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1.0 **OBJECTIVE**

This specification defines the performance, test, quality and reliability requirements of the SCA (Single Connect Attach) system.


2.0 **SCOPE**

This specification is applicable to the termination characteristics of the SCA family of products which provides for direct blind mate interconnection of disk drives to backplanes.

3.0 **GENERAL**

This document is composed of the following sections:

<u>Paragraph</u>	<u>Title</u>
1.0	OBJECTIVE
2.0	SCOPE
3.0	GENERAL
4.0	APPLICABLE DOCUMENTS
5.0	REQUIREMENTS
5.1	Qualification
5.2	Material
5.3	Finish
5.4	Design and Construction
6.0	ELECTRICAL CHARACTERISTICS
7.0	MECHANICAL CHARACTERISTICS
8.0	ENVIRONMENTAL CHARACTERISTICS
9.0	QUALITY ASSURANCE PROVISIONS
9.1	Equipment Calibration
9.2	Inspection Conditions
9.3	Sample Quantity and Description
9.4	Acceptance
9.5	Qualification Testing
9.6	Requalification Testing
FIGURE 1	QUALIFICATION TESTING MATRIX
FIGURE 2	METHOD OF CONTACT RESISTANCE MEASUREMENT
FIGURE 3	INSERTION/WITHDRAWAL TEST GAGE

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4.0 **APPLICABLE DOCUMENTS**

4.1 Specifications

- 4.1.1 Engineering drawings.
- 4.1.2 Process Drawings.

4.2 Military Standards

- 4.2.1 MIL-STD-202F: Test Methods for Electronic Component Parts
- 4.2.2 MIL-STD-1344A: Test Methods for Electrical Connectors
- 4.2.3 MIL-C-45662: Equipment Calibration

4.3 Federal Specifications


- 4.3.1 QQ-N-290: Nickel Plating (Electrodeposited)
- 4.3.2 QQ-B-750: Phosphor Bronze Alloy Strip
- 4.3.3 QQ-S-571: Solder

4.4 Other Standards and Specifications

- 4.4.1 UL94: Flammability
- 4.4.2 ASTM B-103: Phosphor Bronze
- 4.4.3 ISO 9000:
- 4.4.4 EIA P/N-3651: Single Connect Attach (SCA) Connectors
- 4.4.5 EIA 364: Electrical connector/socket test procedures including environmental classifications.
- 4.4.6 SFF-8045: 40 pin SCA connector w/parallel selection
- 4.4.7 SFF-8046: 80 pin SCA connector for SCSI disk drives
- 4.4.8 SFF-8047: 40 pin SCA-2 connector w/serial selection
- 4.4.9 SFF-8048: 80 pin SCA-2 connector w/parallel ESI
- 4.4.10 SFF-8451: SCA-2 Unshielded Connections
- 4.4.11 SS-00254: Test Methods for Electronic Components, Lead-Free Soldering Part Design Standards

4.5 FCI Specifications

- 4.5.1 BUS-03-114: Capacitance Measurement
- 4.5.2 BUS-03-404: Normal Force Measurement
- 4.5.3 BUS-03-405: Insertion/Withdrawal Force Measurement
- 4.5.4 BUS-16-016: Phosphor Bronze Strip
- 4.5.5 BUS-16-068: Liquid Crystal Polymer
- 4.5.6 BUS-19-002: Solderability
- 4.5.7 BUS-19-020: Porosity
- 4.5.8 BUS-19-040: Plating Adhesion
- 4.5.9 BUS-19-122: Solder Joint Reliability

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5.0 REQUIREMENTS

5.1 Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein.

5.2 Material

Material for each part shall be specified herein, or equivalent. Substitute material shall meet the performance requirements of this specification.

5.2.1 Receptacle Terminal. The base material shall be C51000 phosphor-bronze strip.

5.2.2 Plug Terminal. The base material shall be C51000 phosphor bronze.

5.2.3 Plug and Receptacle Insulator Housings. The insulators for the plug connectors shall be molded of liquid crystal polymer (LCP)that is rated UL94V-O or better in accordance with UL-94. The insulator for the receptacle connector shall be molded of a High Temperature Nylon (HTN)or LCP that is rated UL94V-O or better in accordance with UL-94. See applicable product drawing for material.


