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## Application Specification

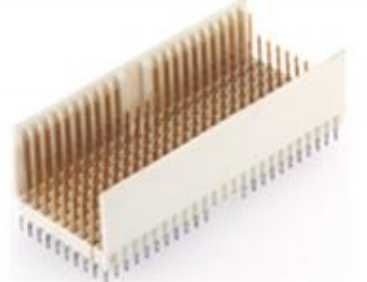
5 Row Straight Header



5 Row Straight Header



8 Row Straight Header



8 Row Straight Header



5 Row Right Angle Header



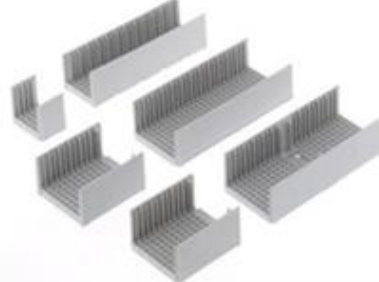
5 Row Right Angle Header



Straight Header-Power



5 Row & 8 Row Shroud



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## 1. OBJECTIVE

This specification covers end product and workmanship requirements for insertion into circuit boards for Millipacs® HM 5 Row & 8 Row Vertical Headers, Shrouds and 5 Row Right Angle Headers along with general product information. Contact your local AFCI representative for additional information.

## 2. SCOPE

- Product description
- Define product variations
- Define connector outline for circuit board designs.
- Recommended application equipment
- Recommended requirements and procedure for board insertion
- Recommended repair procedures

## 3. GENERAL

### 3.1 Method of Specifying

We do not recommend any exceptions unless approval is obtained in advance from the AFCI Engineering Design group. If there is a conflict between the product drawings and this specification the product drawings shall take precedence.

### 3.2 Workmanship

Workmanship shall be of a level that indicates controlled conditions of manufacture such that Subsequent operations, functionality and performance are not degraded.

### 3.3 Usage

The headers and shrouds covered by this instruction are intended for use in a wide variety of Environments and are designed to meet the conditions specified in Bellcore GR-1217-CORE and IEC-61076-4-101

### 3.4 Visual

Visual examinations shall be performed with a magnification of up to 10x (8 to 10x recommended)

## 4. PRODUCT DESCRIPTIONS

### 4.1 General Information on Headers and Shrouds

This information applies only to product covered by this specification. The following figures only Show a typical module of each product. Custom loads and lengths are typically available. Check with your local AFCI representative for the availability variations.

### 4.2 Electrical Performance of Connector Systems

#### 4.2.1. Test data and SPICE model

Test data along with SPICE models are available on the AFCI web page or through your local AFCI sales person. Data is available for Impedance, crosstalk, rise time, eye patterns and band width.

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### 4.3 Headers & Shrouds

Headers come in various lengths which are defined by IEC and cPCI specifications. Three contact mating heights with different plating levels are available based on different performance level. Lubricated contacts are also available. Various tail lengths are available including Rear plug up terminals which are used with Shrouds. Power Contacts also available in straight headers.



Figure 1 : 5 Row Header



Figure 2 : 5 Row Shroud



Figure 3 : 8 Row Header



Figure 4 : 8 Row Shroud

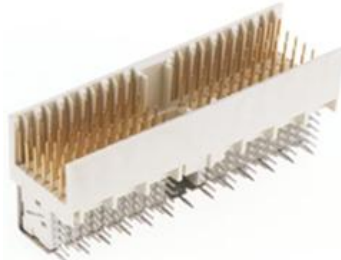


Figure 5: 5 Row Right Angle Header



Figure 6: 5 Row Header Power

### 4.4 Coding Keys

Coding Keys provides a mechanical feature to define matching intermateable pairs. Interfering Coding keys block off insertion to prevent connector mating and electrical contact. You can use the insertion tool HM2Y197E to easily insert the coding keys.



Coding Keys



HM2Y197E

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## 5. PRODUCT VARIATIONS

The following information lists the various headers and pins that are covered by this application Specification.

## 5.1 Part numbering overview for Straight Headers

This table defines the part number format that is used in the products covered by this application.

[illegible]

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## 5.2 Part numbering overview for Right Angle Headers

(MILLIPACS II)												
Millipacs / cPCI Spider Chart (Nomenclature) Right Angle Headers												
HM2	J	07	P	E	5	1	1	0	N9	L	LF - Lead Free	
J	Right Angle Header										(Optional)	
										L	Lubricated	
										L1	Lubricated (Telcordia)	
01	Type A With Cable Locking Feature									L9 / AB	Telcordia UE	
02	Type B With Cable Locking Feature									E9 / AD	Level 1 (500 mating cycles)	
03	Type C With Cable Locking Feature									N9 / AA	Level 2 (250 mating cycles) Telcordia CO	
07	Type A									Z1	Level 3 (50 mating cycles)	
08	Type B									0	Unshielded	
09	Type C									8	Shielded (4 mm Pitch Top Shield )	
65	Type AB									x	Other Special shielding	
66	Type AB 22									1	Standard mating height (5.3mm)	
70	Type B 22									x	Other Sequential assignment for custom pattern	
71	Type B 19									1	Standard mating height (5.3mm)	
										x	Other Sequential assignment for custom pattern	
										5	5 row	
P	Pressfit									E	3.3mm Tails	

