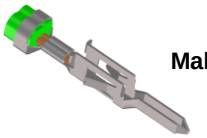
molex

PRODUCT SPECIFICATION

PRODUCT SPECIFICATION FOR

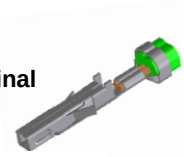
Mini-Fit Plus HCS™

INTERCONNECT SYSTEMS

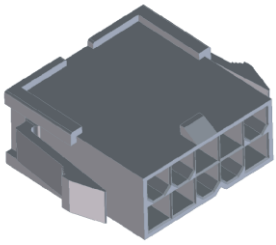


46012
Male Terminal

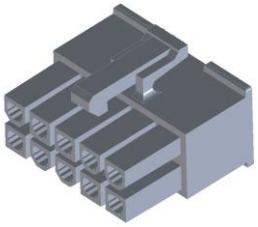
45750
Female Terminal



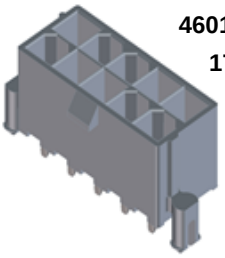
5559, 46993, 72646
Plug Housing



5557, 46992, 46994
Receptacle Housing

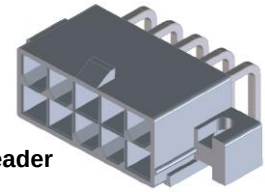


Crimp Terminals and Housing for Wire-Wire



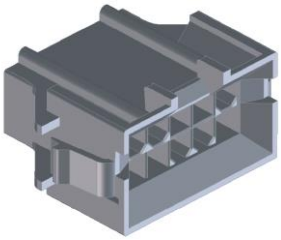
46014, 46015, 172675, 172676
Vertical Header

