

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>1 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

## 1.0 OBJECTIVE

This specification provides information and requirements regarding customer application of PwrMAX® Connector System. This specification is intended to provide general guidance for application process development. It is recognized that no single application process will work under all customer scenarios and that customers will develop their own application processes to meet their needs. However, if these application processes differ greatly from the one recommended, AFCI cannot guarantee results.

## 2.0 SCOPE

This specification provides information and requirements regarding customer application of PwrMAX® connector system. Configurations include:

**TABLE 1**

<b>PwrMAX®</b>	<b>Application</b>	<b>Description of available configuration</b>
Connector with Guide Ends (Legacy version)	Board connector mates to Board connector Or Board connector mates to Board connector with cable configuration	Right Angle Plug, Solder or Press-Fit Type
		Right Angle Receptacle, Press-Fit Type
		Vertical Receptacle, Solder or Press-Fit Type
		Right Angle Receptacle, Press-Fit Type with Cable configuration
		Vertical Receptacle, Solder or Press-Fit Type with Cable configuration
Connector with Guide Ends (G2 version)	Board connector mates to Board connector	Right Angle Plug, Solder or Press-Fit Type
		Right Angle Receptacle Press-Fit Type
		Vertical Receptacle, Solder or Press-Fit Type
Connector with Guideless Ends (G2 version)	Board connector mates to Board connector	Right Angle Header, Solder or Press-Fit Type
		Right Angle Receptacle, Press-Fit Type
		Vertical Receptacle, Solder or Press-Fit Type

## 3.0 DRAWINGS AND APPLICABLE DOCUMENTS

- AFCI PRODUCT SPECIFICATION GS-12-1314
- AFCI PRODUCT DRAWINGS 10141036, 10141022, 10141042, 10143473, 10143475, 10143481, 10143483 etc.

Product drawings and AFCI's GS-12-1314 Product Specification are available at <https://www.amphenol-icc.com/> In the event of a conflict between this application specification and the drawing, the drawing will take precedence. Customers are advised to refer to the latest revision level of AFCI product drawings for appropriate details.

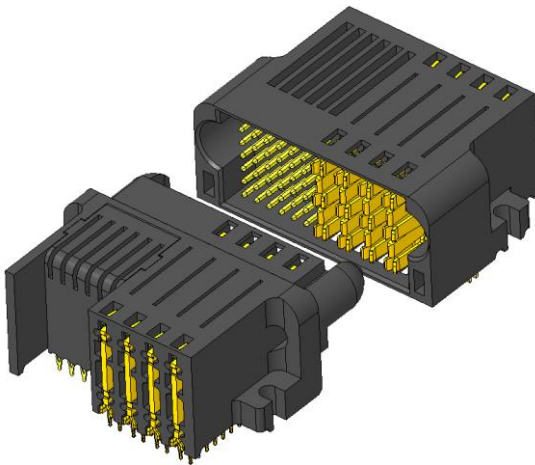
NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>2 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

#### 4.0 APPLICATION REQUIREMENTS

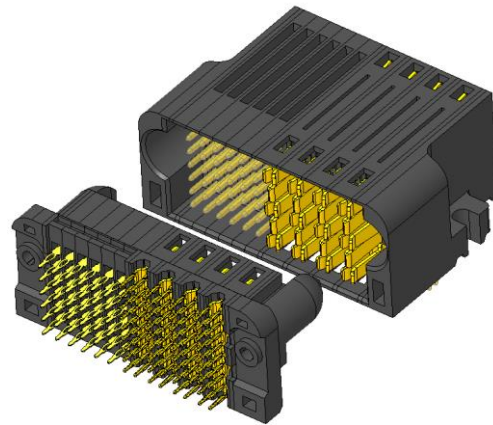
This document is meant to be an application guide. If there is a conflict between the product drawings and specifications, the drawings take precedence.

#### 4.1 Product Application

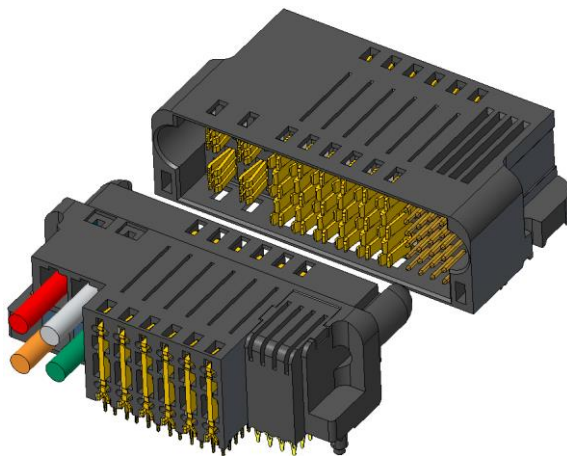
PwrMAX® board connector has two options for application – Board-to-Board & Board-to-Board connector with Cable configuration.