## 5.3 Part numbering overview for Straight Headers Power (Pre – Assembled)

(MILLIPACS II)												
Millipacs / cPCI Spider Chart (Nomenclature) Pre - Assembled Power Connector												
HM2	A	30	P	G	XXXX	N9	Lx	LF - Lead Free				
A	Header							(Optional)				
							L	Lubricated				
							L1	Lubricated (Telcordia)				
30	Type L							(Only For Type M)				
31	Type M						L9 / AB	Telcordia UE				
32	Type N						E9 / AD	Level 1 (500 mating cycles)				
							N9 / AA	Level 2 (250 mating cycles) Telcordia CO				
							Z1	Level 3 (50 mating cycles)				
							GE / BB	Telcordia UE - Rear Plug up				
							GL / BD	Level 1 (500 mating cycles) - Rear plug up				
							GF / BA	Level 2 (250 mating cycles) /Telcordia CO - Rear Plug up				
							GC	Level 3 (50 mating cycles) - Rear Plug up				
							xxxx	Sequential assignment for custom pattern				
P	Pressfit						G	Power Contact (Header)				



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#### 5.4 Part numbering overview for Shrouds

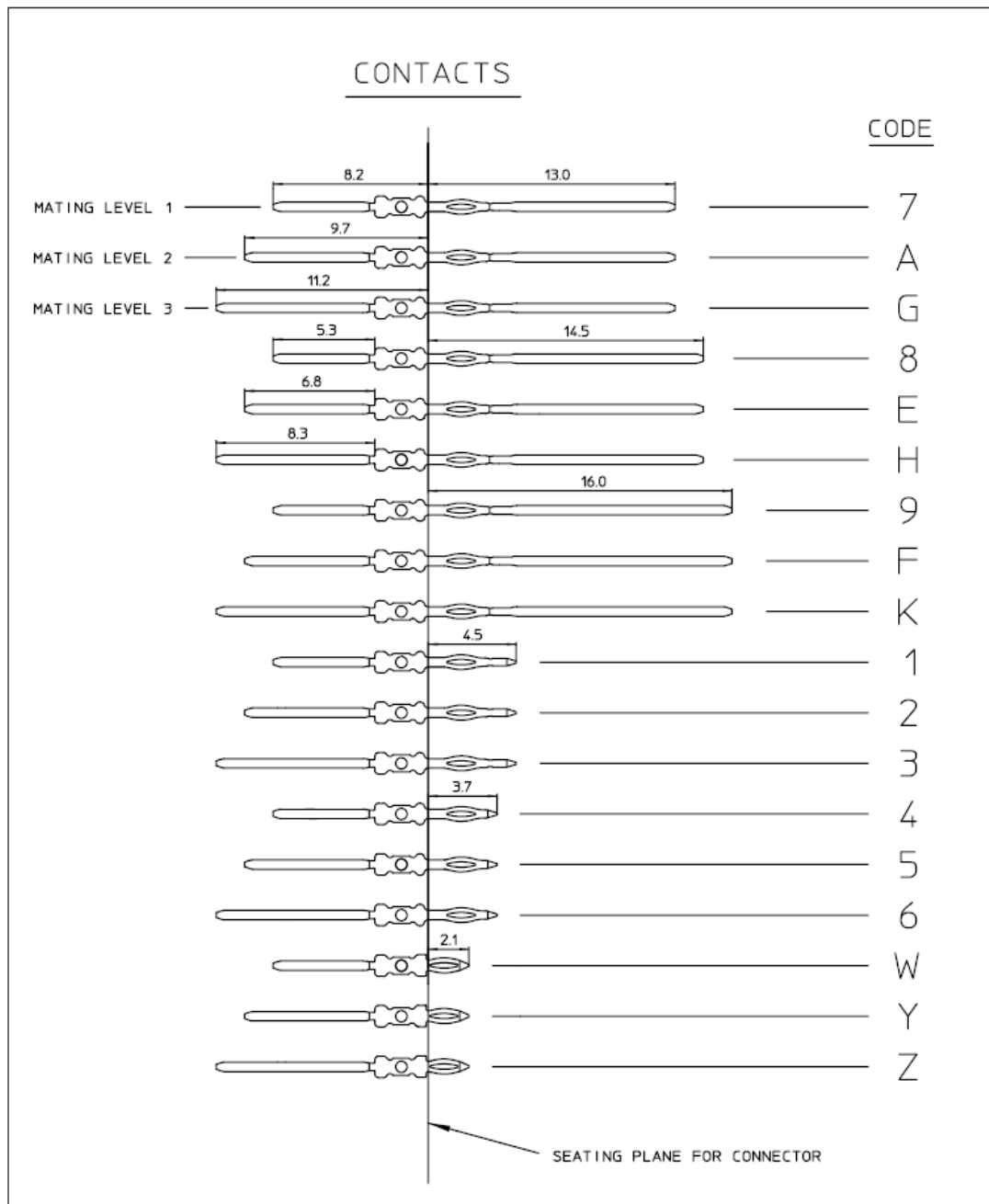
This table defines the part number format that is used in the products covered by this application

