FLATPAQ* Modular Connectors

NOTE

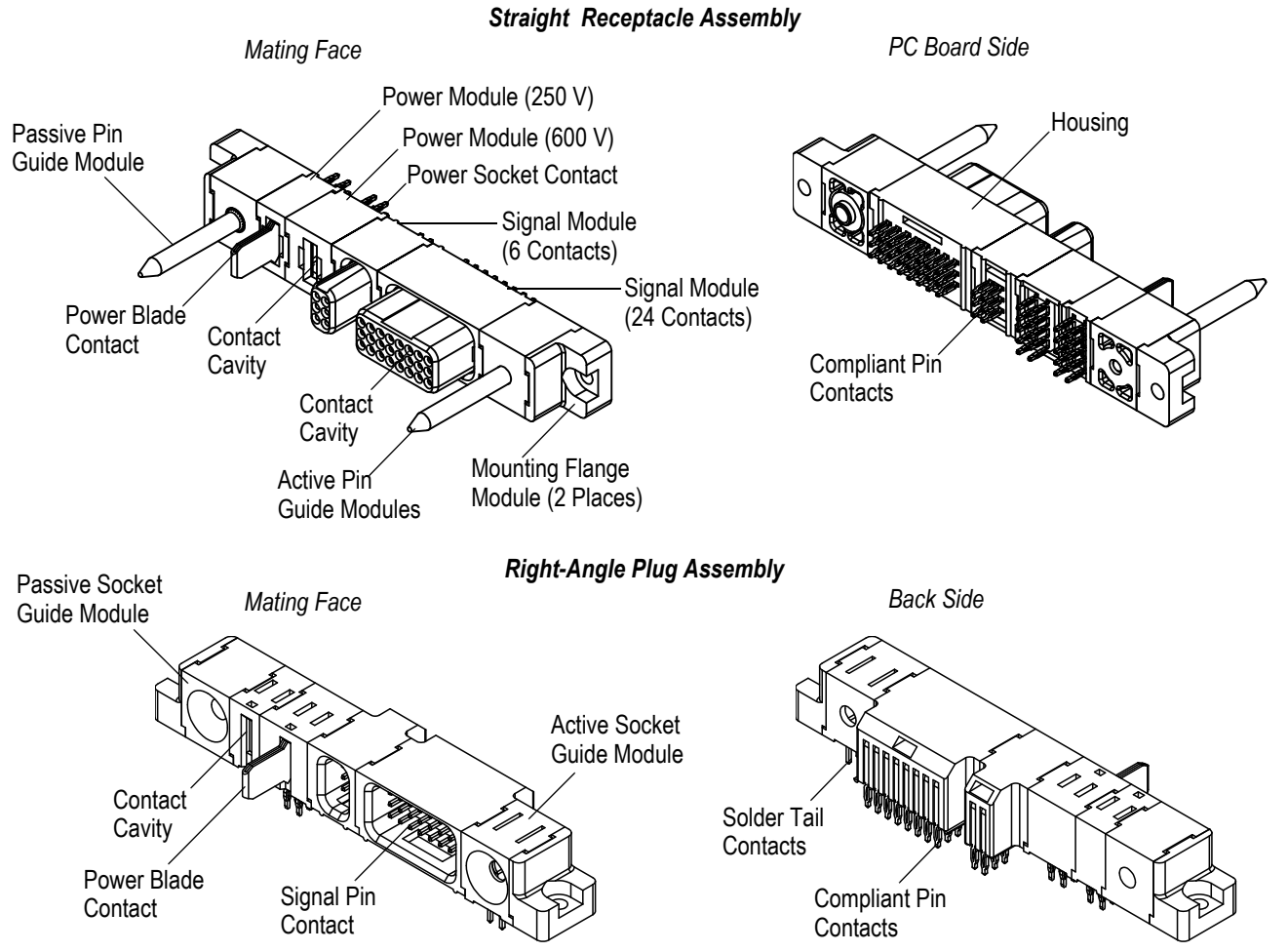
All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of ±0.13 [±.005] and angles have a tolerance of ±2°. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This application specification covers the requirements for application of FLATPAQ modular connectors onto printed circuit (pc) boards specifically designed for hot-pluggable AC and DC power board-to-board applications. These connectors consist of straight and right-angle receptacle assemblies and plug assemblies. The connectors have precision formed compliant pin (press-fit) or solder tail contacts. Each connector consists of power modules containing 1 row of power (either blade or socket) contacts, signal modules containing 3 rows of signal (either pin or socket) contacts. Guide modules and mounting flange modules are available.

The amount of power and signal contacts in a connector is customer specified. Custom configurations (arrangement of modules) can be designed to meet customer requirements. The connector configuration is described by reading left to right on the plug and right to left on the receptacle.

When corresponding with personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.



Restriction of Hazardous Substances (RoHS) Compliant

Figure 1

The connectors are available in two contact mating lengths to provide 3 levels of mating sequences: the power contacts have Level 1 mate-first break-last (MFBL), Level 2 standard, and Level 3 mate-last break-first (MLBF), and the signal contacts have Level 2 MFBL and Level 3 standard. Each power module has a contact centerline spacing of 7.50 [.295] for power modules rated at 250 V and 12.0 [.472] for power modules rated at 600 V. Each signal module has a contact centerline spacing of 2.50 [.0984].