5569, 172448, 172648
Right Angle Header

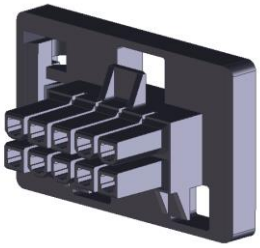


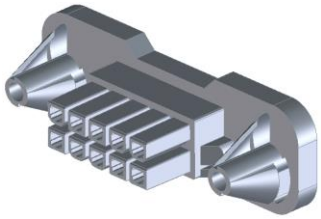
Headers for Wire-Board

42475
BMI Plug Housing



44516
BMI Slide and Lock Receptacle

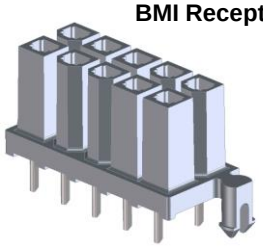


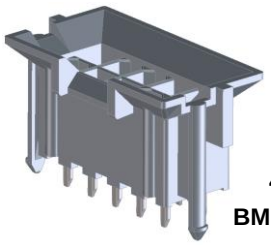


42474
BMI Receptacle w/ Spirals

BMI Style Panel Mount Housings for Wire-Panel, Panel-Panel and Panel-Board

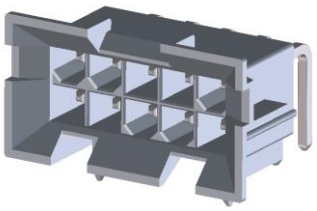
46010
BMI Receptacle Header





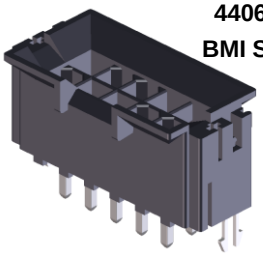
46011
BMI Vertical Header

42404
BMI Right Angle Header

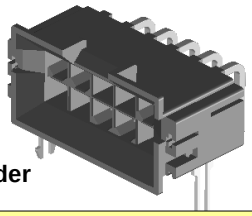


BMI Style Headers for Panel-Board or Board-Board

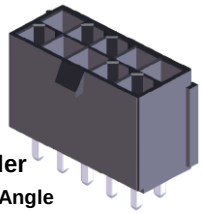
44068
BMI SMC Vertical Header



43810
BMI SMC Right Angle Header

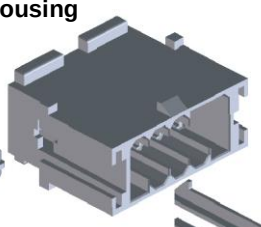


87427
SMC Vertical Header
Also available in Right Angle



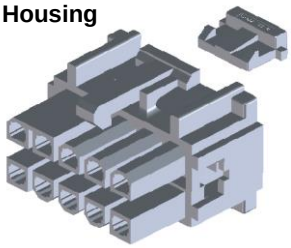
BMI Surface Mount Compatible Style Headers

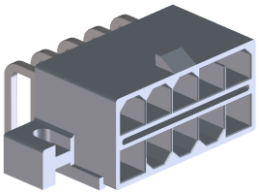
30068
TPA Plug Housing



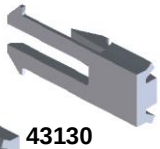
30067
TPA Receptacle Housing

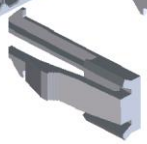
30071
CPA Key





30072
TPA Pin

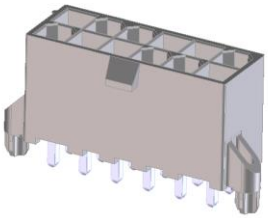




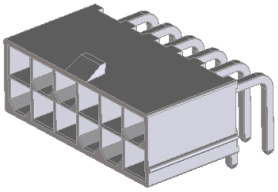
43130
Mounting Ears

30070
TPA Right Angle Header

TPA Series Header and Housings for use with Plus HCS Terminals



46207
Vertical Header



46991
Right Angle

RTC Series Header and Housings

Product feature designations:

BMI Blind Mate Interface – lead-in features allow easier alignment in panel-to-board and board-to-board applications.

SMC Surface Mount Compatible - solder temperatures up to 240°C.

RTC Reflow Temperature Compatible – reflow solder temperatures up to 260°C.

TPA Terminal Position Assurance – helps ensure crimp terminals are fully inserted into their housing and prevents terminals from backing out in high vibration applications.

CPA Connector Position Assurance – assures receptacle housing cannot be inadvertently disengaged from mating header or plug housing.

MINI-FIT PLUS HCS

TABLE OF CONTENTS

1.0 SCOPE

This Product Specification covers the electrical, mechanical and environmental performance requirements for the **Mini-Fit Plus HCS**™ (High Current System) in 4.20 mm (.165 inch) pitch. The **Mini-Fit Plus HCS**™ uses contacts stamped in High Performance Alloy for increased current carrying capacity, while maintaining properties at elevated operating temperatures. Wire-Wire, Wire-Panel, Wire-Board, Panel-Panel, Panel-Board, and Board-Board configurations in Tin and 30 µ" Gold plated systems. Crimp terminals accept 16 to 20 AWG stranded copper wire.

2.0 PRODUCT DESCRIPTION

2.1 SERIES NUMBERS, DESCRIPTION, SALES DRAWING NUMBERS

SERIES	DESCRIPTION	TPA	BMI	RTC	AGENCY APPROVAL
Crimp Terminals					
45750	Female Crimp Terminal				N/A
46012	Male Crimp Terminal				N/A
Crimp Terminal Housings					
5557	Receptacle Housing				U,C,T
5559	Plug Housing				U,C,T
42475	Panel Mount BMI Plug Housing		X		U,C,T
45776	Foam-In-Place Plug Housing		X		U,C
42474	Panel Mount Receptacle Housing		X		U,C,T
43974	Panel Mount Receptacle Hsg 40 Ckt				U,C
44516	Panel Mount Receptacle Housing, Slide-and-Lock		X		U,C
30067	TPA Receptacle Housing	X			U,C,T
30068	Panel Mount TPA Plug Housing	X	X		U,C,T
Vertical Headers					
44068	Vertical BMI SMC Header, solid pin		X	X	U,C
46010	Vertical PCB Receptacle Header		X		U,C
46011	Vertical BMI Header		X		U,C
46014	Vertical Header, single row				U,C
46015	Vertical Header, dual row				U,C
46207	RTC Hi-Temp Vertical Header in LCP			X	U,C
172675	Vertical Header, Dual Row				U,C
172676	Vertical Header, Single Row				U,C
87427	Vertical SMC Header				U,C
Right Angle Headers					
5569	Right Angle Header				U,C,T
5569	Right Angle Header with press-fit mounting pegs in LCP			X	U,C,T
30070	Right Angle TPA Header with mounting flanges	X			U,C,T
42404	Right Angle BMI Header		X		U,C,T
43810	Right Angle BMI SMC Header		X	X	U,C
43973	Right Angle Header, 40 Ckt		X		U,C
45567	Right Angle Header, 36 Ckt		X		U,C
46991	Right Angle Header			X	U,C,T
87427	Right Angle SMC Header			X	U,C

