


NUMBER <b>GS-12-180</b>	TYPE <b>PRODUCT SPECIFICATIONS</b>		
TITLE Converged Metral® Header		PAGE 1 of 9	REVISION G
		AUTHORIZED BY D. Horchler	DATE 9 Oct 07
		STATUS <b>UNRESTRICTED</b>	

## 1.0 OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of the Converged Metral Header product.

## 2.0 SCOPE

This specification is applicable to the termination characteristics of the Converged Metral Header which provides a separable interconnect for printed circuit boards.

## 3.0 GENERAL

This document is composed of the following sections:


Paragraph	Title
1.0	OBJECTIVE
2.0	SCOPE
3.0	GENERAL
4.0	APPLICABLE DOCUMENTS
5.0	REQUIREMENTS
5.1	Qualification
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5.4	Design and Construction
6.0	ELECTRICAL CHARACTERISTICS
7.0	MECHANICAL CHARACTERISTICS
8.0	ENVIRONMENTAL CONDITIONS
9.0	QUALITY ASSURANCE PROVISIONS
9.1	Equipment Calibration
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9.3	Sample Quantity and Description
9.4	Acceptance
9.5	Qualification Testing
9.6	Requalification Testing
TABLE 1	QUALIFICATION TEST SEQUENCE MATRIX

### 3.1 Banned/Restricted Substances

All product where the part number ends in 'LF' meet the European Union directives and other country regulations as described in GS-22-008. The part numbers that do not end in 'LF' meet all regulations except for Pb in SnPb plating.

### 3.2 Manufacturing Processability

All products covered by this specification except those with part number containing '-N' will withstand exposure to 260°C for 60 seconds in a convection, infra-red or vapor phase reflow oven. Part numbers with '-N' will not withstand reflow and the Au contact surface of the contacts shall be exposed to a maximum of 140°C for no longer than 15 seconds in a wave solder operation.

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#### 4.0 APPLICABLE DOCUMENTS

##### 4.1 Specifications

###### 4.1.1 Engineering drawings

##### 4.2 Military Standards

###### 4.2.1 MIL-C-45662

###### 4.2.2 MIL-STD-2166: Connections, Electrical, and Compliant Pin

##### 4.3 Federal Specifications

QQ-N-290 for nickel plating

QQ-N-533 for Beryllium Copper strip

##### 4.4 Other Standards and Specifications

4.4.1 UL94-VO: Flammability

4.4.2 EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications.

4.4.3 ANSI-J-002: Joint Industry Standard, Solderability Test for Component Leads, Terminations, Lugs, and Terminals and Wires.

4.4.4 ISO 9000

4.4.5 Telcordia GR-1217-CORE

##### 4.5 FCI Specifications


GES 20-001, BUS-20-054; BUS-20-055; BUS-20-062; BUS-20-063; BUS-20-73; BUS-20-74; BUS-20-75; BUS-20-76; BUS-03-110; BUS-03-111; BUS-03-112; GS-15-002

FCI Lab Reports - Supporting Data EL 00-03-021, EL-2007-01-012A

#### 5.0 REQUIREMENTS

##### 5.1 Qualification

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

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5.2 Material

The material for each component shall be as specified herein or equivalent. Reference BUS-02-055; BUS-02-056; and BUS-02-058.

Header Pins - Phosphor Bronze Alloy CuSn5 (C51000 H04)  
Shorting Clip - BeCu Alloy 17410 Full Hard

5.3 Finish

The finish for applicable components shall be as specified herein or equivalent. Reference BUS-02-057. The header pins shall be plated with 30u" minimum thickness of either gold or GXT™ over 50u" minimum thickness nickel underplate. The gold deposit shall meet the requirements of MIL-G-45204, type II, Grade C and the nickel deposit shall meet the requirements of QQ-N-290, class 2. Connectors shall be of the design, construction, and physical dimensions specified on the applicable product drawing. The intended application of product to a PCB is via compliant methods.

5.5 Mating Part

The following results/requirements are based the Metral Receptacle being used in conjunction with the Metral header.

**6.0 ELECTRICAL CHARACTERISTICS**

6.1 Low Level Contact Resistance (LLCR)

The low level contact resistance shall not exceed the values shown in Table I when measured in accordance with EIA 364-23. The following details shall apply:

- a. There shall be no electrical discontinuities during subsequent electrical tests, and the low level contact resistance shall not exceed a 10 mΩ rise, maximum, above the values measured in Table I.

Method of connection – See EIA-616 for contact resistance measurement points.