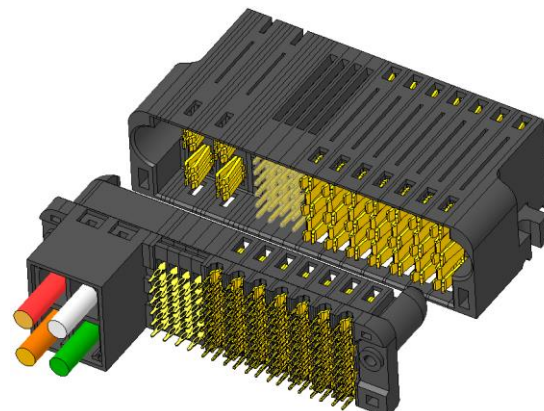
**Figure 1**  
Board-to-Board  
R/A Plug to R/A Receptacle



**Figure 2**  
Board-to-Board  
R/A Plug to Vertical Receptacle



**Figure 3**  
Board-to-Board with cable configuration  
R/A Plug to R/A Receptacle



**Figure 4**  
Board-to-Board with cable configuration  
R/A Plug to Vertical Receptacle

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>3 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

PwrMAX® has two options for connection to Printed Circuit Boards -- Press Fit and Solder to Board. The PwrMAX® Solder contacts are compatible with wave soldering. They are versatile with many configurations to fit the individual needs of the client and are less expensive than press-fit. The Press Fit connection eliminates the need for soldering, achieving a connection to the board through the normal forces between the press fit tail and the plated through hole. The number of signal and power contacts depends on the customer application.

## 4.2 COMPATIBILITY

### 4.2.1 PwrMAX® Hard Metric product compatibility

PwrMAX® High Power Module Connectors are compatible with hard metric products such as Metral, AirMax VS, ZipLine and XCode high speed connector system. The distance between backplane and front edge of the daughter card is 12.5mm.

### 4.2.2 PwrMAX® contact sequencing compatibility

Available mating lengths and associated wipe distances are achieved by changing the length of the header contact. See Figure 5 below for contact wipe distance details.

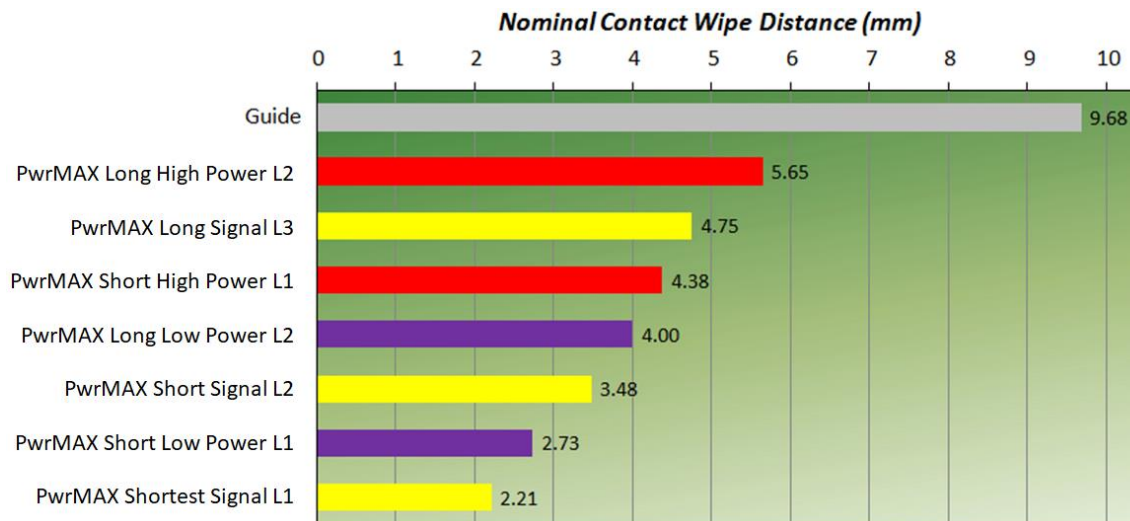


Figure 5 Nominal Contact Wipe Distance

#### Notes:

- Contact wipe distances in Figure 5 do not include tolerance associated with board-to-board distance.
- PwrMAX® Signal L1 or L2 can be used as a detect pin if the following condition is met:
  - The difference in contact wipe distance between the chosen detect pin and the shortest power contact must not be less than 1.27mm.

#### EXAMPLE:

If PwrMAX® Signal L1 is used as a detect pin, then the Lower Power L2 can be selected, since the difference in their Nominal Wipe Distances is  $4.00 - 2.21 = 1.79\text{mm}$ , which is greater than 1.27mm.