Use of the guide modules provide blind mating, mating alignment, and polarization. The guide modules feature rounded edges for ease of mating and are positioned in the connector to prevent improper mating of connectors. The guide modules are available as electrically active or passive. The active pin guide module is secured to the pc board by an integral screw. The active socket guide module has solder tail contacts. The passive pin and passive socket guide modules are held to the pc board by adjacent modules.

Each mounting flange module has a hole (which accepts a commercially-available standard screw) used to secure the connector to the pc board.

The connectors are supplied in tray form for manual placement.

2. REFERENCE MATERIAL

2.1. Revision Summary

- Initial release of application specification

2.2. Customer Assistance

Reference Product Base Part Numbers 2085469 and 2085470 and Product Code D034 are representative of FLATPAQ modular connectors. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local Representative or, after purchase, by calling PRODUCT INFORMATION at the number at the bottom of page 1.

2.3. Drawings

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, call PRODUCT INFORMATION at the number at the bottom of page 1.

2.4. Manuals

Manual 402-40 can be used as a guide to soldering. This manual provides information on various flux types and characteristics 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 Specifications (108-series) provide product performance and test information. There are no documents available that pertain to this product.

2.6. Instructional Material

Instruction Sheets (408-series) provide product assembly instructions or tooling setup and operation procedures. There are no documents available that pertain to this product.

2.7. Standards

The connectors with compliant pin contacts are compatible with Military Standard (MIL-STD)-2166, “Connectors, Electrical, Compliant Pin."

3. REQUIREMENTS

3.1. Safety

Do not stack product shipping containers so high that the trays buckle or deform.

3.2. Material

The housing is made of glass-filled liquid polyphtalamide (PPA) crystal polymer. The signal contacts are made of brass alloy (solder tail) or phosphor bronze (compliant pin), and the power contacts are made of high-conductivity copper alloy utilizing ELCON* connector crown band technology. All contacts are underplated with nickel and plated with either tin or tin-lead. The mating area is gold plated.

3.3. Limitations

These connectors are designed to operate in a temperature range of -40 to 105°C [-40 to 221°F].

Voltage ratings for these connectors according to contact centerline spacing and circuit pad travel are given in Figure 2.

These voltage ratings are based on nominal circuit pad diameters of 1.12 [.0441] for press-fit application and 1.41 [.0556] for solder application and the Underwriters Laboratories Inc. (UL) Pollution Group II, Material Group IIIb. That material group has a comparative tracking index (CTI) of 100≤ CTI < 175.

CONTACT FUNCTION	MAXIMUM VOLTAGE RATING IN AC (RMS) OR DC				
	PITCH	WITHIN PRIMARY CIRCUITS	PRIMARY TO SECONDARY CIRCUITS	PRIMARY TO GROUND CIRCUITS	WITHIN SECONDARY CIRCUITS
Signal	2.5	—	—	—	125
Power	7.5	250	250	250	250
	12.0	600	—	600	600

Figure 2

3.4. Storage

A. Ultraviolet Light

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

B. Shelf Life

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

C. Chemical Exposure

Do not store connectors near any chemical 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

3.5. PC Board

A. Material and Thickness

The pc board material shall be glass epoxy (FR-4 or G-10). The minimum pc board thickness for press-fit application is 2.36 [.093]. The pc board thickness range for solder application is 1.57 through 3.18 [.062 through .125].