(MILLIPACS II)					
Millipacs / cPCI Spider Chart (Nomenclature) Shrouds					
<b>HM2</b>	<b>H</b>	<b>00</b>	<b>P</b>	<b>109</b>	<b>LF - Lead Free</b>
H	Shrouds				
00	MRV Shroud 50mm			1	Stand Off Height - 3.0
02	Rear Header 25 Pos (Discrimination - Pos 1)			109	Stand Off Height - 3.9
03	Rear Header 25 Pos With Locking Feature (Discrimination - Pos 5)			111	Stand Off Height - 4.1
04	Rear Header 25 Pos With Locking Feature			113	Stand Off Height - 4.3
05	Rear Header 125 Pos With Locking Feature			115	Stand Off Height - 4.5
06	Rear Header 25 Pos			117	Stand Off Height - 4.7
07	Type A			119	Stand Off Height - 4.9
08	Type B			122	Stand Off Height - 5.2
09	Type C			130	Stand Off Height - 6.0
26	MRV Shroud 50mm Slots (Discrimination - Pos 2, 10, 14 & 24)			148	Stand Off Height - 7.8
27	MRV Shroud 50mm Slots (Discrimination - Pos 2, 6, 20 & 24)			x	Other Sequential assignment
28	MRV Shroud 50mm Slots (Discrimination - Pos 16, 20 & 24)				
29	MRV Shroud 50mm Slots (Discrimination - Pos 12, 16, 20 & 24)				
30	MRV Shroud 50mm Slots (Discrimination - Pos 3, 7, & 11)				
36	MRV Shroud 50mm Slots (Discrimination - Pos 3, 7, 11, 15, 19 & 23)				
41	Rear Header 30 Pos With Locking feature				
42	Rear Header 30 Pos				
51	Type A 6+6 Pos				
65	Type AB				
66	Type AB 22 Pos				
67	Type AB 19 Pos				
68	Type B 22 Pos				
71	Type B 19 Pos				
80	Type CR				
81	Type E With Locking Feature				
82	Type FR				
87	Type D				
88	Type E				
89	Type F				
95	Type DE				
N1	Type A (15.4mm Max)				
N2	Type B (15.4mm Max)				
N80	Type CR (15.4mm Max)				
P	Pressfit				

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## 5.5 Contact overview for Straight Headers

This table lists the various pin lengths that are used in the headers covered by this application specification.

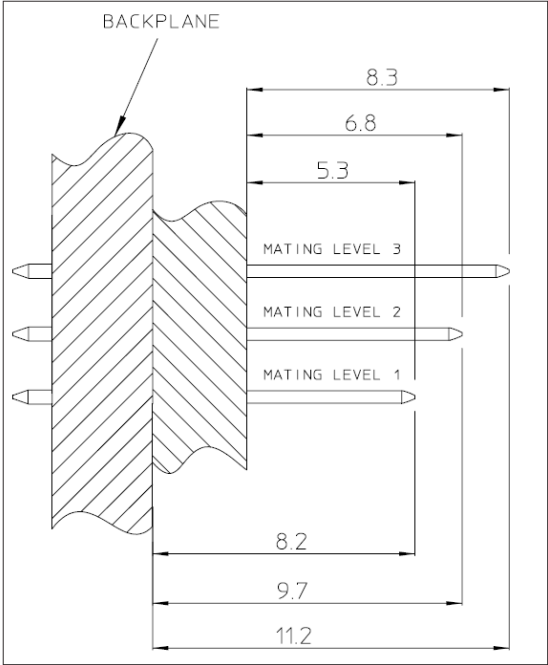




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5.6 Contact Mating Levels for Straight Headers

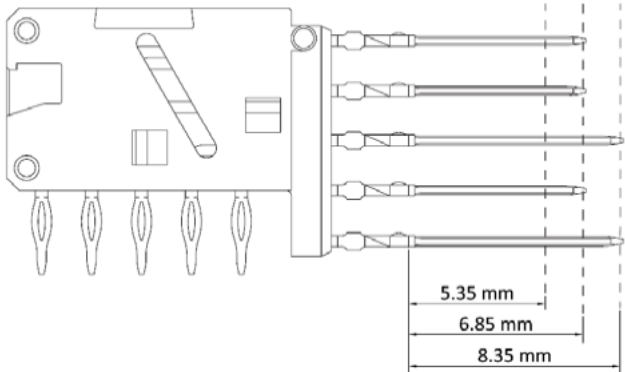
This table lists the various mating levels that are used in the headers covered by this application



5.7 Contact overview & Mating Levels for Right Angle Headers

IMLA s are available in three different contact mating lengths

- Code no. 4 – 5.35mm
- Code no. 5 – 6.85mm
- Code no. 6 – 8.35mm



0	0	0	0	0	0	0	0	0
4	5	5	5	5	5	5	6	4
4	5	5	6	4	4	5	6	4
4	5	6	5	5	5	6	6	5
4	5	5	5	5	4	5	5	4
4	5	5	5	5	5	6	6	4
0	0	0	0	0	0	0	0	0
#1	#2	#3	#4	#5	#6	#7	#8	#9

Nine different combinations are supported with these 3 contact mating lengths.