Agency Approval designations:

U-UL C-CSA T-IEC

Other products conforming to this specification are noted on the individual drawings.

2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

For details regarding dimensions, materials and terminal platings, refer to the appropriate sales drawings for further information.

2.3 SAFETY AGENCY APPROVALS

UL File: E29179

CSA Certificate: LR19980

IEC 61984 Certification: Tested to and found in compliance with IEC 61984. NRTL type examination certificate available upon request. Contact Molex Safety team for questions regarding certification on specific part numbers.

3.0 APPLICABLE STANDARDS AND SPECIFICATIONS

- EIA-364-1000
- Molex solderability specification SMES-152
- Molex heat resistance specification: AS-40000-5013
- Application specification: AS-45499-001 (moisturizing nylon parts)
- Maximum temperature test summary: 457500003-TS

4.0 PACKAGING

Parts shall be packaged to protect against damage during handling, transit and storage.
Nylon parts should remain in their original packaging until ready for use to prevent moisture loss or gain. Nylon will absorb moisture which causes dimensions to increase. Excess moisture gain can result in dimensions exceeding specification. For details, refer to the packaging specification called out on the applicable product sales drawing. For details refer to the Packaging Specification as called out on the applicable product Sales Drawing.

5.0 RATINGS

5.1 VOLTAGE

600 Volts AC RMS or 600 Volts DC*

*Voltage rating based on UL 1977. Maximum voltage allowed may vary dependent upon “End Use Application”. Refer to the applicable end use standard for additional information on Voltage, Creepage and Clearance requirements.

5.2 APPLICABLE WIRES

WIRE GAUGE	INSULATION DIAMETER
16 AWG, Stranded, Copper	1.80-3.15 millimeters / .071-.124 inches
18-20 AWG, Stranded, Copper	1.65-2.95 millimeters / .065-.116 inches

5.3 TEMPERATURE RATING

Minimum temperature (operating* and non-operating): - 40°C
Maximum temperature[1] (operating* and non-operating):

Housing Type	Terminal Type	
	Select Gold Plated	Tin Plated
Glow Wire Capable[2]	125°C	105°C
RTC Header[3]	125°C	
Standard Nylon	105°C	

**Operating values include 30°C terminal temperature rise at rated current*

Field temperatures and field life: Tested per EIA 364-1000.01 to meet field temperature of 65°C for 10 years of life per table-8 in EIA-364-1000.01. See section 6.3.1a for test requirements.

5.4 SOLDER PROCESS TEMPERATURE

Header Type	Plating Type			
	Select Gold over Nickel	Matte Tin over Nickel	Bright Tin over Nickel	Tin over Copper
With Molded Pegs	240°C	240°C	240°C	240°C
Without Molded Pegs	260°C	260°C	240°C	240°C
RTC & SMC Headers: 44068, 43810, 46207, 46991, 87427	260°C	260°C	240°C	240°C
Glow Wire with Pegs Series: 172675, 172676	220°C	220°C	N/A	N/A

5.5 DURABILITY (MATING CYCLES)

Tin: 100 cycles
Gold: 250 cycles

Durability ratings established as tested per Durability Test Procedures described by EIA-364-09C and meet requirements for low level contact resistance and DWV as prescribed per EIA-364-1000.01 Test Sequence Group 7.