B. Hole Dimensions, Plating, and Durability

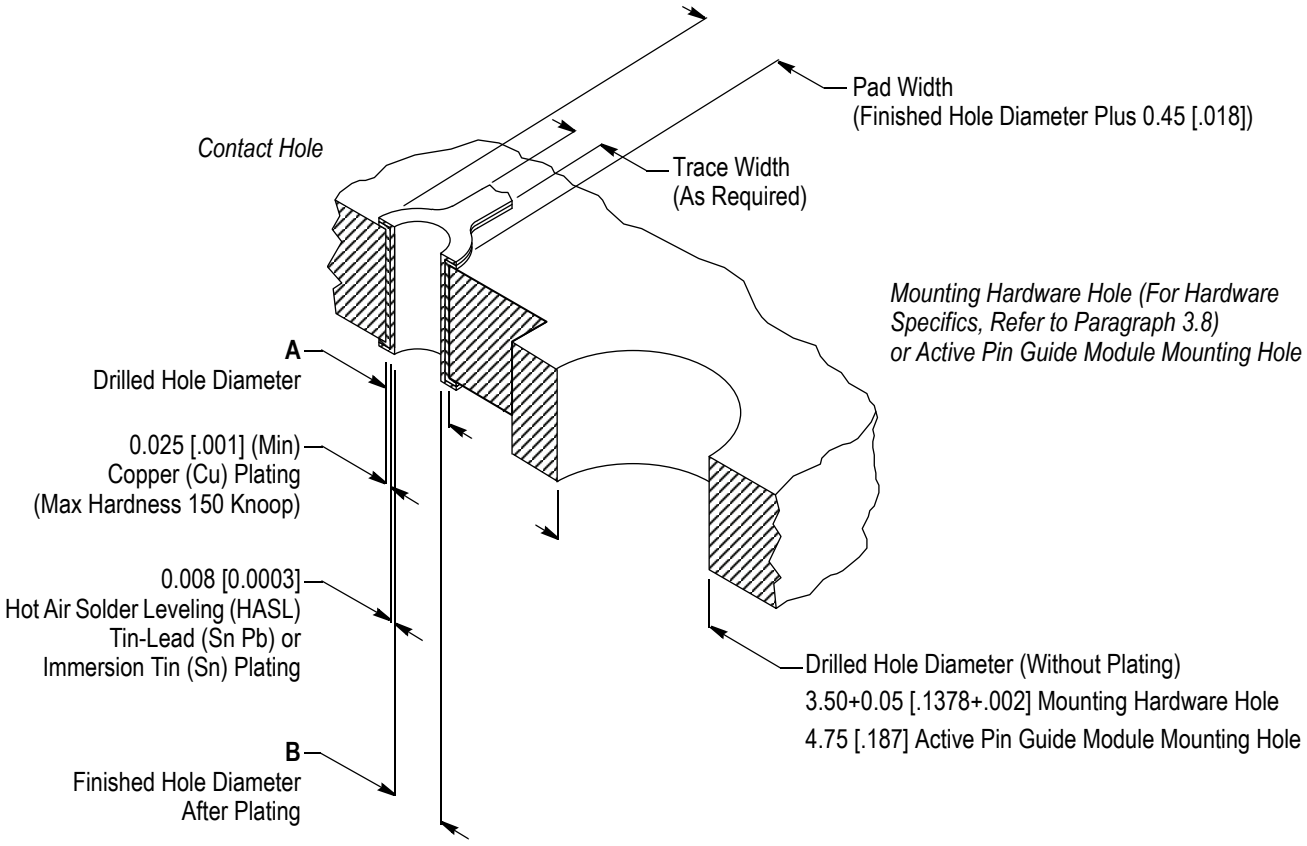
The contact holes must be drilled and plated through to specific dimensions to prevent stubbing during placement of the connector on the pc board and to ensure optimum continuity for circuits. If applicable, holes for mounting hardware and the screw of the active pin guide modules may be used with or without plated through holes. The drilled hole size, plating types, plating thickness, and finished hole size must be as stated to provide unrestricted insertion. See Figure 3.

For connectors with press-fit contacts, the contact holes cannot withstand connector removal more than three times. The radius of any pc board hole must not increase more than 0.038 [.0015] or decrease less than 0.051 [.002].

C. Pads

The pc board circuit pads must be solderable in accordance with Test Specification 109-11.

Hole Dimensions and Plating



APPLICATION	DIMENSION	
	A	B (Nominal, Ref)
Press-Fit	1.15 [.0453] Min	1.02 [.040]
Solder	0.97-1.01 [.0382-0.398]	0.90 [.0354]

Figure 3

D. Layout

The holes in the pc board must be precisely located to ensure proper placement and optimum performance. The pc board layout must be designed using the dimensions provided on the customer drawing for the specific connector. Samples of recommended pc board layouts are shown in Figure 4.

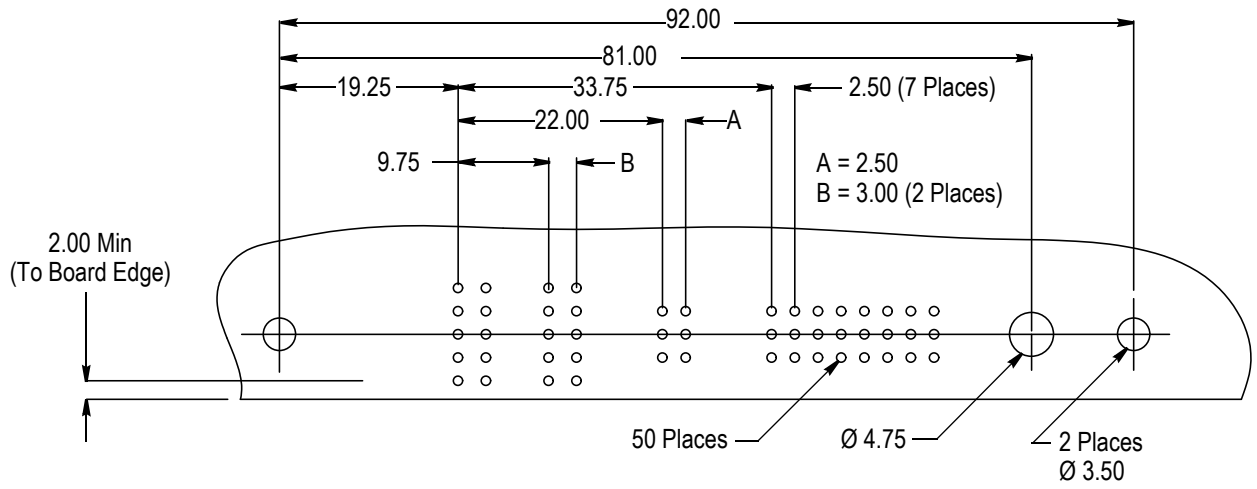
3.6. Connector Spacing

Care must be used to avoid interference between adjacent connectors and other components.