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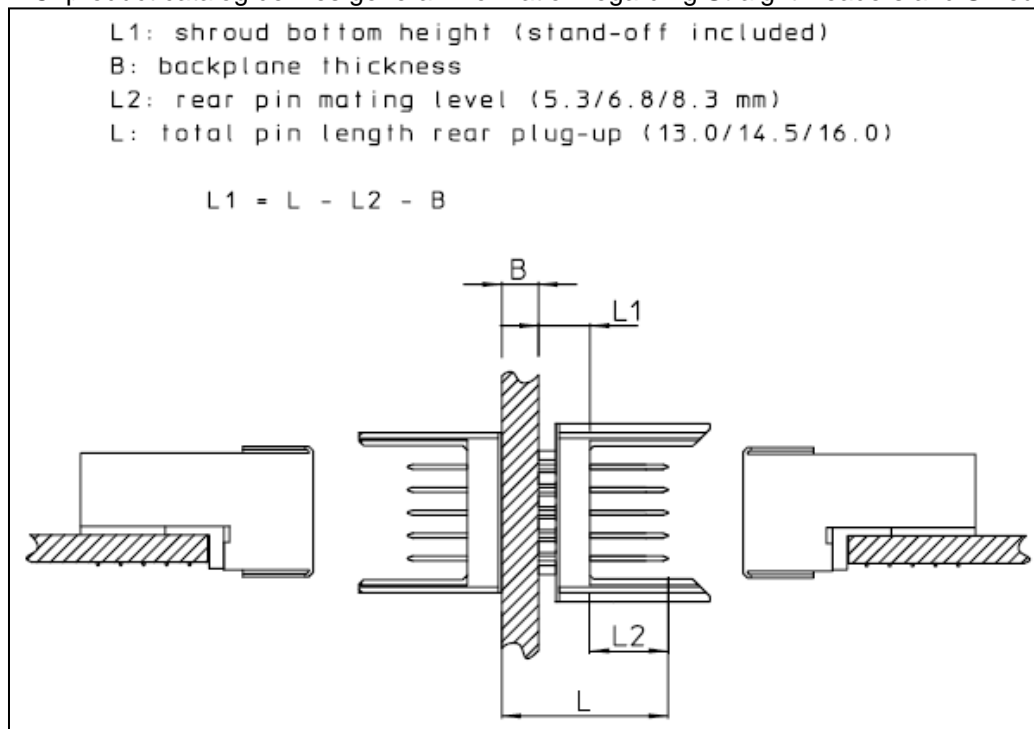
## 5.8 Contact Plating overview for Headers

This table lists the various plating levels to be used in the headers. Special plating code is Gold over Ni plating for increased resistance to fretting corrosion under high vibration applications.

PLATING CODE		DESCRIPTION	PERFORMANCE
STANDARD	SPECIAL		
L9	AB	MALE CONNECTOR SHORT	TELCORDIA UE
E9	AD	MALE CONNECTOR SHORT	PERFORMANCE LEVEL 1 (500 mating cycles)
N9	AA	MALE CONNECTOR SHORT	PERFORMANCE LEVEL 2 (250 mating cycles) / TELCORDIA CO
Z1	-	MALE CONNECTOR SHORT	PERFORMANCE LEVEL 3 (50 mating cycles)
GE	BB	MALE CONNECTOR REAR PLUG-UP	TELCORDIA UE
GL	BD	MALE CONNECTOR REAR PLUG-UP	PERFORMANCE LEVEL 1 (500 mating cycles)
GF	BA	MALE CONNECTOR REAR PLUG-UP	PERFORMANCE LEVEL 2 (250 mating cycles) / TELCORDIA CO
GC	-	MALE CONNECTOR REAR PLUG-UP	PERFORMANCE LEVEL 3 (50 mating cycles)

## 5.9 General Information on Straight Headers and Shrouds

AFCI product catalog defines general information regarding Straight Headers and Shrouds



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## 6. DESIGN CONSIDERATIONS ON HEADER CIRCUIT BOARDS

### 6.1 Guide Pin Modules

Guide modules are used to provide additional alignment and carry electrical power. They can be use in line with any 5 row straight Headers. See the following customer drawings for information

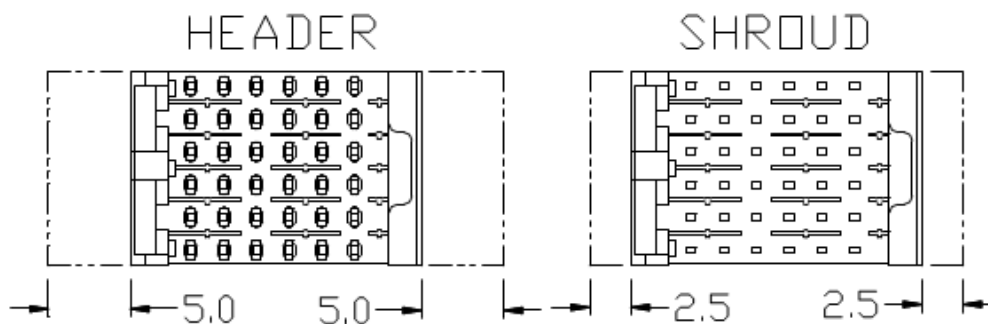
- BSC201911003 – part no : HM2G01LF
- BSC201911008 – part no : HM2G03LF

### 6.2 Circuit Board Layout

Follow the information shown on the product drawing for PCB layout.