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>4 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
		CLASSIFICATION <b>UNRESTRICTED</b>	

### 4.2.3 Lead-free Processing

PwrMAX® Connector System is compatible with waving soldering, and withstands peak processing temperatures of 260°C for a period of 10 seconds without affecting form, fit, or function.

## 4.3 MATING ALIGNMENT

### 4.3.1 PwrMAX® Legacy version

- The guiding system of the PwrMAX® Legacy version allows maximum gatherability 2.54 mm on the radial direction.
- The angle gatherability between board-edge to board-edges allows 4 degree.

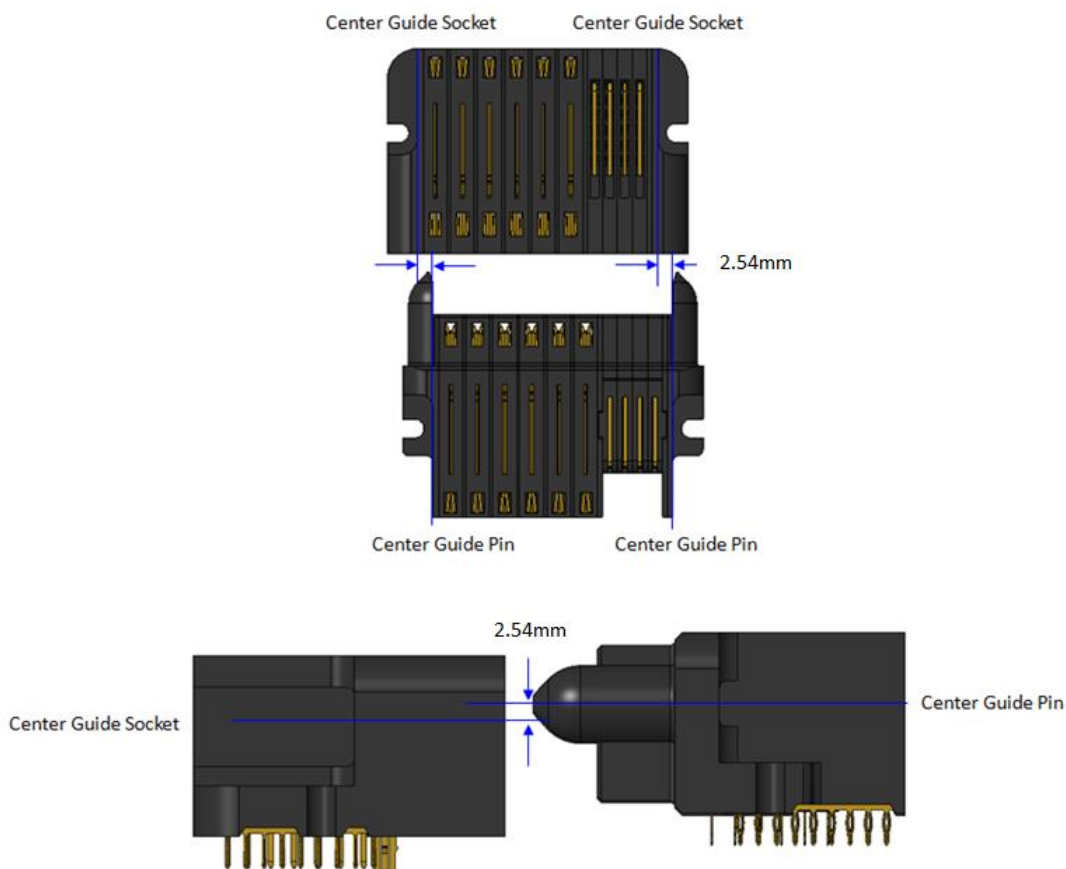


Figure 6 The gatherability of PwrMAX® Legacy version

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>5 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
		CLASSIFICATION <b>UNRESTRICTED</b>	

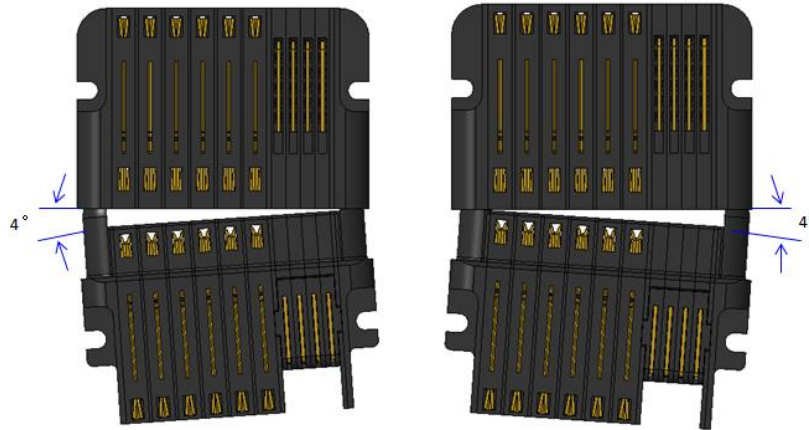


Figure 7 The angle gatherability of PwrMAX® Legacy version

#### 4.3.2 PwrMAX® G2 version

- The guiding system of the PwrMAX® G2 version allows maximum gatherability 1.94 mm on the radial direction.
- The angle gatherability between board-edge to board-edges allows 4 degree.