Sample Recommended PC Board Layout
(As Viewed from Connector Side)

Note: Not to Scale

Straight Receptacle Assembly



Right-Angle Plug Assembly

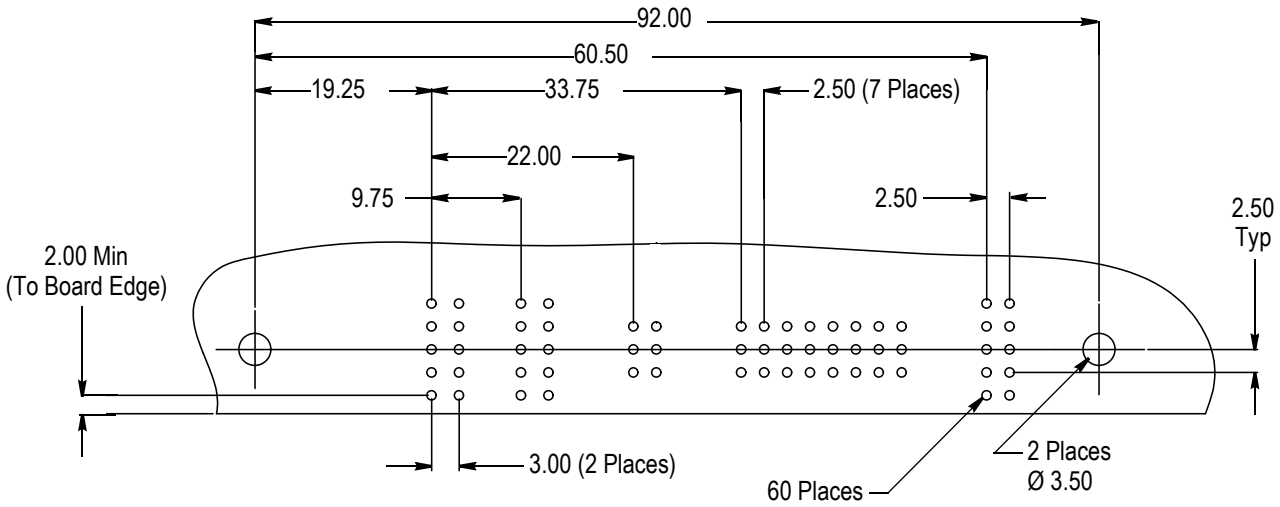


Figure 4

3.7. Connector Placement

NOTE

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

A. Registration

When placing connectors on the pc board, contacts and, if applicable, mounting screws must be aligned and started into the matching holes before seating the connector onto the pc board.

B. Insertion Force

The maximum force required per contact is 133.3 N [30 lb].

3.8. Mounting Hardware

Mounting flange modules can be secured to the pc board using commercially-available standard screws. The screw size and maximum torque (applied to the mating face of the connector) is provided in Figure 5.

NOTE

Typically, this method of mounting (or hold-down) serves connectors used for soldering application. The hardware must be installed BEFORE soldering.

SCREW		MAXIMUM TORQUE (Nm [in.-lb]) (Applied to Mating Force)
SIZE	HEAD DIAMETER (Maximum)	
4-40 or M3	7.37 [.290]	0.57 [5]

Figure 5

3.9. Soldering

Observe guidelines and procedures when soldering contacts. Contact solder tails must be soldered, cleaned, and dried according to the following:

A. Flux Selection

Contact solder tails 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. Flux that is compatible with these connectors are provided in Figure 6.

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

Figure 6

B. Solder Mask

A solder mask MUST be applied over the trace of any connector component hanging below the bottom of the pc board to prevent bridging and wicking of solder away from the contact solder tines. A heat-resistant solder mask is recommended.

CAUTION

If bridging or wicking occurs, the trace must be repaired.

KESTER and ALPHA are trademarks.

C. Process

The connectors must be soldered using lead-free wave soldering or equivalent soldering technique. Refer to Manual 402-40 for soldering guidelines. The temperatures and exposure time shall be as specified in Figure 7.

It is recommended that the pc board be placed on its side during the soldering process.

SOLDERING PROCESS	TYPE	WAVE TEMPERATURE	TIME (At Maximum Temperature)
Wave	Lead-Free	265°C [509°F]	10 Seconds

Figure 7

D. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. Cleaners must be free of dissolved flux and other contaminants. Common cleaning solvents that will not the affect connectors for the time and temperature specified are listed in Figure 8.

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 is not recommended because of harmful occupational and environmental effects. Both are carcinogenic (cancer-causing).

CAUTION

Even when using "no clean" solder paste, it is imperative that the contact interface be kept clean of flux and residue, since it acts as an insulator. Flux may migrate under certain conditions with elevated temperatures and therefore, cleaning is necessary.

The cleaning process must be accomplished by hand.

CAUTION

Lubricant at the mating interface MUST NOT be removed.