5.2.4 Plug ESD Terminal. The base material shall be C51000 phosphor bronze.

5.2.5 Receptacle ESD Clip Terminal. The base material shall be C51000 phosphor bronze.

5.3 Finish

5.3.1 The plug and receptacle terminals shall be plated in the contact area with 0,76um/30u" palladium nickel with gold flash minimum or 0,76um/30u" gold minimum over 1,27um/ 50u" minimum nickel. The plug and receptacle terminal soldertail sections shall be plated with 2,54um /100u" 90/10 tin-lead minimum or 2,54um /100u" tin minimum over 1,27um/50u" minimum nickel. The terminal areas outside of the contact areas and the soldertail areas shall be plated with 1,27um/ 50u" nickel minimum. The Plug and receptacle terminal press-fit sections shall be plated with 0,5um/20u" min. -1,5um/60u" max. 90/10 tin-lead or 0,5um/20u" min. -1,5um/60u" max. tin over 1,27um/50u" minimum nickel. No plating at cut-off point. See applicable product drawing.

5.3.2 The ESD terminals for the plug and receptacle connectors shall be plated with 2,54um/100 u" 90/10 tin-lead minimum or 2,54um /100u" tin minimum over 1,27um/50u" minimum nickel underplate. See applicable product drawing.

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5.4 Design and Construction

The receptacle connector shall be a multi-piece assembly having two rows of contacts in the connector mating area which transition out to a 1.905mm (0.075") row-to-row x 1,27mm (0.050") column-to-column offset stagger through hole pattern. The contact pattern in the mating area will have short and long terminals in a specific pattern that results in a 0.5mm (0.020") differential between contact points in the long and short terminals. (This allows for first mate-last break capability - see respective product prints for location of short and long terminals.) The receptacle ESD clip terminal has the "active" beam of the ESD grounding system and also has board retention features that secures the connector to the board in preparation for solder reflow (through-hole) or board termination (press-fit).

A polarization peg (optional) on the bottom of the connector housing assures proper connector orientation during board mounting. The receptacle through hole connector is designed to accommodate P.C. board thicknesses of 1,57mm (0.062"), 2,36mm (0.093") and 3,18mm (0.125"). The receptacle press-fit connector is designed to terminate to board thicknesses of 2,36mm (0.093) and 3,18mm (0.125"). Visual examination of connectors to be done per EIA 364-18.


The plug connector shall be a multi-piece assembly having two rows of contacts in the mating area which transition out to a straddle mounting style with the contact soldertails on 1,27mm (0.050") centers. The ESD terminal has termination legs that are designed to accept P.C. boards and compliment the straddle mount style. Features on the connector housing (and the pattern required on the routed edge of the P.C. board) assure proper connector mounting and orientation. The straddle mount plug connector is designed to accommodate various P.C. board thicknesses. See applicable product drawing for specified P.C. board thickness.

- 5.4.1 Mating. The connectors shall be capable of mating and unmating manually without the use of special tools.
- 5.4.2 Workmanship. Connectors shall be uniform in quality and shall be free from burrs, scratches, cracks, voids, chips, blisters, pin holes, sharp edges, and other defects that will adversely affect life or serviceability.


6.0 ELECTRICAL CHARACTERISTICS

6.1 Current Rating: The temperature rise above ambient shall not exceed 30 degrees C at any point in the system when contact positions are powered at the levels specified in Table 2. Specific contact positions are also specified in Table 2. Applicable temperature rise de-rating graph is shown in Figure 1. The following details shall apply:

- a) Ambient Conditions: still air at 25 degrees C.
- b) Reference: EIA 364-70, Method B