[1] UL approval of product usage above 105°C pending
[2] See section 5.7 for applicable series
[3] See section 2.1 for applicable series

5.6 MAXIMUM CURRENT RATING (AMPERES)**

WIRE-TO-WIRE									
Wire Size	Single Row Circuit Sizes			Dual Row Circuit Sizes					
	3	4	5	2	4	6, 8	10, 12	14, 16, 18	20, 22, 24
16 AWG	13A	12.5A	12A	13A	12A	11A	10.5A	10A	9.5A
18 AWG	11A	10.5A	10A	11A	10A	9A	8.5A	8A	7.5A
20 AWG	9.5A	9A	9A	9.5A	8.5A	8A	7.5A	7A	6.5A

WIRE-TO-BOARD									
Wire Size	Single Row Circuit Sizes			Dual Row Circuit Sizes					
	3	4	5	2	4	6, 8	10, 12	14, 16, 18	20, 22, 24, 36
16 AWG	12.5 A	12A	11.5A	12.5A	11.5A	10A	9A	8.5A	8A
18 AWG	10.5 A	10A	9.5A	10.5A	9.5A	8.5A	8A	7.5A	7A
20 AWG	9A	8.5A	8.5A	9A	8A	7A	6.5A	6A	5.5A

BOARD-TO-BOARD					
Dual Row Circuit Sizes					
2	4	6, 8	10, 12	14, 16, 18	20, 22, 24
11.5A	11A	9.5A	8A	6.5A	5A

Note: PCB trace design may greatly affect temperature rise results in Wire-to-Board Applications.

** Current rating is application dependent and may be affected by the wire rating such as listed in UL-60950-1. Each application should be evaluated by the end user for compliance to specific safety agency requirements. The ratings listed in the chart above represents the MAXIMUM current carrying capacity of a fully loaded connector with all circuits powered using tinned copper conductor stranded wire per Molex test method based on a 30º C maximum temperature rise over ambient temperature and are provided as a guideline. Appropriate de-rating is required based on circuit size, ambient temperature, copper trace size on the PCB, gross heating from adjacent modules/components and other factors that influence connector performance. Wire size & stranding, tin coated or bare copper wire, wire length & crimp quality are other factors that influence current rating.

5.7 Glow Wire

The following series are glow capable: 46992, 46993, 46994, 172646, 172648, 45776 172675, 172676, 46207, 46991. Representative samples were tested and found compliant with EN 60695-2-11-2001 / IEC 60695-2-11-2000 Glow Wire Test Methods for End-Products. These were additionally investigated for compliance with EN 60335-1 / IEC 60335-1 750C / 2 sec with no flaming. VDE Test report available upon request.

6.0 PRODUCT PERFORMANCE TESTS & REQUIREMENTS

6.1 ELECTRICAL REQUIREMENTS

ITEM	TEST	TEST PROCEDURE	REQUIREMENT
1	**Contact Resistance (Low Level)**	EIA-364-23: Mate connectors; apply a maximum voltage of 20 mV and a current of 100 mA. Wire resistance shall be removed from the measured value.	10 mΩ Maximum Initial resistance for each test sequence. Resistance measurements for subsequent tests are the Maximum change from Initial as specified.
2	**Insulation Resistance**	Mate connectors: apply a voltage of 500 VDC between adjacent terminals and between terminals to ground.	1000 Megohms MINIMUM
3	**Dielectric Withstanding Voltage**	Mate Connectors: Apply a voltage of 2200 VAC for 1 minute between adjacent contacts.	No breakdown. Current leakage < 5 mA
4	**Temperature Rise (via Current Cycling)**	EIA-364-70 (Temperature Rise) & EIA-364-55 (Current Cycling): Measure the T-Rise at the rated current after 96 hours, during current cycling (45 minutes ON and 15 minutes OFF per hour) for 240 hours, and after final 96-hour steady state.	Temperature rise: +30°C MAXIMUM