### 6.3 Defining the Header and Shroud Outline on the Circuit Board

The minimum space or outline that is required for straight headers and shrouds covered by this application spec is shown on the individual customer drawings. Additional space is required to allow for various repairs operations. Generally no additional space is required for individual pin replacement. To allow support tooling for replacement of the whole header or shroud we recommend as shown on the following figure. 3D models are available of most parts for PCB design



**Straight Header and Shroud Repair Outline**

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## 7. APPLICATION TOOLING

### 7.1 Brief Summary

In order to properly insert press fit headers and shroud onto a circuit board you need two items:

- A press & Insertion tooling

### 7.2 Insertion Press

The tooling can work in a variety of presses. The important thing to remember is that you need to have Press with enough force to insert the specific configuration you are working with and that the press table Can properly hold the circuit board size.

Typical types of presses are: Manual arbor press & Servo driven electronic press

The preferred type of press to insert the headers and shrouds is the servo driven electrical press. This press gives you the best control during the insertion process and offers the most flexibility. APCI offers arbor and electric presses. For more information contact your local Sales person.

APCI provides a range of state-of-the-art press-fit insertion machines. The IMPRESS family has the following offerings

**IMPRESS 2000** : A modular based fully automated pick-and-place insertion machine.  
**IMPRESS 1000** : A semi-automatic step-and-repeat press with motor driven xy-table.  
**IMPRESS 500E** : A hand-operated servo driven C-frame press.  
**Baby IMPRESS** : A flat-bed servo motor driven bench-presses.  
**IMPRESS 500M+** : A hand-operated C-frame bench-press.

Please refer to the following table for relevant specifications:

Type	2000 XL	1000 XXL	500E	Baby IMPRESS	500M+
Cat. No.	PAH13302	PAH156	PAY284A2	PAY326	PAY479
Press force	40 kN	80 kN	80 kN	20 ... 50 kN	15 kN
Board size (1)	950 x 635 mm	1200 x 625 mm	720 x 580 mm	600 mm between posts of the H-bridge	270 mm throat depth
Max. tool size	160 mm	255 mm	255 mm	255 mm	150 mm
Press cycle per hour (2)	900	700 ... 900	600	500	300
Tool exchange	Automatically	Manually or automatically (option)	Manually	Manually	Manually
Board stuffing	Automatic pick-and-place	Manually	Manually	Manually	Manually
Board positioning	Automatically	Automatically	Manually (LMT-system optional)	Manually	Manually
Board support	Rising post	Rising post	Rising post	Flat bed	Fixed anvil or flat bed
Force controlled press stroke	Provided	Provided	Provided	Provided	Not provided

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- (1): Board size means maximum PCB size. For maximum daughterboard size, refer to the specifications.  
(2): These capacity figures are only an indication while the real capacity depends on the Board and production parameters.

**Note:** The tools between the IMPRESS machines (except the IMPRESS 2000) are interchangeable.

### 7.3 Press Blocks and Press Block Holders

The press blocks fit inside the headers and shrouds. In the headers the press block presses on both the pin shoulders and the inside bottom of the header housing. In the shrouds the press blocks presses only on the inside bottom of the shroud housing.

The application tooling needed for 5 Row & 8 Row Straight headers and shrouds consist of the following.

(5 + 2) Row Straight Headers		IMPRESS 500				
		without LMT			with LMT**	
		Anvil	Adaptor	Push blade	Anvil	LMT-blade
A	Male	PAY307A1	10146110-VH5A	PAY308A2	PAY307A1	PAY308A16
	Shroud	PAY307A65	--	PAY308A87	PAY307A65	PAY308A87
B (25 Pos.)	Male	PAY307A1	10146110-VH5B	PAY308A2	PAY307A1	PAY308A17
	Shroud	PAY307A65	--	PAY308A87	PAY307A65	PAY308A87
B (19 Pos.)	Male	PAY307A44	10146110-VH5B19	PAY308A2	PAY307A44	PAY308A58
	Shroud	PAY307A67	--	PAY308A90	PAY307A67	PAY308A90
B (22 Pos.)	Male	PAY307A45	10146110-VH5B22	PAY308A2	PAY307A45	PAY308A59
	Shroud	PAY307A66	--	PAY308A89	PAY307A66	PAY308A89
AB (25 Pos.)	Male	PAY307A1	10146110-VH5AB	PAY308A2	PAY307A1	PAY308A69
	Shroud	PAY307A65	--	PAY308A87	PAY307A65	PAY308A87
AB (22 Pos.)	Male	PAY307A45	10146110-VH5AB22	PAY308A2	PAY307A45	PAY308A70
	Shroud	PAY307A66	--	PAY308A89	PAY307A66	PAY308A89
AB (19 Pos.)	Male	PAY307A44	10146110-VH5AB19	PAY308A2	PAY307A44	PAY308A71
	Shroud	PAY307A67	--	PAY308A90	PAY307A67	PAY308A90
C / CR	Male	PAY307A2	10146110-VH5C	PAY308A2	PAY307A2	PAY308A18
	Shroud	PAY307A89	--	PAY308A88	PAY307A89	PAY308A88
M	Male	PAY307A1	PAY245A20	PAY308A2	PAY307A1	PAY308A16
	Shroud	On Request			On Request	
M (Pre-ass.)	Male	PAY307A68	PAY245A29	PAY308A2	On Request	
L (Pre-ass.)	Male	PAY307A69	PAY245A30	PAY308A2	On Request	
N (Pre-ass.)	Male	PAY307A70	PAY245A31	PAY308A2	On Request	
L	Hybrid	PAY307A65	--	PAY308A87	PAY307A65	PAY308A87
N	Hybrid	PAY307A89	--	PAY308A88	PAY307A89	PAY308A88