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- 6.2 Low Level Contact Resistance. The low level contact resistance of an SCA receptacle connector mated with an SCA plug connector shall not exceed a change of 15 milliohms after environmental exposure when measured in accordance with EIA 364-23. The following details shall apply:
- a) Method of Connection: see current and voltage lead set-ups as shown in Figure 2.
 - b) Test Voltage: 50 millivolt maximum open circuit
 - c) Test Current: Not to exceed 100 milliamps
- 6.3 Insulation Resistance - The insulation resistance of mated connectors shall not be less than 1000 megohms when measured in accordance with EIA 364-21. The following details shall apply:
- a) Test Voltage - 500 volts DC.
 - b) Preparation - The connectors shall be mated but not soldered to a P.C. Board.
 - c) Electrification Time - 2 minutes, unless otherwise specified.
 - d) Points of Measurement - Between adjacent contacts.
- 6.4 Dielectric Withstanding Voltage - There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (> 1 milliamper) when mated connectors are tested in accordance with EIA 364-20, Method B. The following details shall apply:
- a) Test Voltage - 500 volts (DC)
 - b) Test Duration - 60 seconds
 - c) Preparation - The connectors shall be mated but not soldered to a PC board.
 - d) Test Condition - 1 (760 Torr - sea level)
 - e) Points of Measurement - Between adjacent contacts
- 6.5 Contact Resistance, Low Level (LLCR); interface between compliant section and plated through hole. The change in low level contact resistance shall not exceed 1.0 milliohm after environmental exposure when measured in accordance with EIA-364-TP-23, Method 3002.1. The following details shall apply:
- a) Method of Connection - Attach current and voltage leads as shown in Figure 2.
 - b) Test Voltage - 20 millivolts DC max open circuit
 - c) Test Current - not to exceed 100 milliamps

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7.0 MECHANICAL REQUIREMENTS

- 7.1 Mating/Unmating Force - The force to mate a receptacle connector and compatible plug connector shall not exceed 90 grams maximum per contact position. The unmating force shall not be less than 15 grams minimum per contact position. The following details shall apply:
- Cross Head Speed - 0.5 inch per minute
 - Utilize free floating fixtures
 - Reference - EIA 364-13
- 7.2 Contact Retention - Individual contacts (signal and ESD) in the plug and receptacle housing shall withstand an axial load of 0.5 lbs. (227 grams) minimum applied at a rate of 0.20 inches/minute without dislodging from the housing cavity.
- Reference: EIA 364-29
- 7.3 Normal Force - The contact normal force shall not be less than 60 grams (nor greater than 200 grams) when tested in accordance with FCI test specification BUS-03-404.
- 7.4 Individual Pin Insertion/Retention Force - The force required to insert an individual compliant pin into a plated thru hole in a printed circuit board at a rate of 0.2 inches/minute shall not exceed 60N (13.5 pounds). The retention force in the axial direction opposite that of insertion shall not be less than 6.7N (1.5 pounds).
- 7.5 PCB Hole Deformation Radius - Cross-section parallel to board surface. Photograph and measure the hole deformation (deformation on board material) radius at a point .010" from the surface, and the center of the compliant pin section. Include 10 holes. The average (of 10 holes) hole deformation radius shall be no greater than 0.0015" when measured from the drilled hole. The absolute maximum deformation radius shall not exceed 0.002". Reference MIL-STD-2166.
- 7.6 PCB Hole Wall Damage - Cross-section perpendicular to the board surface, and thru the compliant section wear track. Photograph and measure the copper thickness remaining between the compliant section and the printed wiring board laminate. Include 10 holes. The minimum average (of 10 holes) copper thickness remaining between the compliant pin and the printed wiring board laminate shall not be less than 0.0003". In addition, there shall be no copper cracks, separations between conductive interfaces, or laminate-to-copper separations. Reference MIL-STD-2166.

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8.0 ENVIRONMENTAL CONDITIONS

After exposure to the following environmental conditions in accordance with the specified test procedures and/or details, the product shall show no physical damage and shall meet the electrical and mechanical requirements per paragraphs 6.0 and 7.0 as specified in Figure 1.0 test sequence. Product subjected to these environmental tests must be applied to printed circuit boards. Unless otherwise specified, the assemblies shall be mated during exposure.