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	Solvent	1	
Isopropyl Alcohol	Solvent	5	
KESTER 5778	Aqueous	5	
KESTER 5779	Aqueous	5	
LONCOTERGE 520	Aqueous	5	
LONCOTERGE 530	Aqueous	5	
Terpene Solvent	Solvent	5	

Figure 8

NOTE

If a particular solvent is not listed, contact PRODUCT INFORMATION at the number at the bottom of page 1.

BIOACT, CARBITOL, and LONCOTERGE are trademarks.

E. Drying

When drying cleaned connectors and pc boards, make certain that temperature limitations are not exceeded: -40 to 105°C [-40 to 221°F]. Excessive temperatures may cause housing degradation.

3.10. Checking Installed Modules

A. Power and Signal Press-Fit Application

The entire "eye" of each contact must be within the pc board hole. The housing must be seated on the pc board within the dimension provided in Figure 9 (see Detail A).

B. Power and Signal Soldering Application

All solder joints should conform to those specified in Workmanship Specification 101-21 and all other requirements specified in this document. Solder fillets must be evenly formed around each contact solder tail. There must be no visible skips or voids. The housing must be seated on the pc board within the dimension provided in Figure 9 (see Detail B).

Checking Installed Connector

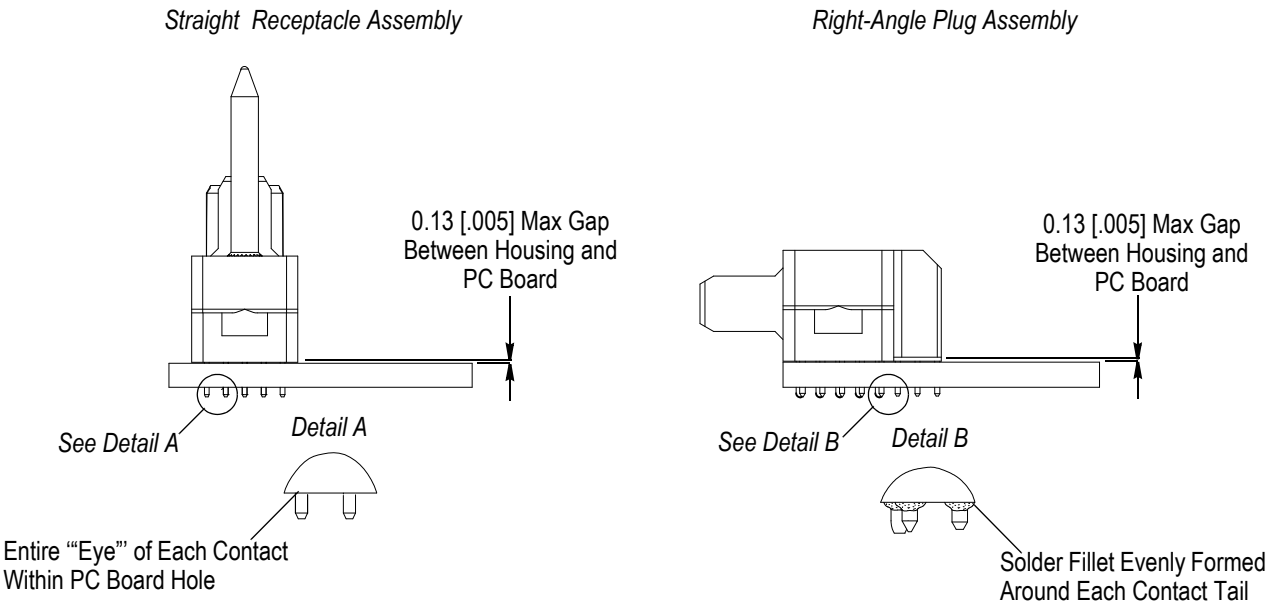


Figure 9

C. Guide Modules

The screw of the active pin guide modules must be secured to the pc board.

Guide modules with solder tail contacts must be fully seated on the pc board and solder fillet must be evenly formed around each contact tail.

3.11. Connector Mating

CAUTION

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

A. Polarization

When mating the connectors, if guide modules are used, polarization is provided by matching the guide pins of the receptacle with the guide sockets of the plug.

B. Mating Force

The maximum amount of force per contact to mate connectors is given in Figure 10.

CONTACT	MAXIMUM MATING FORCE PER CONTACT
Power	17.8 N [4.0 lb-force]
Signal	1.40 N [5.0 oz-force]

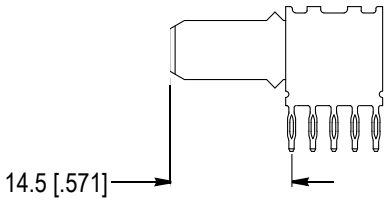
Figure 10

C. Mating Lengths

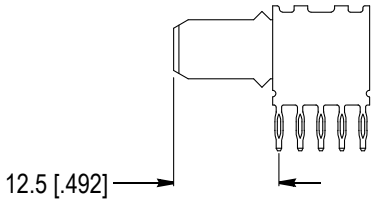
Contact mating lengths available for the connectors are listed in Figure 11.