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CPCI		without LMT			with LMT**	
		Anvil	Adaptor	Push blade	Anvil	LMT-blade
AB (22 Pos.)	Male	PAY307A45	10146110-VH5AB22	PAY308A2	PAY307A45	PAY308A70
	Shroud	PAY307A66	PAY245A43	PAY308A2	On Request	
AB (19 Pos.)	Male	PAY307A44	10146110-VH5AB19	PAY308A2	PAY307A44	PAY308A71
	Shroud	PAY307A67	PAY245A44	PAY308A2	On Request	
A	Male	PAY307A1	10146110-VH5A	PAY308A2	PAY307A1	PAY308A16
	Shroud	PAY307A65	HM2Y196A31	PAY308A2	On Request	
B (19 Pos.)	Male	PAY307A44	10146110-VH5B19	PAY308A2	PAY307A44	PAY308A33
	Shroud	PAY307A67	PAY245A44	PAY308A2	On Request	
B (22 Pos.)	Male	PAY307A45	10146110-VH5B22	PAY308A2	PAY307A45	PAY308A34
	Shroud	PAY307A66	PAY245A43	PAY308A2	On Request	
(8 + 2) Row Straight Headers		without LMT			with LMT**	
		Anvil	Adaptor	Push blade	Anvil	LMT-blade
D	Male	PAY307A40	10146110-VH8D	PAY308A72	PAY307A40	PAY308A74
	Shroud	PAY307A87	--	PAY308A85	PAY307A87	PAY308A85
E	Male	PAY307A40	10146110-VH8E	PAY308A72	PAY307A40	PAY308A75
	Shroud	PAY307A87	--	PAY308A85	PAY307A87	PAY308A85
F / FR	Male	PAY307A41	10146110-VH8F	PAY308A72	PAY307A41	PAY308A76
	Shroud	PAY307A88	--	PAY308A86	PAY307A88	PAY308A86
DE	Male	PAY307A40	10146110-VH8DE	PAY308A72	PAY307A40	PAY308A103
	Shroud	PAY307A87	--	PAY308A85	PAY307A87	PAY308A85
5 Row Right Angle Headers		without LMT			with LMT**	
		Anvil	Adapter	Push blade***	Anvil	LMT-blade
A		PAY307A3	On Request	PAY308A2	PAY307A3	PAY308A49
B (25 Pos.)		PAY307A3	On Request	PAY308A2	PAY307A3	PAY308A49
B (19 Pos.)		PAY307A91	On Request	PAY308A2	PAY307A91	PAY308A68
B (22 Pos.)		PAY307A90	On Request	PAY308A2	PAY307A91	PAY308A67
AB (25 Pos.)		PAY307A3	On Request	PAY308A2	PAY307A3	PAY308A49
AB (22 Pos.)		PAY307A90	On Request	PAY308A2	PAY307A91	PAY308A67
C		PAY307A92	On Request	PAY308A2	PAY307A92	PAY308A110

(\*\*) : Not available on IMPRESS 500M+ and Baby IMPRESS  
 (\*\*\*) : Push blade PAY308A2 is 50mm long. In case of 19 and 22 pos. on request.

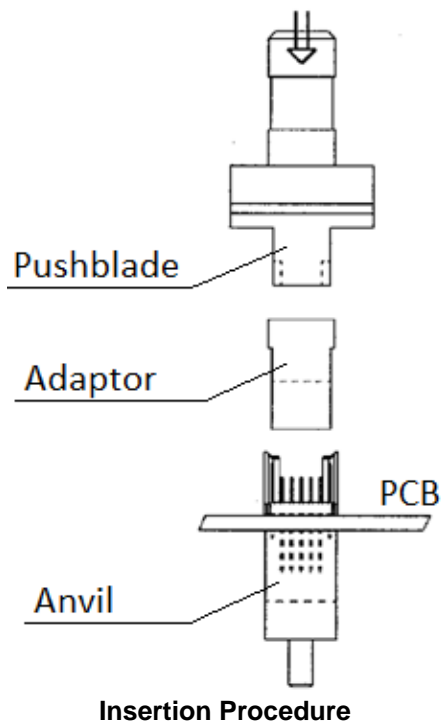
**Note** : For Straight Header adaptors details pls refer drawing No: 10146110-VH  
 : For Right Angle Headers adaptors needed in case of shielded connectors.  
 : For more details contact AFCE representative.  
 : Tools for IMPRESS 1000 are same as for the IMPRESS 500 with LMT  
 : Tools for IMPRESS 2000 are on request.

