TEST SUMMARY

SL AND C-GRID CONNECTOR SYSTEM

1.0 SCOPE

This Test Summary covers the SL and C-Grid product Line. This summary is to summarize all previous testing performed on SL and C-Grid in relation to the Product specifications.

2.0 PRODUCT DESCRIPTION

2.1 SERIES NUMBER(S)

SL:

70021 male, crimp terminal
70058 female box, crimp terminal
71851 female box, high force crimp terminal
70066 & 70107 single row, crimp housing
70400 female, single row, insulation displacement, connector assembly
70475 & 71178 male, single row, insulation displacement, connector assembly
70541 straight mount header, with active latch and PC board snaps
70543 straight mount header, with active latch
70545 straight mount header, with active latch and PC board retention tri-pegs
70546 straight mount header, low profile with PC board retention tri-pegs
70551 right angle mount header, with active latch and PC board snaps
70553 right angle mount header, with active latch
70555 right angle mount header, with active latch and PC board retention tri-pegs
70556 right angle mount header, low profile with PC board retention tri-pegs
70563 straight mount header, with active latch
70564 straight mount header, low profile
70566 straight mount header, low profile with PC board retention tri-pegs
70571 right angle mount header, with active latch and PC board snaps
70573 right angle mount header, with active latch
70575 right angle mount header, with active latch and PC retention tri-pegs
70634 right angle mount smt header, with active latch and PC board retention tri-peg
71164 straight mount & right angle mount headers, with voided circuits
74098 right angle mount smt header, with active latch and PC board snaps
74099 straight mount smt header, with active latch, and some with Pick & Place Cap
74105 right angle smt header, with active latch

C-Grid:

70450 dual row, crimp housing
70204 dual row, straight mount header, with PC slots and Guide Ears
70216 dual row, right angle unshrouded header, high profile
70280 dual row, straight mount unshrouded header
70287 dual row, straight mount unshrouded header, with retention pin
70567 dual row, straight mount header
70568 dual row, straight mount header, with through hole pegs
71308 dual row, straight mount smt unshrouded header, with and without pegs

71349 dual row, straight mount smt header, with and without pegs
71395 dual row, straight mount smt PCB connector, high profile
71412 dual row, straight mount smt PCB connector, low profile
71764 dual row, right angle unshrouded header, low profile
71850 dual row, straight mount PCB connector, high profile
74162 dual row, right angle header
74164 dual row, right angle header, with pegs
75100 dual row, straight mount header, with PC slots and Guide Ears, compliant pin
75101 dual row, straight mount header, with PC slots and Guide Ears, compliant pin
75102 dual row, straight mount unshrouded header, compliant pin
79168 dual row, straight mount smt unshrouded header, with pegs, high profile

2.2 PRODUCT SPECIFICATION TITLE AND DOCUMENT NUMBER

PS-70400	Product Specification Single Row – Stackable Linear (SL) Connector System
PS-70541	Assembly Connector SL Shrouded Header .100/(2.54) Grid: Family Index
PS-70280	.100” Grid Vertical Mount Dual Row Breakaway Header
PS-71308	.100” Grid Vertical Dual Row Surface Mount Headers
PS-75100-001	Product Specification .100 Center Dual Row Headers with CPI Terminals
PS-71764	.100” Grid Right Angle Dual Row Low Profile Breakaway Header
PS-70216	.100” Grid Right Angle Dual Row High Profile Breakaway Header
PS-74162-001	Product Specification .100” Grid Right Angle Mount Dual Row Shrouded Header
PS-74164-001	Product Specification .100” Grid Right Angle Mount Dual Row Shrouded Header w/pegs
PS-70567	Product Specification .100” Grid Vertical Mount Dual Row Shrouded Header
PS-71349-001	71349 Fully Shrouded, Dual Row Wafer, Vertical SMT, .100” Grid
PS-70204	.100” Grid Shrouded Dual Row Header With PCB Slot and Guide Ears
PS-70181	Dual Row Vertical Mount Housing With PC Tail/Box Contact
PS-71395	73195 Dual Row, High Profile SMT Vertical Receptacle on .100 Grid

3.0 TEST SUMMARIES

3.1 Mechanical

3.1.1 Durability

3.1.1.1 Description: Header is mated to the receptacle and then unmated at a rate of 10 cycles/minute. The header (gold plate pins) was subjected to 25 mate/unmate cycles