Mating Length for Power Contacts
(Centerline of First Contact to End of Lead-In)

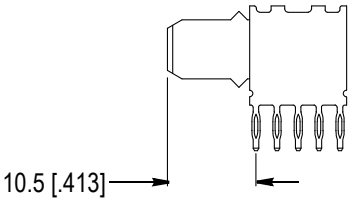
Mating Level 1‡



Mating Level 2

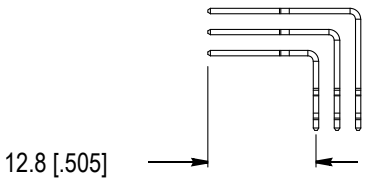


Mating Level 3

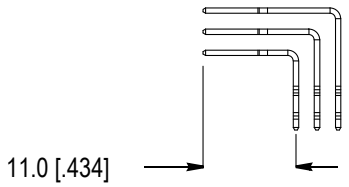


Mating Length for Signal Contacts
(Centerline of First Contact to End of First Contacts)

Mating Level 2‡



Mating Level 3



‡ The offset distance between Mating Level 1 for power contacts and Mating Level 2 for signal contacts is not enough to consider these as separate levels.

Note: Not to Scale

CONTACT TYPE	MATING LENGTH	MATING LEVEL
Power	MFBL (Pre-Mate)	1
	Standard	2
	MLBF (Post-Mate)	3
Signal	MFBL (Pre-Mate)	2
	Standard	3

Figure 11

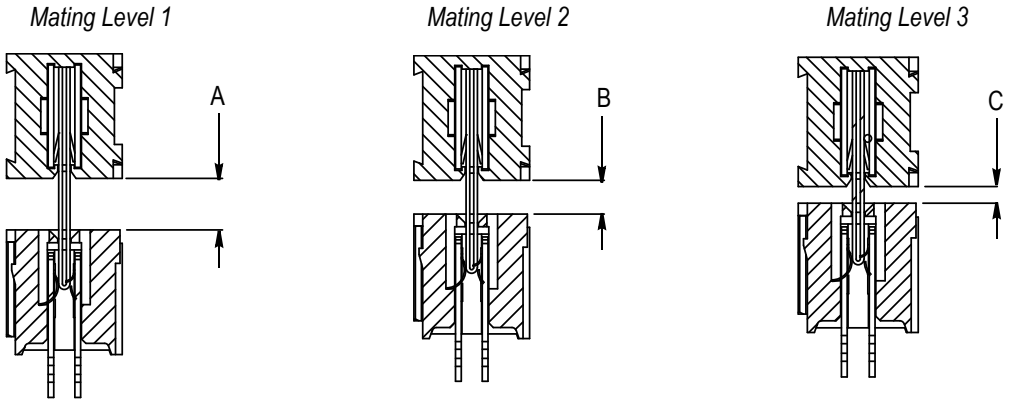
D. Mating Distance and Wipe Length

The connectors provide sequencing among contacts with 3 mating levels. The mating distance, measured from the receptacle mating face to the plug mating face at the point of electrical engagement, depends on the contact (power or signal) and mating length (standard, MFBL, or MLBF) of the mating connectors.

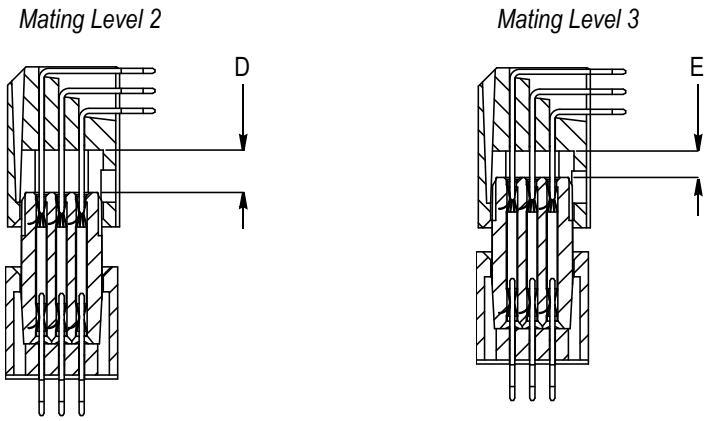
Wipe length for these connectors is defined as that portion (length) of the mating contacts that touches (wipes) from the point of engagement to the point of being fully mated. The wipe length depends on the contact (power or signal) and mating length (standard, MFBL, or MLBF) of each individual contact.

The mating distance and minimum wipe length at the mating level for power and signal contacts is listed in Figure 12.

Mating Distance for Power Contacts



Mating Distance for Signal Contacts



Note: Not to Scale

CONTACT TYPE	MATING LENGTH	MATING LEVEL	MATING DISTANCE			WIPE LENGTH (Min)
			DIMENSION	FIRST MATE	RELIABLE MATE	
Power	MFBL (Pre-Mate)	1	A	7.0	5.5	1.5
	Standard	2	B	5.0	3.5	1.5
	MLBF (Post-Mate)	3	C	3.0	1.5	1.5
Signal	MFBL (Pre-Mate)	2	D	5.7	4.9	0.8
	Standard	3	E	3.7	2.9	0.8

Figure 12

E. Misalignment

When mating connectors, side-to-side and up-and-down misalignment is allowed to the dimensions given in Figure 13.