6.2 MECHANICAL REQUIREMENTS

ITEM	TEST	TEST PROCEDURE	REQUIREMENT
1	**Terminal Mate / Unmate Forces Per Circuit for:** **Wire – Wire; Wire – Board (formed pin header); and Wire – Board (solid pin header)**	Mate and unmate female to male crimp terminal or female terminal to header at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute. Testing to be conducted with individual (single) circuit. Measure and record the maximum mate and unmate forces with latch disabled.	**Tin, W-W & W-B (formed pin):** Mate: 15.6 N (3.50 lbf) MAX. Unmate: 13.8N (3.10 lbf) MAX.
			Gold, W-W & W-B (formed pin): Mate: 4.9 N (1.10 lbf) MAX. Unmate: 4.0 N (0.91 lbf) MAX.
			Tin, W-B (solid pin): Mate: 13.3 N (3.0 lbf) MAX. Unmate: 11.0N (2.47 lbf) MAX.
			Gold, W-B (solid pin): Mate: 3.4 N (0.77 lbf) MAX. Unmate: 2.8 N (0.63 lbf) MAX.

6.2 MECHANICAL REQUIREMENTS (CON'D)			
ITEM	**TEST**	**TEST PROCEDURE**	**REQUIREMENT**
2	**Normal Force**	Apply a perpendicular force simultaneously to each beam until the desired total deflection is achieved. Return to original size, then deflect beams a second time and measure normal force.	3.5 N (360 g) MINIMUM (Reference Only)
3	**Durability**	Per EIA-364-09C, mate connectors 100 cycles for tin plated product, 250 cycles for gold plated product at a maximum rate of 10 cycles per minute based on mated pairs of 30µ" Au or 100µ" tin at the contact interface.	10 mΩ Max. chg. from Initial; Visual: No Damage
4	**Durability (preconditioning)**	Mate connectors by hand, 20 cycles for tin plated product, 50 cycles for gold as required prior to environmental test sequence as indicated.	Visual: no damage
5	**Reseating**	Unmate / mate connectors by hand three cycles.	Visual: no damage
6	**Vibration (Random)**	Mate connectors and vibrate per EIA 364-28, test condition VII, letter D. Test Duration: 15 minutes in each axis.	10 mΩ Max. chg. from Initial; Discontinuity < 1 microsecond
7	**Crimp Terminal Insertion Force (into housing)**	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm (1 ± ¼ inches).	15.0 N (3.37 lbf) MAXIMUM insertion force
8	**Crimp Terminal Retention Force (in housing)**	Axial pullout force on the terminal in the housing at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	30 N (6.74 lbf) MINIMUM retention force
9	**Wire Crimp Retention**	Apply an axial pullout force on the wire at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute without influence from the insulation crimp. Wire pullout force is applicator dependent. Refer to relevant Molex Applicator Tooling specification.	16 Awg = 68.4 N (15.4 lbf) Min. 18 Awg = 68.4 N (15.4 lbf) Min. 20 Awg = 58.7 N (13.2 lbf) Min.
10	**Thumb Latch Operation Force**	Depress latch at a rate of 25 ± 6mm (1 ± ¼ inches) per minute.	22.2 N (5.0 LBF) MAXIMUM.
11	**Thumb Latch Yield Strength**	Mate loaded connectors fully. Pull connectors apart at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute. (after 1st mate)	68 N (15.3 lbf) MINIMUM.

6.2 MECHANICAL REQUIREMENTS (CON'D)			
ITEM	**TEST**	**TEST PROCEDURE**	**REQUIREMENT**
12	**Solid PC Tail Header Pin Retention Force (in housing) (5569, 172448, 172648 Series)**	Apply axial push force on the terminal in the housing at a rate of 25 ± 6mm (1 ± ¼ inch) per minute.	9.81 N (2.20 lbf) MINIMUM RETENTION FORCE
13	**Stamped PC Tail Terminal Retention Force (in housing) (5566, 172447, 172647 Series)**	Apply axial push force on the terminal in the housing at a rate of 25 ± 6mm (1 ± ¼ inch) per minute.	9.81 N (2.20 lbf) MINIMUM RETENTION FORCE
14	**PCB Engagement Forces**	Engage a connector at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute. Applies to parts with PCB retention features only with PCB holes at nominal diameter and location. Values will vary with PCB material & PCB fabrication and peg type.	For 5569, 172448, 172648: 26.7 to 66.7 N (6.0 to 15.0 lbf) For 5566, 172447, 172647: 4.4 to 44.5 N (1.0 TO 10.0 lbf) Typical insertion force per peg. For Reference ONLY