3.1.1.2 Requirement: Contact Resistance: Less than 10 milliohm change from Initial

3.1.1.3 Results:

	Initial	Durability
	mΩ	ΔmΩ
Minimum	13.36	-0.40
Maximum	16.54	0.93
Average	14.44	-0.02
StDev	0.37	0.25
n	56	56

3.1.2 Connector Insertion/Withdrawal Forces (*Applies to SL shrouded headers and SL receptacle with latch*)

3.1.2.1 Description:

- Insert at a rate of 1 in/min until latch engagement was achieved.
- Unmate at a rate of 1 in/min until latch defeat occurred.
- Unmate at a rate of 0.8 in/min with latch disengaged

3.1.2.2 Requirement: Insertion: 29.4 N maximum and Retention: 45 N minimum with latch engaged and 15 N with latch disengaged

3.1.2.3 Results:

	Connector Force		
	Insertion Force, N	Retention Force, N	
		Latch engaged	Latch disengaged
	2 Circuit	2 Circuit	4 Circuit
Minimum	5.89	49.67	8.15
Maximum	11.19	63.01	11.05
Average	7.49	56.10	10.11
StDev	1.15	2.81	1.21
n	65	60	5

3.1.3 Receptacle Terminal Retention in Housing

3.1.3.1 Description: Pull wire at a rate of 1 in/min until the terminal was extracted from the housing

3.1.3.2 Requirement: 17.79 N minimum

3.1.3.3 Results:

2 Circuit Receptacle, N	
	Circuit 1
Minimum	26.11
Maximum	58.50
Average	35.20
StDev	7.72
n	79
Criteria	17.79 N Min

3.1.4 Header Housing Retention to pins after wave soldering (*Applies to Shrouded Housings*)

3.1.4.1 Description: Pull at a speed of 25.4 mm/min. An axial force was exerted in an upward direction until the locking mechanism is defeated and/or the connector housing separated from the pins.

3.1.4.2 Results:

	2 Circuit	5 Circuit
Minimum (lbf)	10.00	18.10
Maximum (lbf)	14.90	19.90
Average (lbf)	12.20	19.00
StDev	1.50	0.60
n	10	10

3.1.5 Pin Retention in Header (*Applies to Unshrouded Housings*)

3.1.5.1 Description: Pull at a speed of 25.4 mm/min. An axial force was exerted in an upward direction until the locking mechanism is defeated and/or the connector housing separated from the pins.

3.1.5.2 Requirement: 4 lbf minimum

3.1.5.3 Results:

	100 Circuit
Minimum (lbf)	4.78
Maximum (lbf)	10.84
Average (lbf)	6.91
StDev	1.25
n	250

3.1.6 Terminal/Pin separation Force

3.1.6.1 Description: Insert and withdraw a terminal (male to female) at a rate of 20 mm/min, measure force. Repeat for 10 cycles

3.1.6.2 Requirement: 0.98 to 5.88 N initially and 0.69 to 5.88 N after 10 cycles

3.1.6.3 Results:

	First Mate, N	10x Mate/Unmate, N
Minimum	3.55	2.91
Maximum	4.44	5.87
Average	3.95	4.55
StDev	0.25	0.62
n	20	20

3.1.7 Terminal Crimp Retention

3.1.7.1 Description: Pull the wire in an axial direction from a position approximately 75 mm (+/- 25 mm) from the terminal crimp at a rate of 200 mm/min. Measure the load when the electric wire has been broken or the electric wire has pulled out of the crimped section

3.1.7.2 Requirement: 88.2 N minimum

3.1.7.3 Results:

	Initial, N
Minimum	102.87
Maximum	109.52
Average	107.09
StDev	2.55
n	10

3.2 Electrical

3.2.1 Dielectric Withstanding Voltage

3.2.1.1 Description: EIA-364-20: 500V DC for 1 min applied between adjacent terminals

3.2.1.2 Requirement: No Breakdown

3.2.1.3 Results: No Break Down

3.2.2 Voltage Drop

3.2.2.1 Description: Mate Connectors. Expose to a current of 3 amps and the open circuit voltage set to not exceed 15 volts DC. Power is applied for a minimum of 30 seconds before the first specimen measurement.