8.1 Thermal Shock, EIA 364-32

- a) Number of Cycles: 5
- b) Temperature Range: Between -55 and + 105°C
- c) Time at Each Temperature: 30 minutes
- d) Transfer Time: 5 minutes, maximum

8.2 Humidity-Temperature Cycling, EIA 364-31, Method III, Test Condition B

- a) Number of Cycles: 10 days
- b) Duration of Cycle : 24 hours
- c) Relative Humidity: 95% to 90% RH During dwells, 80% to 95% during temperature ramping
- d) Temperature Range: between +25 and +65°C

8.3 High Temperature Life, EIA 364-17, Test Condition 4


- a) Test Duration: 1,000 hours
- b) Temperature - 105°C

8.4 Industrial Mixed Flowing Gas (IMFG) - EIA 364-65

- a) Class: II
- b) Duration: 20 days (mated)

8.5 Physical Shock - EIA 364-27, Test Condition H

- a) Condition: A (50G, 11 millisecond, half-sine)
- b) Shocks - 3 shocks in both directions along each of three orthogonal axes (18 total)
- c) Mounting - Rigidly mount assemblies
- d) No discontinuities greater than 1 microsecond
- e) See Figure 3

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8.6 Vibration (Random Vibration) - EIA 364-28, Test Condition V Letter A

- a) Test Condition: : Random 50-2000 Hz; 5.35G Minimum
- b) Duration ; 1 hour per axis
- c) Direction; each of 3 orthogonal axis
- d) Power Spectral Density: 0.02
- e) Mounting: Rigidly mount assemblies
- f) No discontinuities greater than 1 microsecond
- g) See Figure 3

8.7 Durability - EIA 364-09

- a) Number Cycles: 500 cycles
- b) Cycling Rate: 600 cycles/hour
- c) Preconditioning Cycles: 25

8.8 Solderability - ANSI-J-002, Test Condition A

- a) Steam Aging - 4 hours
- b) Contact areas evaluated shall meet the ANSI-J-002 requirements.
- c) Acceptable Coverage: 95% minimum

8.9 Resistance to Solder Heat - EIA 364-56


- a) Test Condition: E
- b) There shall be no evidence of physical or mechanical damage

8.10 Resistance to Solvents - EIA 364-11

- a) Solvents: Trichloroethylene
- b) Solvent Temperature: Boiling point
- c) Immersion Time: approximately 78 seconds
- d) Number of Immersions: one

8.11 Surface mount connector solder joint reliability - BUS-19-122

Refer to BUS-19-122 for specific test details, sample quantities and acceptance criteria.

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8.12 Gas-Tight-Joint-Test - EIA 364-TP36

- a) Reference EIA-364-TP36 (nitric acid solution)
- b) Duration : 30 minutes
- c) Temperature: 25 °C
- d) Relative Humidity: 75%

8.13 Solderability (Lead Free)

- a) Reference SS-00254-2 (Reflow Solder)
- b) Reference SS-00254-1 (Dip and Wave Solder)

8.14 Whisker Test

- a) Reference SS-00254-8

9.0 QUALITY ASSURANCE PROVISIONS

9.1 Equipment Calibration. All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with MIL-C-45662 and ISO 9000.

9.2 Inspection Conditions. Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions:

- a) Temperature: 25 ± 5°C
- b) Relative Humidity: 30% to 60%
- c) Barometric Pressure: Local ambient

9.3 Sample Quantity and Description


The number of samples to be tested in each test group shown in Figure 1 are defined as follows:

Groups 1 through 8:

5 samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet dimensional requirements of connector.

Groups 9 through 11:

5 samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet dimensional requirements of connector. 25 contacts from each sample is to be tested. All contact positions should be tested under this distribution.

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Group 12:

5 samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet whisker test requirements of connector.

9.4 Acceptance


9.4.1 Electrical and mechanical requirements placed on test samples as indicated in paragraphs 6.0 and 7.0 shall be established from test data using appropriate statistical techniques or shall otherwise be customer specified, and all samples tested in accordance with this product specification shall meet the stated requirements.