6.3 ENVIRONMENTAL REQUIREMENTS			
ITEM	**TEST**	**TEST PROCEDURE**	**REQUIREMENT**
1a	**Temperature Life Group 1**	Per EIA-364-17, method A: mate connectors. Expose tin plated terminals to 240 hours at 105 ± 2°C. Expose gold plated terminals to 1000 hours at 125 ± 2°C (see 457500003-TS).	10 mΩ Max. chg. from Initial; Visual: No Damage
1b	**Temperature Life (preconditioning) Group 3**	Per EIA-364-17, method A: mate connectors and expose to 120 hours at 105 ± 2°C.	10 mΩ Max. chg. from Initial; Visual: No Damage
2	**Thermal Shock**	Per EIA-364-32, method A, test condition I, test duration A-4: mate connectors and expose for 10 cycles between –55°C and 105° C; dwell 0.5 hours at each temperature.	10 mΩ Max. chg. from Initial; Visual: No Damage Dielectric Strength per 5.1.3 Insulation Resistance per 5.1.2
3	**Cyclic Temperature & Humidity**	Per EIA-364-31, method III w/o conditioning, initial measurements, cold shock and vibration. Cycle mated connectors between 25°C ±3°C @ 80% ±3% RH and 65°C ±3°C @ 50% ±3RH. Ramp time: 0.5 hr.; dwell time: 1 hr. Perform 24 cycles. Remove surface moisture and air dry for 1 hour prior to measurements	10 mΩ Max. chg. from Initial; Visual: No Damage

6.3 ENVIRONMENTAL REQUIREMENTS (CON'D)			
4	**Solderability**	Molex Test Method: Per SMES-152	Solder coverage: 95% MINIMUM
5	**Reflow Solder Resistance (46991, 46207 Series)**	Convection reflow solder process 260°C Maximum per AS-40000-5013	Visual: No Damage
6	**Wave Solder Resistance**	Dip connector terminals tail in solder: Solder Duration: 5 ± 0.5 seconds; Solder Temperature: Use maximum solder temperature from Section 5.4	Visual: No Damage to insulator housing material

7.0 OTHER INFORMATION

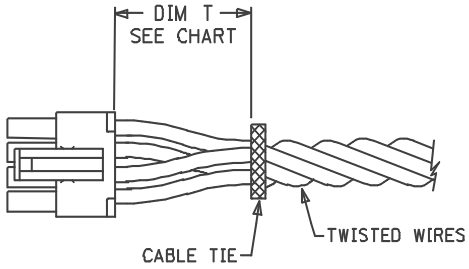
7.1 GAGES AND FIXTURES

It is recommended that test plugs (Series 44281) be used for continuity testing of receptacles. Standard mating parts should not be used for harness testing.

NOTE: The use of unauthorized testing devices and/or probes with a Molex product may cause damage to and affect functionality of the Molex product, and such use may void any and all warranties, expressed or implied.