3.2.2.2 Requirement: less than 30 mV initially and less than 60 mV after endurance exposure

3.2.2.3 Results:

Voltage Drop (mV)				After Durability of 50 cycles (mV)		
	Initial	Initial	Initial		Initial	50x Mate/Unmate
	2 Ckt	3 Ckt	4 Ckt		4 Ckt	4 Ckt
Minimum	16.54	17.88	20.42	Minimum	21.60	18.78
Maximum	22.89	23.28	24.92	Maximum	24.92	23.44
Average	20.85	21.19	22.12	Average	22.59	22.09
StDev	2.56	1.56	0.98	StDev	1.05	1.27
n	5	10	50	n	10	10

3.2.2.3.1 Endurance Exposure: Vibration

3.2.2.3.1.1 Description: Subject mated connectors to a total of 8 hours of simple harmonic motions. (Apply 4 hours in the Z axis and 2 hours in each of the X and Y axes). Vary the frequency uniformly from 10 Hz to 50 Hz traversed continuously in 8 minutes.

After Vibration (mV)		
	Initial	Vibration
	4 Ckt	4 Ckt
Minimum	21.33	21.31
Maximum	24.56	55.25
Average	22.88	30.19
StDev	0.98	10.70
n	10	10

3.2.2.3.2 Endurance Exposure: Heat Resistance

3.2.2.3.2.1 Description: Place mated connectors in an air circulating chamber oven exposed to a temperature of 100 degrees for 120 hours.

After Heat Resistance (mV)		
	Initial	Heat
	4 Ckt	4 Ckt
Minimum	21.14	21.14
Maximum	23.85	26.51
Average	21.96	22.41
StDev	0.86	1.55
n	10	10

3.2.2.3.3 Endurance Exposure: Cold Resistance

3.2.2.3.3.1 Description: Place mated connectors in an air circulating chamber exposed to a temperature of -40°C for 120 hours.

After Cold Resistance (mV)		
	Initial	50x Mate/Unmate
	4 Ckt	4 Ckt
Minimum	21.10	21.21
Maximum	22.90	23.34
Average	21.89	22.01
StDev	0.57	0.73
n	5	5

3.2.2.3.4 Endurance Exposure: Dust Proofness

3.2.2.3.4.1 Description: Place mated connectors 150mm from the walls of a chamber that measure 1000 mm in length, width, and height. Approximately 1.5kg of Portland cement is to be diffused at a rate of 10 seconds per 15 minutes by blowing air onto it. Expose for 1 hour.

After Dust Proofness (mV)		
	Initial	50x Mate/Unmate
	4 Ckt	4 Ckt
Minimum	20.42	21.14
Maximum	22.15	27.60
Average	21.26	23.56
StDev	0.56	2.05
n	10	10

3.2.3 Leak Current

3.2.3.1 Description: Apply a potential of 13 volts DC across the adjacent contacts of a mated pair. After 60 seconds, measure the initial leakage current. Place mated pair in a thermostatic chamber at a temperature of 60±5° C and a humidity level of 90-95% for one hour. Measure the leakage current again.

3.2.3.2 Requirement: less than 10 microamps initially and less than 1 milliamp post environment testing

3.2.3.3 Results:

	Initial, µA	Humidity, µA
Maximum	0.1	0.4
n	5	5

3.2.4 Insulation Resistance

3.2.4.1 Description: Mate Connectors. Apply a potential of 500 volts DC across the contacts for a period of 15 seconds. Measure the insulation resistance. Follow procedure for all adjacent contacts. Then cover the external housing surface with aluminum foil. Pull back foil approximately 3mm from the exposed contact leads. Attach one lead to the foil and the other lead to all circuit wires simultaneously and repeat IR test.

3.2.4.2 Requirement: 1000 Mega ohms minimum

3.2.4.3 Results:

	Ckt to Ckt, M ohm	Ckt to Housing, M ohm
Minimum	9999	9999
n	15	5

3.3 Environmental

3.3.1 Thermal Aging

3.3.1.1 Description: Mate Connectors. Expose a group to 72 hours at 105±3° C. Also, Expose a group to 240 hours at 85±3° C.