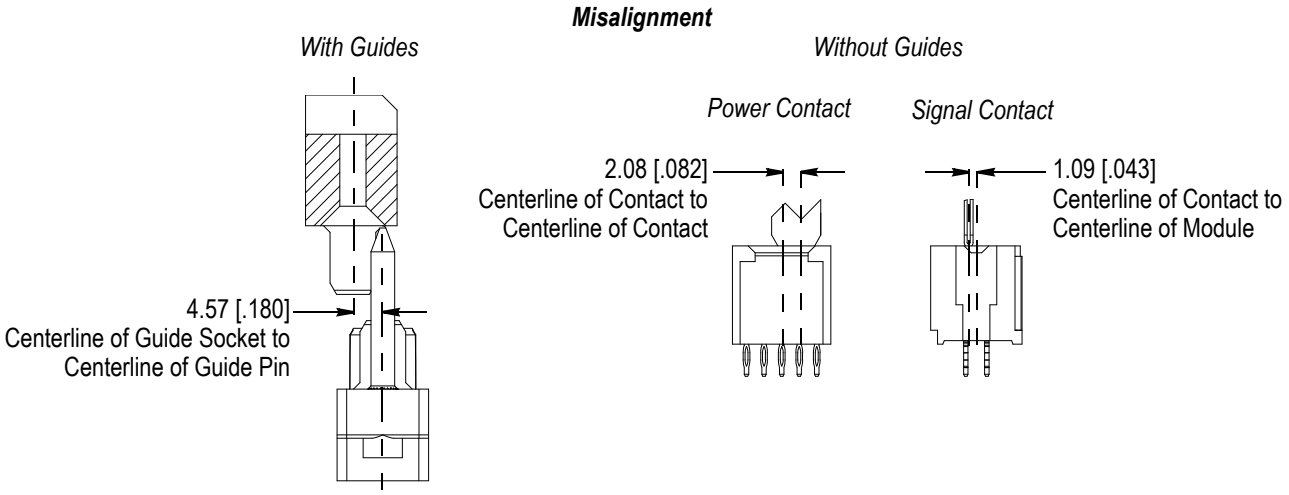


Figure 13

F. Mating Dimension

When fully engaged, the dimension between the first contact of the receptacle and the first contact of the plug must meet the dimension given in Figure 14.

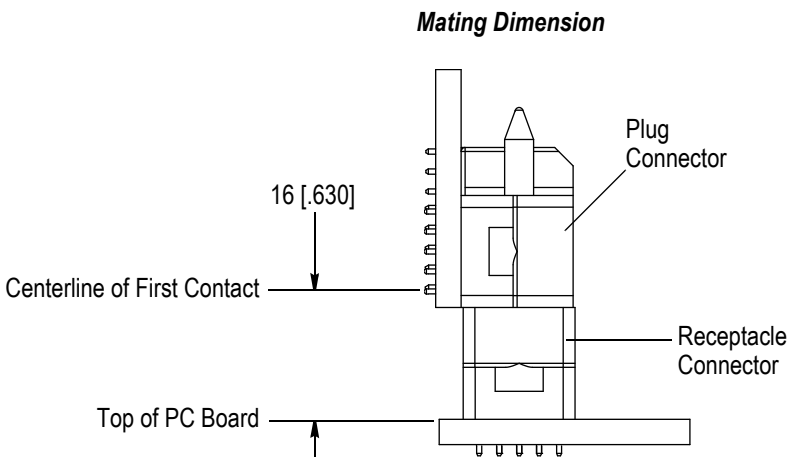


Figure 14

G. Durability

The connectors can withstand 500 mating cycles.

3.12. Circuit Testing

Unmated receptacles and mated plugs must be tested against hazardous voltages using the test probe specified in UL 1950. Specific areas of the connector must be tested as indicated in the specification.

3.13. Unmating

The minimum amount of force per contact to unmate connectors is given in Figure 15.

CONTACT	MAXIMUM UNMATING FORCE PER CONTACT
Power	4.4 N [1.0 lb-force]
Signal	0.1 N [.5 oz-force]

Figure 15

3.14. Connector Removal

A. Press-Fit Application

These connectors must be removed from the pc board using a push bar (or flat rock) and pc board support.

The minimum amount of force required per contact is 44.4 N [10 lb].

CAUTION

For repairability, the tips of the contacts must extend below the surface of the pc board by at least 1.02 [.040]; if not, the connector MUST NOT be removed from the pc board.

B. Soldering Application

These connectors must be removed from the pc board by standard de-soldering methods. After removal from the pc board, the connector MUST NOT be re-used.

3.15. Repair

These connectors are not repairable. Damaged or defective connectors MUST NOT be used.

4. QUALIFICATION

No qualifying support for FLATPAQ modular connectors was defined at the time of publication of this document.

5. TOOLING

5.1. Soldering Application

No tooling is required for placement of the connectors being used for soldering application.

5.2. Press-Fit Application

Tooling needed to seat connectors with press-fit contacts are shown in Figure 16.

A. Application Tooling

The application tooling (such as a manual arbor press) used to seat these connectors must provide sufficient amount of downward force to insert the contacts into the pc board holes.