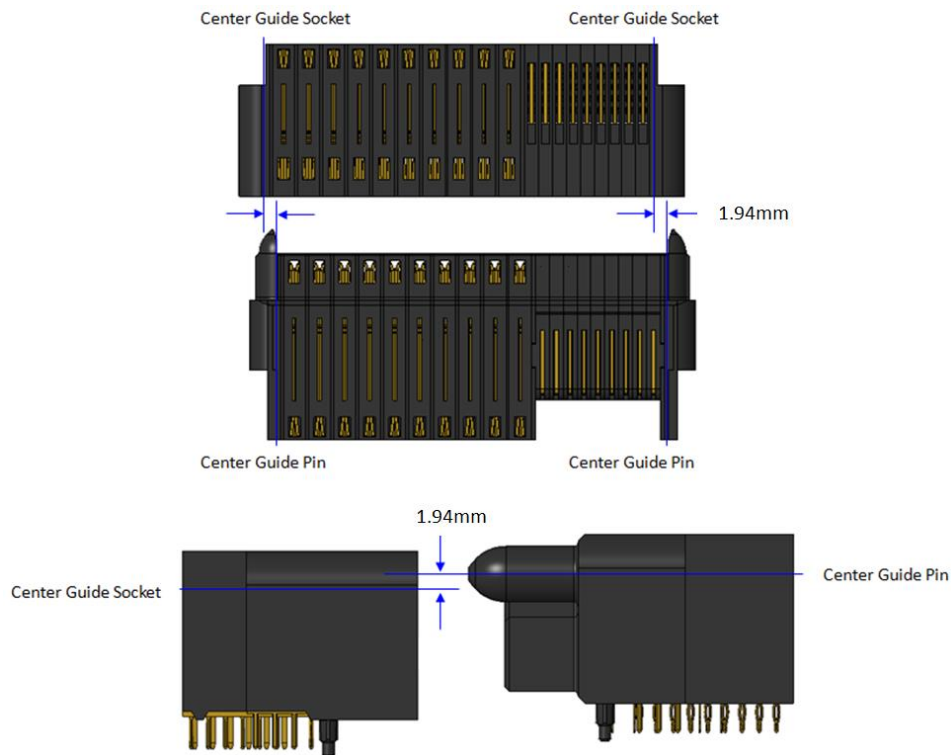


Figure 8 The gatherability of PwrMAX® G2 version

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>6 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
		CLASSIFICATION <b>UNRESTRICTED</b>	



Figure 9 The angle gatherability of PwrMAX® G2 version

#### 4.3.3 PwrMAX® G2 version with Guideless Ends

The PwrMAX® G2 connector with Guideless Ends allows a maximum gatherability of **+/- 0.90 mm** on X & Y direction.

### 4.4 MECHANICAL PROPERTIES

#### 4.4.1 Insertion/Retention forces (Hold-Down)

- The Insertion force for single hold-down shall be less than 27N.
- The retention force for single hold-down shall be greater than 13.5 N.

#### 4.4.2 Compliant Pin Insertion Force

- High Power - The force required to insert an individual compliant pin into a plated through hole in a tin/OSP printed circuit board at a rate of 5.08mm/minute shall not exceed 67 N.
- Low Power - The force required to insert an individual compliant pin into a plated through hole in a tin/OSP printed circuit board at a rate of 5.08mm/minute shall not exceed 90 N.
- Signal Receptacle - The force required to insert an individual compliant pin into a plated through hole in a tin/OSP printed circuit board at a rate of 5.08mm/minute shall not exceed 27 N.
- Signal Plug - The force required to insert an individual compliant pin into a plated through hole in a tin/OSP printed circuit board at a rate of 5.08mm/minute shall not exceed 93 N.

#### 4.4.3 Compliant Pin Retention Force

- High Power - The retention force in the axial direction opposite that of insertion at a rate of 5.08mm/minute shall not be less than 6.7 N per press-fit tail.
- Low Power - The retention force in an axial direction opposite that of insertion at a rate of 5.08mm/minute shall not be less than 10 N per press-fit tail.
- Signal - The retention force in an axial direction opposite that of insertion at a rate of 5.08mm/minute shall not be less than 6.7 N.