3.3.1.2 Requirement: Contact resistance: less than 10 milliohm change from initial

3.3.1.3 Results:

	72 hours/105±3° C	240 hours/85±3° C
	ΔmΩ	ΔmΩ
Minimum	-0.19	-1.37
Maximum	0.58	1.35
Average	-0.06	0.04
StDev	0.14	0.44
n	65	110

3.3.2 Thermal Shock

3.3.2.1 Description: Mate Connectors. Expose to 10 Cycles of

Temperature °C	Duration (minutes)
105±3	30
-40±3	30

3.3.2.2 Requirement: No Physical Damage; Contact resistance: less than 10 milliohm change from initial

3.3.2.3 Results: No Physical Damage

	ΔmΩ
Minimum	-1.48
Maximum	1.12
Average	-0.12
StDev	0.48
n	111

3.3.3 Thermal/Humidity Cycling

3.3.3.1 Description: Mate Connectors. Expose to 24 cycles of a temperature/humidity profile that ramp between 25±3°C at 80±3% relative humidity (R.H.) and 65±3°C at 50±3% R.H. Dwell times are one hour and ramp times between temperature extremes are 30 minutes.

3.3.3.2 Requirement: No Physical Damage; Contact resistance: less than 10 milliohm change from initial

3.3.3.3 Results: No Physical Damage

	ΔmΩ
Minimum	-0.08
Maximum	0.99
Average	0.38
StDev	0.24
n	65

3.3.4 Temperature Rise

3.3.4.1 Description: Mate Connectors. Apply a current of 3.0 amps for a period of 45 minutes (until the sample temperature stabilize). Measure initial absolute temperature. Also, measure in a similar manner after environmental or endurance treatments. T-Rise calculated from the delta between ambient temperature and absolute temperature.

3.3.4.2 Requirement: less than 25°C initially and less than 30°C post endurance

3.3.4.3 Results:

3.3.4.3.1 Endurance Exposure: Vibration

3.3.4.3.1.1 Description: Subject mated connectors to a total of 8 hours of simple harmonic motions. (Apply 4 hours in the Z axis and 2 hours in each of the X and Y axes). Vary the frequency uniformly from 10 Hz to 50 Hz traversed continuously in 8 minutes.

3.3.4.3.2 Endurance Exposure: Heat Resistance

3.3.4.3.2.1 Description: Place mated connectors in an air circulating chamber oven exposed to a temperature of 100 degrees for 120 hours.

3.3.4.3.3 Endurance Exposure: Cold Resistance

3.3.4.3.3.1 Description: Place mated connectors in an air circulating chamber exposed to a temperature of -40°C for 120 hours.