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## 8. APPLICATION PROCEDURE

The installation procedure for the headers and shrouds cover by this application specification can be summarized as follows

- Properly place header or shroud in desired location on PC board. Check to see compliant sections line up with holes in board.



- Place appropriate top and bottom tooling in their correct locations. See manual on insertion tooling for correct locations of top and bottom tooling for press being used.
- To insure proper insertion into the board, **HEADERS AND SHROUDS MUST BE CENTERED BENEATH RAM OF PRESS**. Offset loading may result in improper seating of headers or shrouds and lead to bending of pins.
- Actuate insertion press and then remove assembly from press after press returns. AICI recommends that the insertion force for headers to be maximum **45 Newton's per pin**. Actuation of Insertion Press should be slow and controlled. Pressing to a certain change in slope will yield more consistent results than pressing to a set distance due to variances in board thickness.

## 9. POST APPLICATION INSPECTION PROCEDURES

### 9.1 Straight Header and Shroud to Board Clearance

The headers and shroud should be seated flush to the board but in no instance be more than 0.1mm (0.004 inch) off the board. In case of RPU Header with alignment strip, the Max gap allowed between PCB and HDR Bottom surface is 0.28 mm considering the alignment strip thickness. Also after the Press fit, the maximum allowable height difference between two adjacent header connectors is 0.1 mm.



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## 9.2 Visual

All pins inserted into circuit board via holes. Pins and plastic not damaged.

## 9.3 Pin Tip Variations

The pin tips shall be within 0.20 mm true position ( $\pm 0.10$ mm) of location after insertion of the header on the header side and should be within the same tolerance on the back side of the board after shroud insertion.

# 10. REMOVAL TOOLING AND REPAIR PROCEDURES

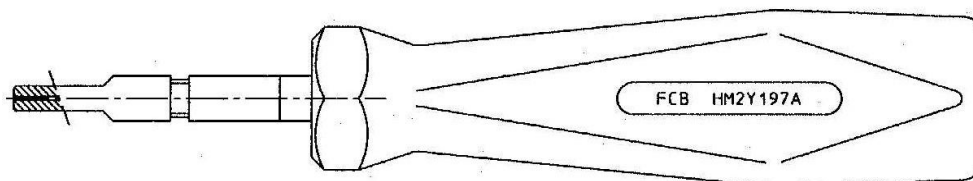
The removal procedures vary depending on your board layout, the pin length and the board thickness. There are also cases in which a single pin repair is the best action to take. There are manuals supplied with the tooling that is shown below to help you through the pin removal process. If you are not sure what type of repair process is best for your application, contact your local AICI sales person.

## Replacement Pins

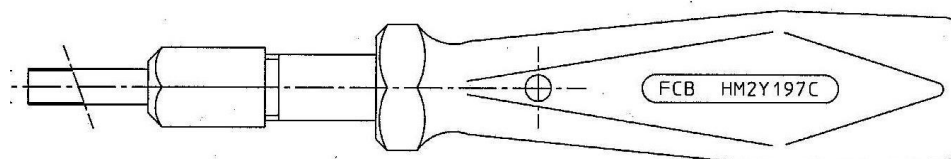
When removing and replacing individual pins use order replacement pins. Pins may be replaced twice. Consult AICI sales person to obtain the replacement pins.

## 10.1 Individual Pin Extraction Tools – HM2Y197A, HM2Y197C

The extraction tool pushes the pins out of the circuit board from the opposite side of the straight header one at a time. After all the pins have been removed you can then pull the header or shroud off the board with a pair of pliers. Individual pin repair can be accomplished by removing the defective pin and inserting a replacement pin.



**HM2Y197A**  
**Push out Tool for Signal Contacts**

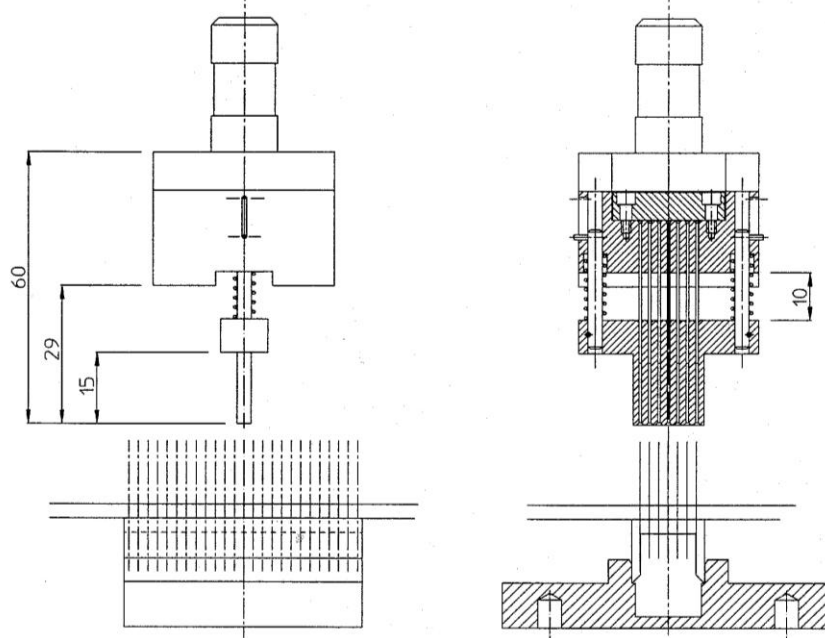


**HM2Y197C**  
**Push out Tool for Power and High frequency contacts**

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## 10.2 Contact row Extraction Tool - PAY245A10 & PAY245A11