B. PC Board Support

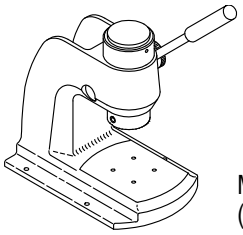
A pc board support must be used to prevent bowing of the pc board during the placement of these connectors on the pc board. The board support must have a flat surface with holes or a channel large enough and deep enough to receive any protruding components. The pc board must be secured to the board support to prevent movement of the board during seating.

The board support must also be used when removing these connectors from the pc board.

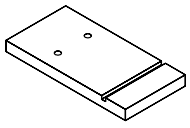
C. Flat Rock Tooling

Commercially available bar stock (flat rock tooling) with a flat surface large enough to cover all contacts must be used with the application tooling to seat and remove these connectors.

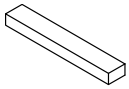
For removing these connectors from the pc board, it is suggested that the pc board be supported from the connector side.



Manual Arbor Press
(Typical)



PC Board Support
(Must Be Custom Made)



Flat Rock Tooling
(Must Be Custom Made)

Figure 16

6. VISUAL AID

The illustration below shows a typical application of FLATPAQ modular 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.

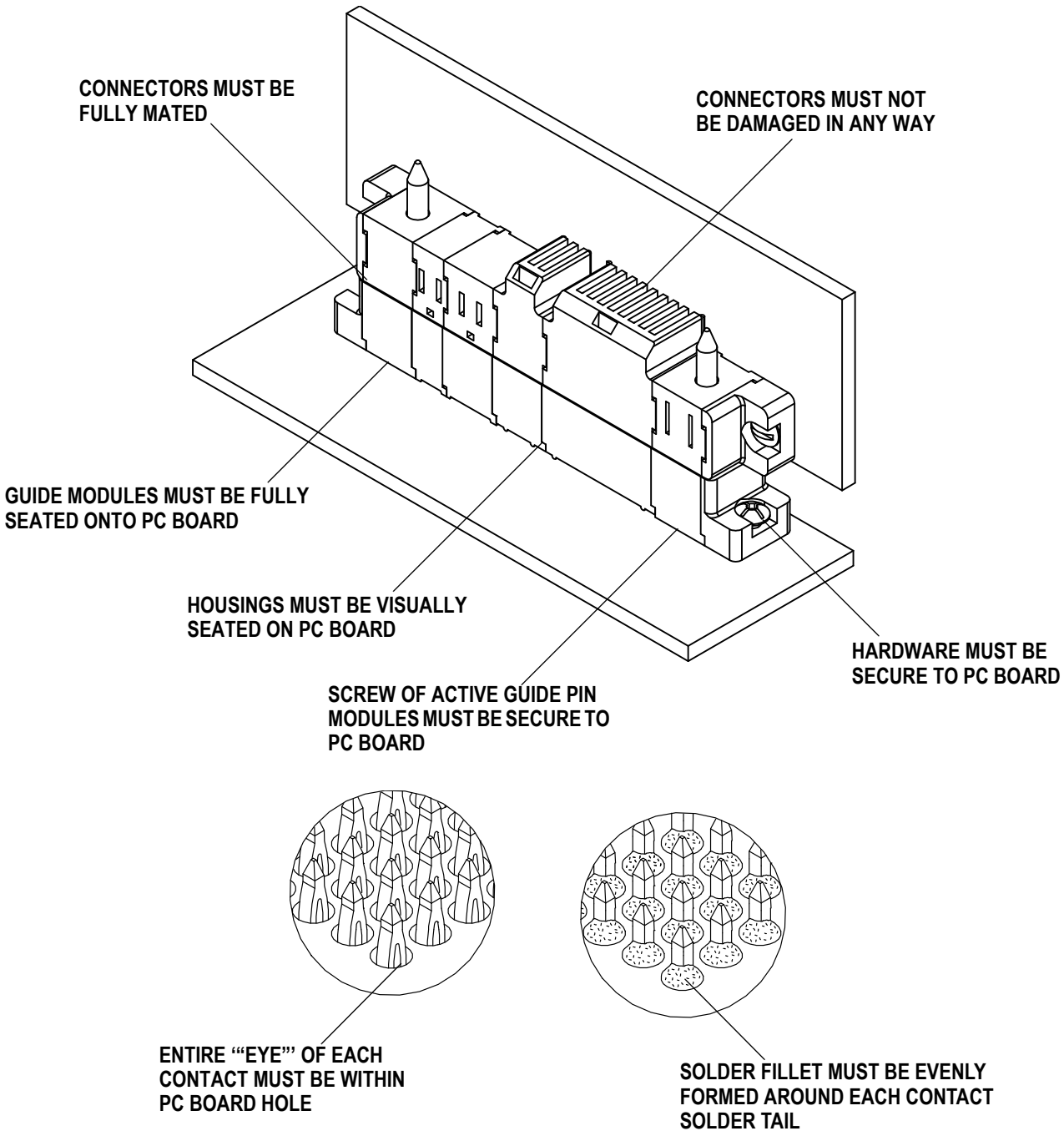


Figure 17. VISUAL AID