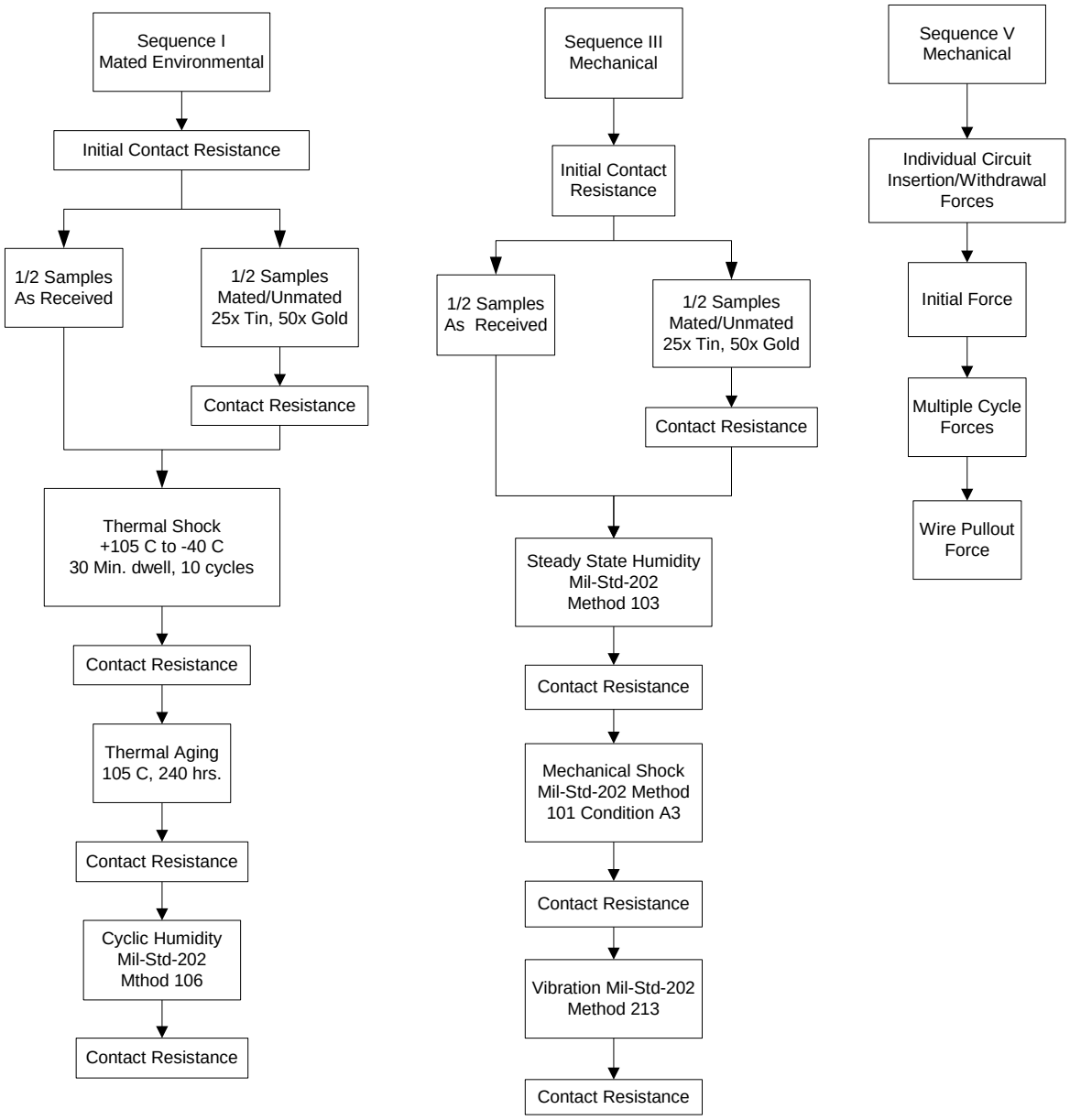
(°C)	Initial	Initial	Initial	Durability (50x)	Vibration	Heat Resistance	Cold Resistance
	2 Ckt	3 Ckt	4 Ckt	4 Ckt	4 Ckt	4 Ckt	4 Ckt
Minimum	7.00	10.45	8.94	8.54	11.16	9.46	9.14
Maximum	9.25	11.29	10.50	10.33	18.33	12.68	10.88
Average	7.80	10.78	9.79	9.74	13.39	10.72	10.07
StDev	0.92	0.57	0.51	0.73	3.01	1.40	0.65
n	3	4	10	5	5	5	5

3.4 Original Product Qualification

3.4.1 Qualification Testing

3.4.1.1 Samples for testing shall be representative of normal productions lots.

3.4.1.2 Sample groups shall consist of a minimum (5) mated pairs of headers and receptacles. 30 minimum data points per group shall be measured. Measurements shall be taken from the middle and ends of the connectors as a minimum.



3.4.2 Test Summary

3.4.2.1 Sequence I – Mated Environmental:

TEST CONDITION	TREATMENT	REQUIREMENT	UNITS	MEAN	MINIMUM	MAXIMUM
Contact Resistance	Initial	30 max.	milliohms	14.47	13.77	15.08
	After Durability	10 max. Change from initial	Δ-milliohms	.09	-0.82	1.40
	After Shock (Thermal)	10 max. Change from initial	Δ-milliohms	.02	-1.15	1.32
	After Thermal Aging	10 max. Change from initial	Δ-milliohms	.00	-1.06	1.18
	After Humidity (Cyclic)	10 max. Change from initial	Δ-milliohms	.25	-1.00	1.78

3.4.2.2 Sequence III – Mechanical:

TEST CONDITION	TREATMENT	REQUIREMENT	UNITS	MEAN	MINIMUM	MAXIMUM
Contact Resistance	Initial	30 max.	milliohms	8.6	8.0	9.4
	After Humidity (Steady State)	10 max. Change from initial	Δ-milliohms	8.6	8.0	9.6
	After Shock (Mechanical)	10 max. Change from initial	Δ-milliohms	8.7	8.1	9.9
	After Vibration	10 max. Change from initial	Δ-milliohms	8.7	8.1	9.4