The tool PAY245A10 is used for extracting long contact pins and the tool PAY245A11 is used for extracting short contact pins for straight headers. The extraction tool pushes the pins out of the circuit board from the opposite side of the header, one row at a time. After all the pins have been removed you can then pull the header or shroud off the board with a pair of pliers.



**Contact row Extraction Tool**

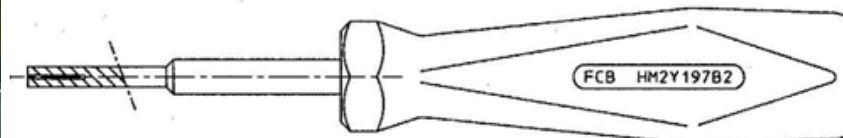
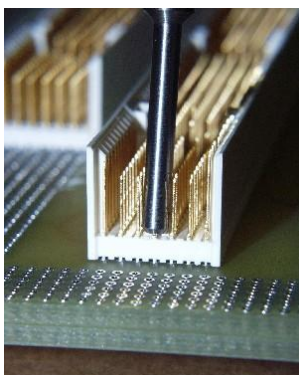
The tool is used in combination with an IMPRESS 500M.

## 10.3 Individual Pin Insertion Tool – HM2Y197B1 & HM2Y197B2

The Insertion tool pushes the pins individual into the Straight header connector.

HM2Y197B1 : Insertion tool for individual shielding contacts

HM2Y197B2 : Insertion tool for individual signal contacts



**HM2Y197B2 Insertion Tool**

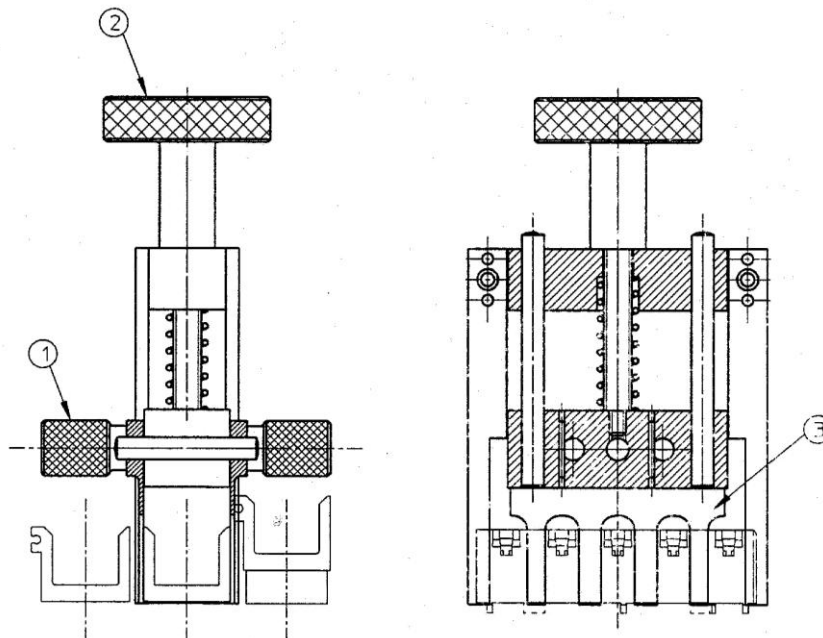
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#### 10.4 Repairing Bent Pins

Bent pins must either be straightened or replaced. We recommend that if the pin is bent more than 45° it be replaced. If the pin is bent equal to or less than 45°, it can be straightened with a pliers or equivalent tool that has a smooth surface on the inside jaws. The repair shall be considered a success if the repaired pin is not 'kinked' nor the contact surface scraped. Burnish marks on the contact surface of the pins are acceptable. Do not use any pliers or tools made of aluminum as they could contaminate the contact surface.

#### 10.5 Shroud removal tool - HM2Y241

The shroud removal tool, P/N HM2Y241 pulls the shroud out of the circuit board from the opposite side of the header one at a time. After all the pins have been removed you can then pull the straight header or shroud off the board with a pair of pliers.



**HM2Y241 Shroud Removal Tool**

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### REVISION RECORD

REV	PAGE	DESCRIPTION	EC #	DATE
A	ALL	NEW DOCUMENT		
B	ALL	Logo Change	I06-0085	22 Jun 2006
C	ALL	Alignment Strip Thickness Consideration	ELX-I-19949	13 Jan 2015
D	ALL	Template Changed	ELX-I-36422-1	20 Mar 2020
		Part No Nomenclature updated		
		RA Headers & Power Headers Added		
		Adaptor part no's updated		