9.4.2 Failures attributed to equipment, test setup, or operator error shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

9.5 Qualification Testing. Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequence shall be as shown in Table 1.

9.6 Requalification Testing. If any of the following conditions occur, the responsible product engineer shall initiate requalification testing consisting of all applicable parts of the qualification test matrix, Table 1.

- a) A significant design change is made to the existing product which impacts the product form, fit or function. Examples of significant changes shall include, but not be limited to, changes in the plating material composition or thickness, contact force, contact surface geometry, insulator design, contact base material, or contact lubrication requirements.
- b) A significant change is made to the manufacturing process which impacts the product form, fit or function.
- c) A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.

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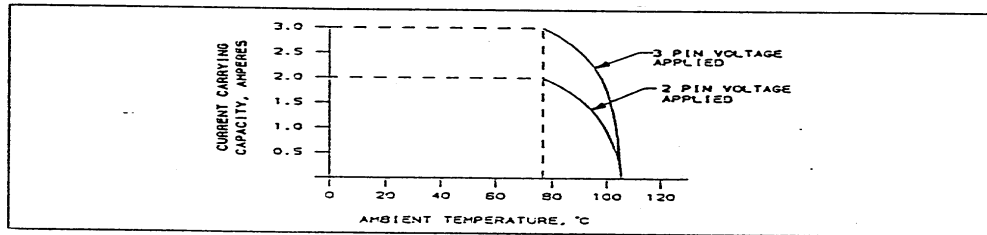



FIGURE 1
CURRENT VS. TEMPERATURE RISE DERATING GRAPH

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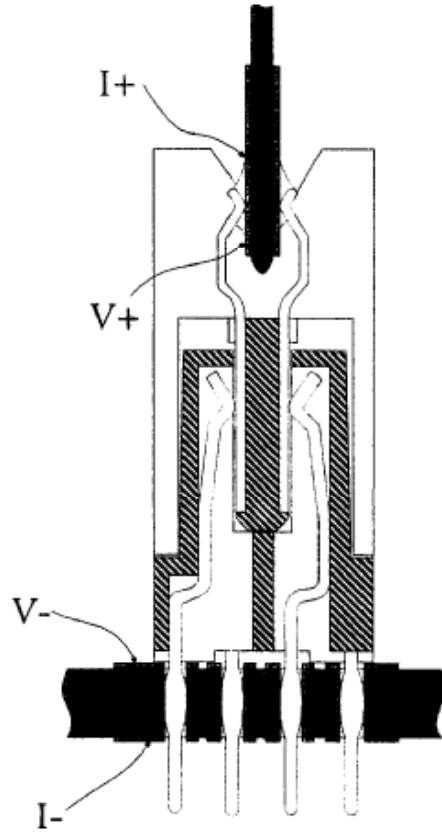



FIGURE 2
Method of Connection, Contact Resistance

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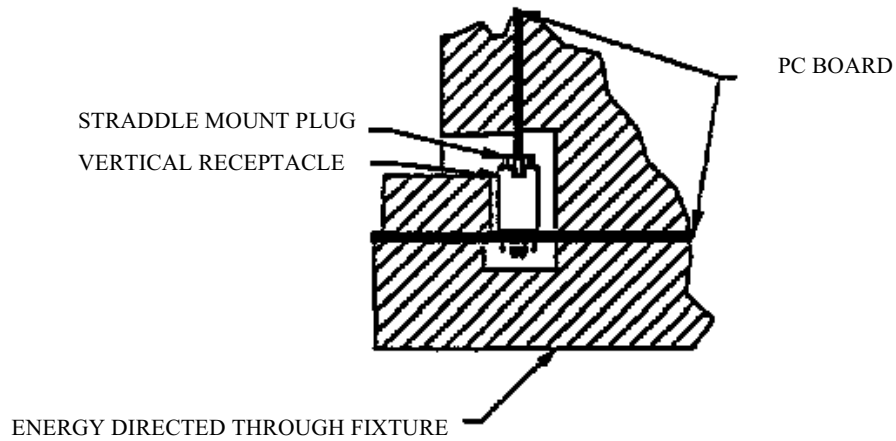


