE SIZE (AWG)	CRIMPING DIE ASSEMBLY	INSTRUCTION SHEET
18-16	58493-1	408-9905
14	58492-1	
12	58490-1	408-9807
10	58491-1	



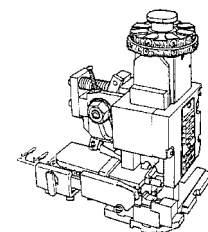
AMP-O-LECTRIC Model "K"
Terminating Machine
565435-5 (409-5128)



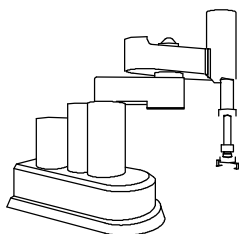
AMP-O-LECTRIC Model "G"
Terminating Machine 354500-1
(409-5842)



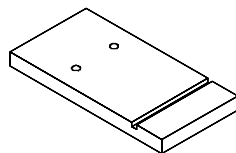
AMPOMATOR CLS IV+
Lead-Making Machine
356500-1 (409-5878)



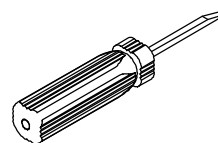
Heavy-Duty Miniature
Quick-Change Applicator
(See Table)



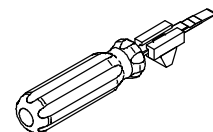
Robotic Equipment
(Designed Upon Request)



PC Board Support
(Must Be Custom Made)
(Refer to 408-6927)



Extraction Tool 844751-2
(408-9685)



Extraction Tool 91308-1
(408-4507)

WIRE SIZE (AWG)	POWER UNIT	CUSTOMER MANUAL	APPLICATOR	INSTRUCTION SHEET
18-14	356500-[]	409-5878	567403-1	408-8040
	565435-5	409-5128	567403-2	
	354500-1	409-5842		
12-10	356500-[]	409-5878	567256-3	408-8040
	565435-5	409-5128	567256-4	
	354500-1	409-5842		

Figure 17

6. VISUAL AID

Figure 18 shows a typical application of AMPINNERGY WTB 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.

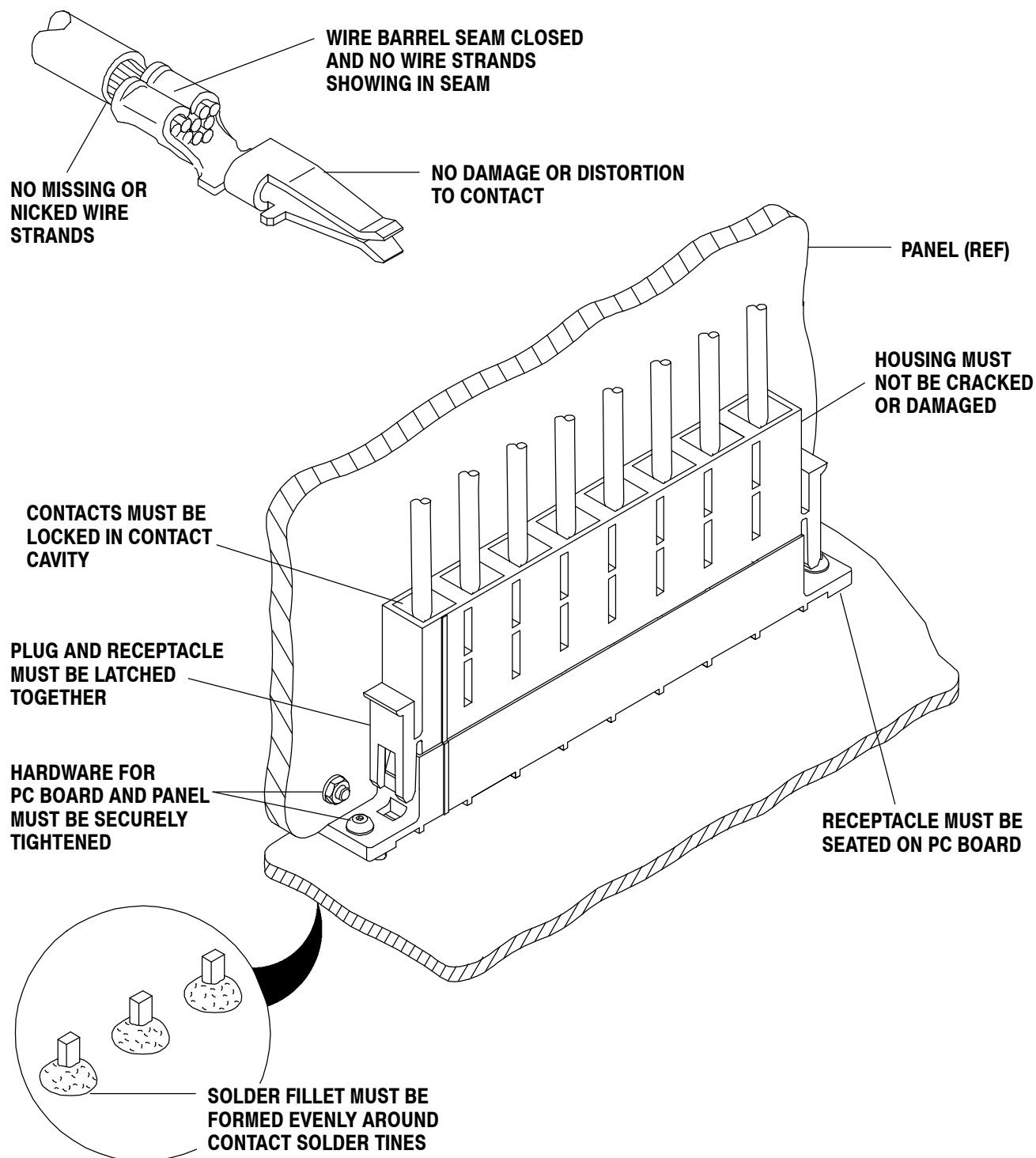


FIGURE 18. VISUAL AID