3.4.2.3 Environmental Performance:

TEST CONDITION	TREATMENT	REQUIREMENT	UNITS	MAXIMUM
Temperature Rise and Current Cycling (+30°C)	22 AWG	<30°C	Amps	3
	24 AWG	<30°C	Amps	3
	26 AWG	<30°C	Amps	1.8
	28 AWG	<30°C	Amps	1.2
	30 AWG	<30°C	Amps	0.70
	32 AWG	<30°C	Amps	0.45
	34 AWG	<30°C	Amps	0.32
	36 AWG	<30°C	Amps	0.21

3.4.2.4 Sequence V – Mechanical:

70058 - MATING FORCE SEQUENCE 5.3						
TEST CONDITION	**TREATMENT**	**PLATING**	**UNITS**	**MEAN**	**MINIMUM**	**MAXIMUM**
Insertion Force	Initial	Tin	LB/N	0.73/3.24	0.62/2.74	0.82/3.63
		Gold	LB/N	0.39/1.75	0.28/1.25	0.59/2.62
	After 25 Cycles	Tin	LB/N	0.75/3.32	0.64/2.83	0.89/3.94
	After 50 Cycles	Gold	LB/N	0.44/1.96	0.27/1.19	0.55/2.44
Withdrawal Force	Initial	Tin	LB/N	0.97/4.31	0.79/3.52	1.05/4.65
		Gold	LB/N	0.29/1.28	0.20/0.89	0.44/1.97
	After 25 Cycles	Tin	LB/N	0.77/3.43	0.68/3.04	0.90/4.02
	After 50 Cycles	Gold	LB/N	0.38/1.69	0.29/1.29	0.56/2.50

71851 - MATING FORCE SEQUENCE 5.3						
TEST CONDITION	**TREATMENT**	**PLATING**	**UNITS**	**MEAN**	**MINIMUM**	**MAXIMUM**
Insertion Force	Initial	Tin	LB/N	2.39/10.62	2.24/9.96	2.53/11.25
		Gold	LB/N	0.99/4.39	0.91/4.05	1.05/4.67
	After 25 Cycles	Tin	LB/N	2.18/9.71	1.60/7.12	2.82/12.54
	After 50 Cycles	Gold	LB/N	1.01/4.48	0.86/3.83	1.17/5.20
Withdrawal Force	Initial	Tin	LB/N	2.68/11.92	2.28/10.14	3.18/14.15
		Gold	LB/N	0.69/3.07	0.62/2.76	0.77/3.43
	After 25 Cycles	Tin	LB/N	2.70/12.02	1.79/7.96	4.23/18.82
	After 50 Cycles	Gold	LB/N	1.07/4.76	0.84/3.74	1.25/5.56

TEST CONDITION	**TREATMENT**	**UNITS**	**MEAN**	**MINIMUM**	**MAXIMUM**
Wire Pullout Force (Axial)	22 AWG with strain relief	LB/N	14.67/65.3	12.63/56.2	16.28/72.4
	22 AWG w/o strain relief	LB/N	10.78/48.0	8.81/39.2	12.24/54.5
	24 AWG	LB/N	8.32/37.0	6.40/28.5	10.10/44.9
	26 AWG	LB/N			
	28 AWG	LB/N			
	30 AWG	LB/N			
	32 AWG	LB/N			
	34 AWG	LB/N			
	36 AWG	LB/N			

TEST SUMMARY

3.4.2.5 Miscellaneous

TEST CONDITION	TREATMENT	REQUIREMENT	UNITS	MEAN	MINIMUM	MAXIMUM
Terminal Retention Force (in Housing)	Initial	4.0/17.79 Minimum	LB/N	8.53/37.94	5.18/23.04	12.53/55.74
Insulation Resistance	Initial	1000 Min.	Megaohms	Passed		
	After Shock (Thermal)	1000 Min.	Megaohms	Passed		
	After Thermal Aging	1000 Min.	Megaohms	Passed		
	After Humidity (Steady State)	1000 Min.	Megaohms	Passed		
	After Humidity (Cyclic)	1000 Min.	Megaohms	Passed		