FIGURE 3
VIBRATION AND PHYSICAL SHOCK TEST FIXTURE STRAIGHT TYPICAL



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Table 1- Test Groups and Sequences


TEST GROUP														
		1	2	3a	3b	4	5	6	7	8	9	10	11	12
	PA RA													
Examination of Product	5.4	1,10	1,9	1,10	1,10	1,9	1,3	1,4	1,5 ,8	1,3	1	1,7	1	1, 3
L. L. Contact Resistance	6.2	3,8	3,7	3,6, 8		3,7						2,5		
Insulation Resistance	6.3				2,5,8									
Dielectric Withstanding V.	6.4				3,6,9									
Current Rating	6.1													2
L. L. Press Fit Interface Resist.	6.5	4,9	4,8	4,9		4,8						3,6		
Mating/Unmating Force	7.1	2	2	2		2								
Normal Force	7.3								2,6					
Contact Retention	7.2								3,7					
Insertion Force (Press Fit Only)	7.4										2,4, 6			
Retention Force (Press fit Only)	7.4										3,5, 7			
PCB Hole Deformation Radius	7.5										8			
PCB Hole Wall Damage	7.6										9			
Thermal Shock	8.1			5	4									
Humidity, Temperature Cycling	8.2			7	7									
High Temperature Life	8.3		6						4					
Industrial Mixed Flowing Gas	8.4					6								
Vibration	8.6	6												
Physical Shock	8.5	7												
Durability	8.7	5												
Solderability	8.8						2							
Resistance to Soldering Heat	8.9							2						
Resistance to Solvents	8.10							3						
Solder Joint Reliability	8.11									2				
Durability (Pre-Condition)	8.7		5			5					3			
Gas-Tight Joint Test	8.12											4		
Solderability (Lead Free)	8.13						2(a)							
Whisker Test	8.14													2

NOTE : PRESS FIT RESISTANCE WAS MEASURED ON 50 OF THE 400 TERMINALS.

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POSITION	CURRENT, AMPS	VOLTAGE, VOLTS	CONTACT POSITION (+) ENERGIZED (IN PARALLEL)	CONTACT POSITIONS (-)
40	2	5	19,20	32,35
40	2,5	12	2,3,4	22,23,26,29
80	2	5	34,35	75,76
80	3	12	2,3,4	41,42,43

**TABLE 2
CONTACT CURRENT RATING**

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REVISION RECORD

<u>REV</u>	<u>PAGE</u>	<u>DESCRIPTION</u>	<u>EC#</u>	<u>DATE</u>
A	ALL	New Release	V80296	02/16/98
B	14	Add test group 8 into chart/table	V80889	05/29/98
C	2	Delete Plug & Receptacle 71292,71780,71781,87566 & 87567 and add 4.1.2	V80977	06/09/98
D	2,3,4,6,7,8	Add 4.4.10, Modify 5.2.3 to add LCP. Modify 5.4 noting Straddle Mount plug for various PCB thickness. 7.1 "per contact position" to "per contact pair". 8.0 state "applied" to PCB. 8.6a to 50-2000Hz, 5.35B minimum.	V82162	12/23/98
E	ALL	Revised format to be consistent with GS-01-001, and change BERG, Dupont, etc. references to FCI.	V01904	08/03/00
F	3	Add to Section 5.3.1- "The Plug and receptacle terminal press-fit sections shall be plated with 0,5um/20u" min. -1,5um/60u" max. 90/10 tin-lead"	V02700	11/10/00
	2 Section 4.5	Replaced GES-19-002 with BUS-19-122		
G	3, 9, 10, 14	5.3.1 – Add contact area with 0.76um/30u" gold minimum , soldertail section with 2,54um/100u" tin minimum and press fit section with 0,5um/20u" min – 1,5um/60u" max. tin over 1.27um/50u" minimum nickel. No plating at cutting point. Add 8.13, 8.14 & test group 12	S04-0281	12/29/04
H	6	7.4 - Individual Pin Insertion shall not exceed 60N (13.5 pounds) was 6 pounds.	S05-0061	02/28/05