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>7 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

#### 4.4.4 Mating/Un-mating Force

**TABLE 2**

	Mating Force (Maximum)	Un-mating Force (Minimum)
One pair of HP Contacts	25 N	6.5 N
One pair of LP Contacts	7 N	2.2 N
One pair of Signal Contact	1 N	0.2 N

#### 4.4.5 Crimp Tensile Strength

The force required to pull the properly crimped wire from the terminal shall not be less than the value specified in Table. If terminals are equipped with an insulation barrel, they should not be crimped to have an effect on this test. Reference – SAE/USCAR21 or UL 486A. If terminals are equipped with an insulation barrel, they should not be crimped to have an effect on this test.

**TABLE 3**

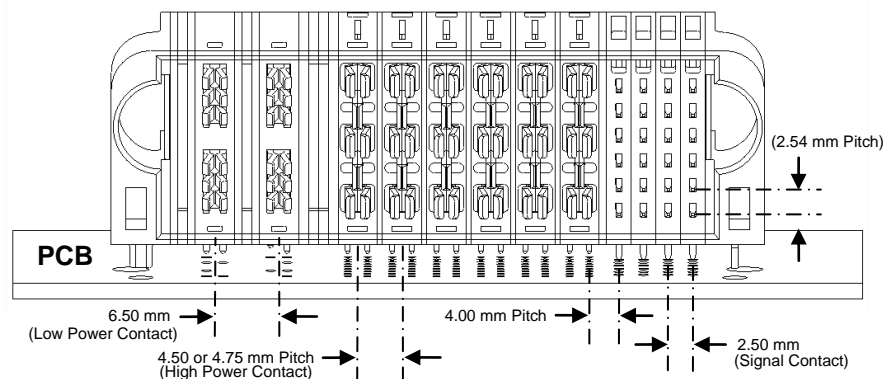
Cable Size (AWG)	12	8	6
Crimping Pull Force (N) min.	240	350	445*

Notes:

1. The specification is applicable only for board connector with cable configuration
2. The specification for 6 AWG refer to UL 486A

### 4.5 VOLTAGE RATING

- a. Voltage ratings for these connectors are based upon UL – 60950 -1 Second Edition Tale 2N
- b. Voltage ratings according to Minimum Creep Distance (MCD) on PCB are given in Table 4



**Figure 10 Options of Contact Pitch**

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>8 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

**TABLE 4**

PwrMAX® Maximum Working Voltage Vs. Minimum Creep Distance (Reference UL 60950-1 Second Edition Table 2N)						
Type	Contact Pitch (mm / inch)	Pollution Degree (office Environment)	Material Group (Base on UL Rating)	MCD (mm)	Maximum Working Voltage (AC RMS)	Maximum Working Voltage (DC/AC Peak)
Signal	2.50 [.0984"]	2	II	0.90	80	113
High Power	4.50 [.1772"]			1.20	173	245
	4.75 [.1870"]			1.45	206	292
Low Power	6.50 [.2559"]			3.22	453	640
Signal	2.50 [.0984"]	2	IIIb	0.90	37	53
High Power	4.50 [.1772"]			1.20	50	71
	4.75 [.1870"]			1.45	113	159
Low Power	6.50 [.2559"]			3.22	322	455

#### 4.6 Touch Proof Testing

Prevention of operator access to energized parts, refer to UL60950 & IEC 60950-1 SECTION 2.1.1.1  
Use the test probe to test prevention of operator access to energized conductors (such as powered electrical contacts within an unmated backplane connector).

- a. Test probe (Figure 11)
- b. Test Position (Figure 12)

The following sections show each of these test probes positioned as closely as possible to the mating side contacts of the PwrMAX® Receptacle, which will be located on the Daughter Card and may be powered in an unmated state.

##### 4.6.1 Test Probe

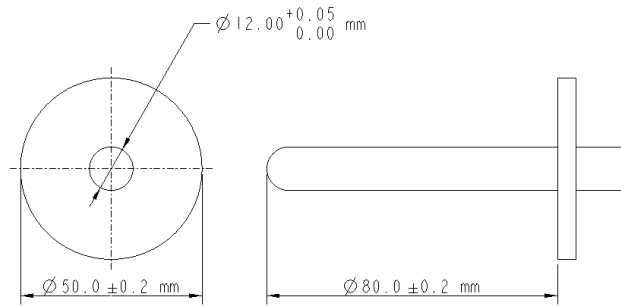
The Test probe may not make contact with energized parts while the access doors and covers of the system enclosure are open. Separable connectors must be disconnected for this test. The figure 11 shows the dimensions of the Test probe.