**Table I – Contact Resistance**

Initial Resistance  
Signal milliohms Maximum


Row A	25
Row B	35
Row C	40
Row D	45
Row E	45

- 6.2 Insulation Resistance - The insulation resistance of mated connector pair connectors shall not be less than 5000 megohms initially, (1000 megohms after environmental exposure) when measured in accordance with EIA 364-21. The following details shall apply:

- a. Test Voltage - 500 volts DC

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- b. Electrification Time - 1 minute
  - c. Points of Measurement - Between adjacent contacts and between contacts and metal shields
- 6.3 Dielectric Withstanding Voltage - There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (> 0.5 milliampere) when the mated connectors are tested in accordance with EIA 364-20A. The following details shall apply:
- a. Test Voltage - 500 VDC, 60Hz.
  - b. Test Duration - 60 seconds.
  - c. Voltage: Applied at a rate of 500 volts per second.
  - d. Points of Measurement - Between adjacent contacts and between contacts and the metal shields
- 6.4 Signal Pin Current Capacity - The current carrying capacity of a mated signal pair is rated at 1.5 ampere with current applied to all contacts [24 (4 row) or 30(5 row) contacts] when measured in accordance with EIA-364-70.
- Power Pin Current Capacity - The current carrying capacity of a mated power pair is rated at 3 ampere with current applied to all contacts [24 (4 row) or 30(5 row) contacts] when measured in accordance with EIA-364-70.
- 6.5 Capacitance - The specification requirement shall be satisfied when evaluated in accordance with FCI Test Specification BUS-03-114 and the following details:
- a. Specification requirement 2.2 pF max.
  - b. Sample documentation
  - c. Sample test conditions
    - Frequency 1mhz
    - Amplitude 1volts
    - Surrounding Contacts tied to ground
- 6.6 Inductance - The inductance between adjacent contacts shall be no greater than 25 nH, and between one contact and all other surrounding contacts grounded shall be no greater than 15 nH. The following details apply per BUS-03-113:
- a. Connectors shall be mated.
  - b. Measurements shall be made from tail to tail tip.
    - a. Test conditions 1 nS rise time pulse (0.0V to 1.0V), with a 50 –ohm termination.
    - b. Measurement equipment: Sampler/TDR/Scope equipment with a 50 Ohm reference impedance.
- 6.7 Propagation Delay - The specification requirement shall be satisfied when evaluated in accordance with FCI Test Specification BUS-03-111 and the following details:
- a. Specification requirement 225ps max, 40ps risetime 10 - 90% measured at 50%
  - b. Skew between adjacent rows not exceed 35ps, total skew not to exceed 100ps
  - c. Sample documentation

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- 6.8 Characteristic Impedance - The specification requirement shall be satisfied when evaluated in accordance with FCI Test Specification BUS-03-110 and the following details:
- a. Specification requirement 55 Ohms +/- 5 Ohms single ended except where column 6 is not bounded by the shield of a neighboring module. In this case the unshielded end column shall have a requirement of 61 +/- 5 Ohms single ended.
  - b. Sample documentation
  - c. Sample test conditions @ 500ps ( 10 - 90% ) risetime with all lines terminated in their characteristic impedance
- 6.9 Crosstalk – Adjacent active/quiet near end cross talk shall not exceed 5% in any row or column combination. The far end cross talk shall not exceed 2.5%. The specification requirement shall be satisfied when evaluated in accordance with FCI Test Specification BUS-03-108 and the following details:
- a. Connectors shall be mated.
  - b. Measurements shall be made from tail tip to tail tip.
  - c. Test condition: 1 ns rise time pulse (0.0V to 2.0V) with a 50 –ohm termination.
  - d. Measurement equipment: Sampler/Pulse Generator/Scope equipment with a 50 ohm reference impedance.


## 7.0 MECHANICAL CHARACTERISTICS

- 7.1 Contact Retention to Housing- There shall be no loosening of the contact or damage to the contact or damage to the connector when a axial force of 10N is applied to a contact in either direction along the axis of retention, when measured in accordance with EIA-364-29.
- 7.2 Total mating force- The total force to mate a male header with Metral receptacle header shall not exceed 0.45N for signal or 1.5N for power times the number of contacts, when measured in accordance with EIA-364-13.
- 7.3 Header Pin Insertion/Retention Force - The force required to insert header with compliant pins into plated through holes in a printed circuit board at a rate of 0.5 inches/minute shall not exceed 65 N per pin. The retention force in an axial direction opposite that of insertion shall not be less than 20 N per pin after 3 insertion/extraction cycles on the same holes.
- 7.4 PCB Hole Deformation Radius - Cross-section parallel to board surface. Photograph and measure the hole deformation (deformation on board material) radius at a point 0.010" from the surface, and at the center of the compliant pin section. Include 10 holes. The average (of 10 holes) hole deformation radius shall be no greater than 0.0381 mm (0.0015 in.) when measured from the drilled hole. The absolute maximum deformation radius shall not exceed 0.0508 mm (0.002 in ). Reference MIL-STD-2166.
- 7.5 PCB Hole Wall Damage - Cross-section perpendicular to the board surface, and through the compliant section wear track. Photograph and measure the copper thickness remaining between the compliant pin 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 0.003 in. (0.0003 in. ). In addition there shall be no copper

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cracks, separations between conductive interfaces, or laminate-to-copper separations. Reference MIL-STD-2166.