7.2 CABLE TIE AND OR WIRE TWIST LOCATION

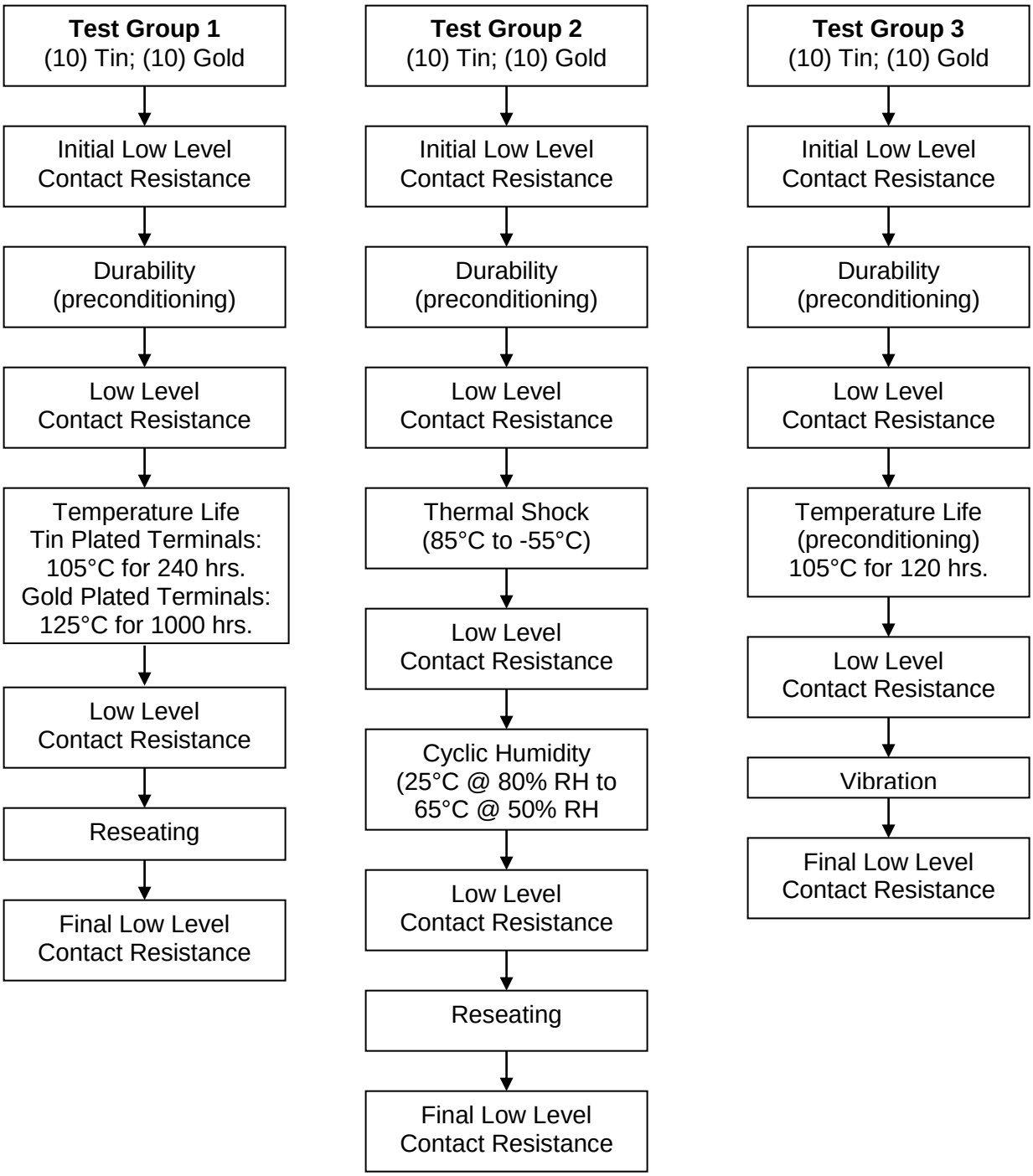
Circuit Sizes		Dim T Min.
Dual Row	Single Row	
2-6	2-3	.50" (12.7 mm)
8	4	.75" (19.1 mm)
10-12	5-6	1.00" (25.4 mm)
14-16	7-8	1.25" (31.75 mm)
18-20	9-10	1.50"(38.09 mm)
22-24	11-12	1.75" (44.45 mm)



The "T" dimension defines a "free" length of wire, or a length of wire that is not subject to significant bias by external factors such as a wire tie, wire twisting, or other means of bending or deforming of the wires that repositions them from their natural relaxed state or location where they enter the housing. Wires are to be dressed in such a manner to allow the terminals to float freely in the pocket. This dimension is a general recommendation and may need to be adjusted for different wire gauges and wire type and insulation thickness and insulation material.

7.0 TEST SEQUENCES

Environmental test sequences for Groups 1, 2, 3, and 7 performed in accordance with EIA-364-1000.



7.0 TEST SEQUENCES (CON'D)