##### 4.6.2 Test Position

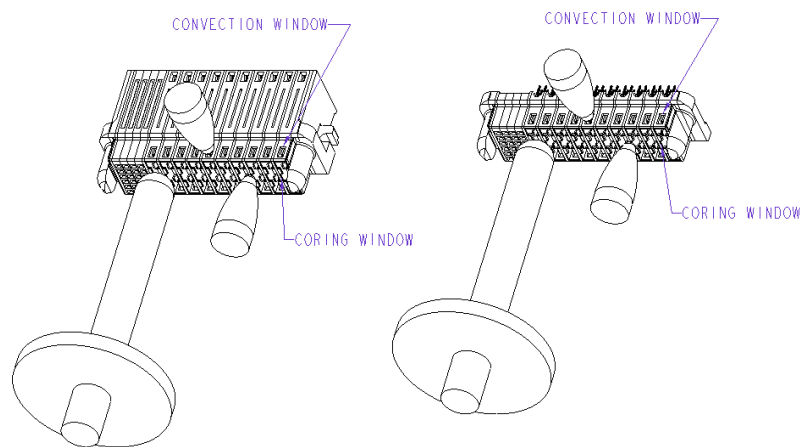
The requirements for the Probe position are not clearly specified by UL and IEC. However, assuming the worst-case scenario where the backplane connector is accessible, the following 3D model was created. The receptacle connector is tested by test probe in the areas shown in the figure 12.



NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>9 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
		CLASSIFICATION <b>UNRESTRICTED</b>	



**Figure 11** Dimension of UL Probe



**Figure 12** Test Position

## 5.0 REQUIREMENTS FOR PCB

### 5.1 PCB requirement

#### 5.1.1 PCB Layout

Regarding specifics of PCB layout, refer to the customer drawing of the specified part number.

#### 5.1.2 PCB Land/Pad size

**Table 5 Recommended PCB Land/Pad size**

Description	PwrMAX® High Power Contact		PwrMAX® Signal and Low Power Contact	
	(mm)	(In)	(mm)	(In)
Drilled Hole Diameter	0.810 - 0.860	0.032 - 0.034	1.125 - 1.175	0.044 - 0.046
Copper Plating	0.025 - 0.050	0.001 - 0.002	0.030 - 0.050	0.001 - 0.002
Tin Plating	0.009 - 0.015	0.002 - 0.006	0.009 - 0.015	0.002 - 0.006
Finished Plating Hole Diameter	0.700 - 0.800	0.027 - 0.031	0.940 - 1.100	0.037 - 0.043
Land / Pad Size	1.200 - 1.300	0.047 - 0.051	1.440 - 1.600	0.056 - 0.063

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>10 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

### 5.1.3 Recommended PCB thickness

Regarding Solder and Press-Fit tail termination, the PCB thickness are recommended as Table 6.

**TABLE 6**

Tail Type	Contact tail length(mm)	Recommended PCB thickness
Solder	3.43 +/- 0.40	2.362 +/- 0.254
	2.70 +/- 0.40	1.905 +/- 0.254
Press-fit	3.43 +/- 0.40	1.60mm minimum
	3.80 +/- 0.40	