## 8.0 ENVIRONMENTAL CONDITIONS

After exposure to the following environmental conditions in accordance with the specified test procedure 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 the Table 1 test sequences. Unless specified otherwise, assemblies shall be mated during exposure.

### 8.1 Thermal Shock - EIA 364-32A November 183, Test Condition II

- a. Number of Cycles - 5
- b. Temperature Range - Between -55 °C +0°C/-5°C and +125° C +3°C/-5°C
- c. Time at Each Temperature - 30 minutes
- d. Transfer Time - 5 minutes, maximum

### 8.2 Humidity - Mated samples are to be exposed to cyclical humidity and temperature in accordance with EIA-364-TP31, Method IV, with the following exceptions. Samples are to be subjected to 50 cycles of 10 hours duration for a total of 500 hours after 24 hours in a conditioning oven at 50+/-2°C. A cycle consists of the following steps:

- 1.) Ramp from 25+/-2°C at 80%-98% RH to 65+/-2°C at 94%+/-4% RH in 120 minutes
- 2.) Dwell at 65+/-2°C at 94%+/-4% RH for 4 hours
- 3.) Ramp down to 25+/-2°C at 80%-98% RH in 120 minutes
- 4.) Dwell at 25+/-2°C at 80%-98% RH for 2 hours

### 8.3 High Temperature Life - EIA 364-17A, November 1987, Method A, Test Condition 4. Headers and receptacles shall be mated w/o any electrical load

- a. Test Temperature - 105 degree C +/- 2 degree C
- b. Test Duration - 1000 hours

### 8.4 Industrial Mixed Flowing Gas (4-Gas MFG)

Samples are to be exposed to industrial gas mixture in accordance with Telcordia GR-1217-CORE, November 1995, Section 9.1.3. The headers only are to be exposed for 10 days to the gas mixture detailed below, with interim resistance measurements made after the 5th and 10th days. The samples are then mated with the appropriate receptacle and exposed to an additional 10 days with resistance measurements taken after the 15th and 20th days of exposure. The test chamber is to be maintained at a temperature of 30°C+/-1°C with a relative humidity of 70%+/-2%.


#### Central Office

Gas Constituent	Gas Concentration
NO2	200 ppb
CL2	10 ppb
H2S	10 ppb
SO2	100 ppb

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8.4.1 Gas concentrations per Central Office

**Uncontrolled Environment**

Gas Constituent	Gas Concentration
NO2	200 ppb
CL2	20 ppb
H2S	100 ppb
SO2	200 ppb

8.4.2 Gas concentrations per Uncontrolled Environment

8.5 Vibration Sinusoidal - in accordance with Telcordia GR-1217-CORE, November 1995

- a. Vibration Amplitude - 0.06" DA or 10G acceleration
- b. Frequency Range - 10 to 500 hertz
- c. Duration - 8 hours along each of three orthogonal axes (24 hours total)
- d. Mounting - Rigidly mount assemblies
- e. No discontinuities greater than 1 u second

8.6 Mechanical Shock - in accordance with Telcordia GR-1217-CORE, November 1995 sections 6.3.5 and 9.1.2.1.

- a. Conditions - half-sine 30G, 11 millisecond duration
- b. Shocks - 3 shocks along each of three orthogonal axes
- c. Mounting - Rigidly mount assemblies
- d. Resistance measurements taken after shock in each axis.

8.7 Durability - Standard laboratory procedure as applicable to the specific product.

- a. Number Cycles - 98 or 99 cycles per Table 1
- b. Cycling Rate - 5 inches per minute

8.8 Dust Contamination - per Telcordia GR-1217-CORE, November 1995


- a. per sections 9.1.1.1 and Table 9-1

8.9 Disturb - an Instron compression/tensile tester shall be used to back the fully seated receptacle from the header by 0.004". The sample is then removed and measurements made.

**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.

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## 9.2 Inspection Conditions

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

- a. Temperature: 25 +/- 5 degree C
- b. Relative Humidity: 30% to 60%
- c. Barometric Pressure: Local ambient

## 9.3 Sample Quantity And Description

Sample quantity for each Test Group in Table 1 shall consist of a minimum of one hundred (100) contacts. The 100 contacts shall be selected from a minimum of four (4) connectors.

## 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 specified in EIA-IS64.

## 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 Test Schedule Tables in EIA-IS64.

- 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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**REVISION RECORD**

REV	PAGE	DESCRIPTION	EC #	DATE
A	All	New Release	V11605	4/2/01
B	3	Added AmNi information to section 5.3 Finish	V21394	8/27/02
	3	Updated section "a" in 6.1 to show the new EIA –616 specification and added a resistance value to be associated with Table 1.		
C	All	Add lead free information	V05-0931	10/3/05
D	5	Reword section 7.3 to agree with lead free test method	V06-0117	2/6/06
E	All	Change logo	V06-0512	5/30/06
F	3	Revised plating callout in section 5.3	V07-0253	3/21/07
G	4	Changed current rating to 1.5 amps	V07-0631	10/9/07