## 5.2 PCB Alignment

### 5.2.1 PwrMAX® Legacy version

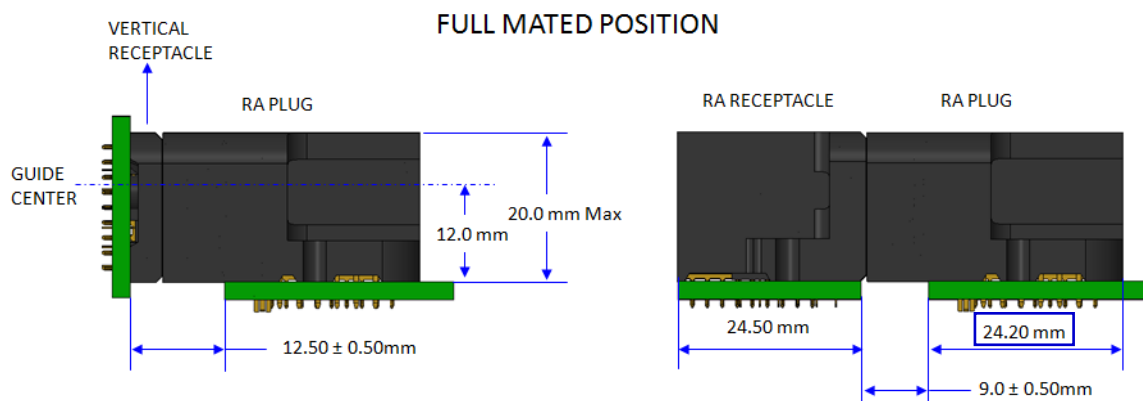


Figure 13

### 5.2.2 PwrMAX® G2 version

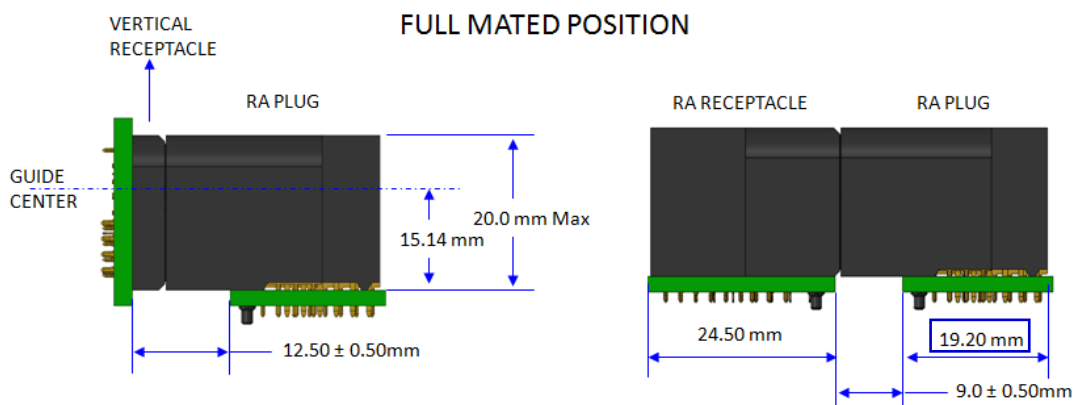


Figure 14

The depth for Plug Connector in Legacy version keeping out zone on PCB is 24.20mm, and 9 tails/column for Legacy plug power contact. The depth for Plug Connector in G2 version keeping out zone on PCB is 19.20mm, and 8 tails/column for G2 plug power contact.

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>11 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
CLASSIFICATION <b>UNRESTRICTED</b>			

## 6.0 APPLICATION TOOLING

Regarding the solder type, no application tooling is required to assemble the connector to PCB

Regarding the Press-fit type, refer to the below.

### 6.1 Right Angle Pug (Press-fit)

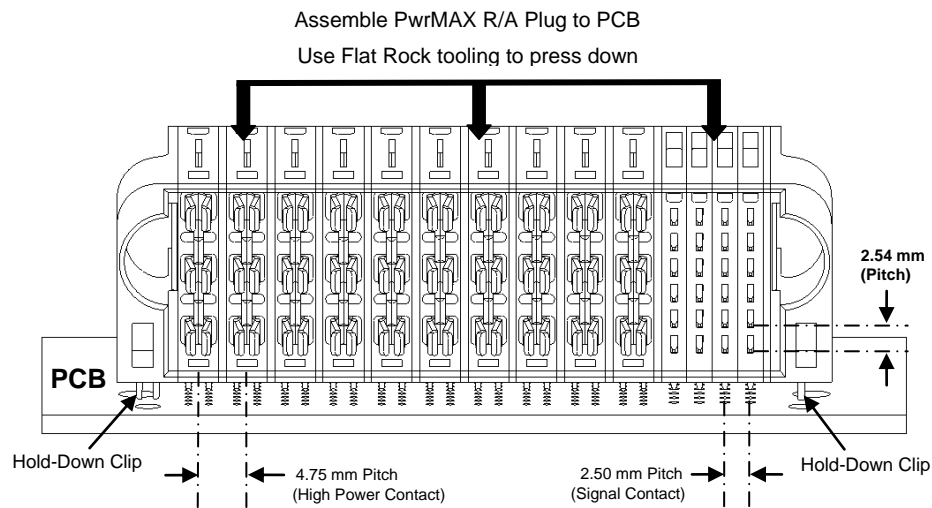


Figure 15

### 6.2 Right Angle Receptacle (Press-fit)

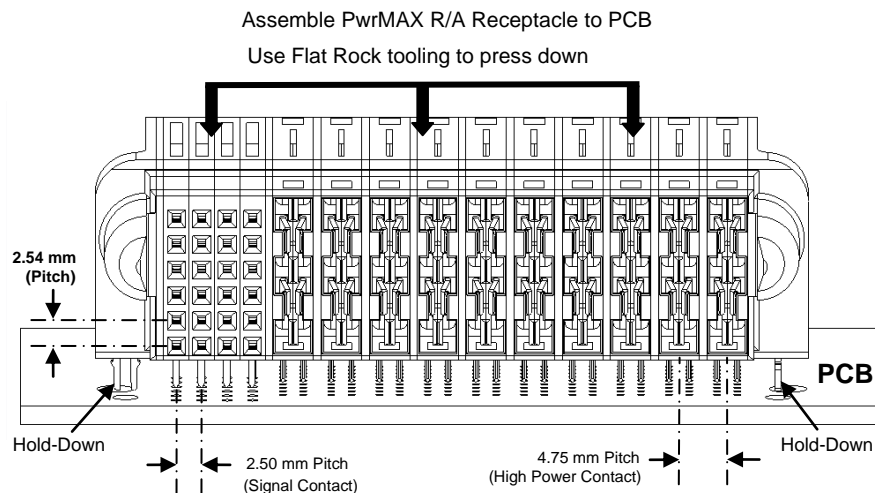


Figure 16

NUMBER <b>GS-20-0447</b>	TYPE <b>General Application Specification</b>	<b>Amphenol ICC</b>	
TITLE <b>PwrMAX® Connector System</b>		PAGE <b>12 of 13</b>	REVISION <b>B</b>
		AUTHORIZED BY <b>He, Zhi-Jun</b>	DATE <b>2022-08-05</b>
		CLASSIFICATION <b>UNRESTRICTED</b>	

### 6.3 Vertical Receptacle (Press-Fit)

Assemble PwrMAX R/A Receptacle to PCB  
Use Flat Rock tooling to press down

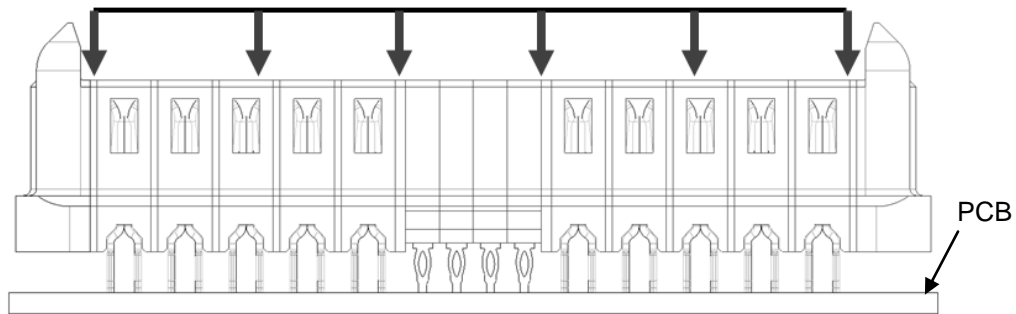


Figure 17

### 6.4 Application inspection requirements

Application inspection should consist of several checks to assure that the product is applied properly and is not damaged.

- Visually assure that all Solder tails are seated in the proper PCB holes and that none have been crushed during application.
- Visually assure that the plastic standoffs on the bottom of the assembly are seated within 0.20 mm of flush to the PCB but not crushed (see Figure 18). A larger gap beneath the standoffs may indicate that the product is not seated parallel or perpendicular to the board. In the case of the plug, this can cause misalignment with adjacent components.

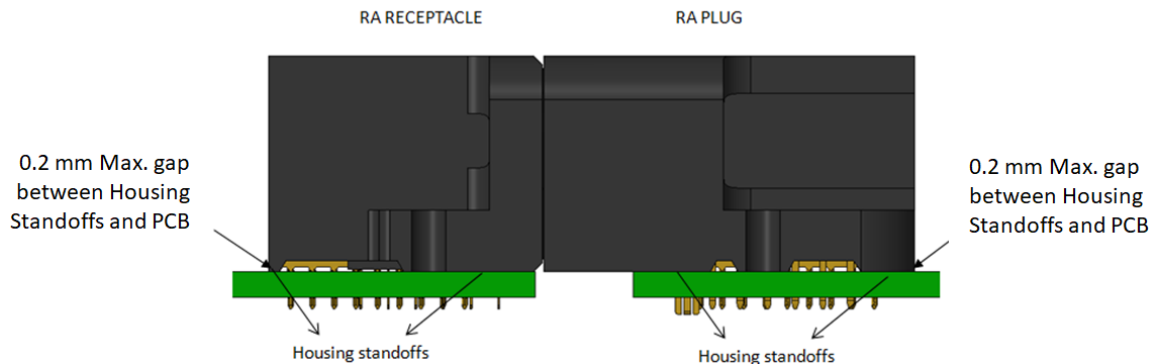



Figure 18

NUMBER  <b>GS-20-0447</b>	TYPE  <b>General Application Specification</b>		
TITLE  <b>PwrMAX® Connector System</b>		PAGE  <b>13 of 13</b>	REVISION  <b>B</b>
		AUTHORIZED BY  <b>He, Zhi-Jun</b>	DATE  <b>2022-08-05</b>
CLASSIFICATION  <b>UNRESTRICTED</b>			

## 7.0 RECORD RETENTION

REV	PAGE	DESCRIPTION	EC #	DATE
A	ALL	Initial release	N/A	2022-01-06
B	3	Clarify notes in item 4.2.2 with the example	N/A	2022-08-05