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|--|--------------------------------------|-------------------------------|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br><b>PRODUCT SPECIFICATION</b> | <b>FCI</b>                    |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                                      | PAGE<br>1 of 13               | REVISION<br>1      |
|  |                                      | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
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PRELIMINARY

# Signal Metral HDXS connector for Octis

## Cable to Board I/O Connector System

### BOARD CONNECTOR




### CABLE CONNECTOR ATTACHED TO THE PLUG KIT




#### **TABLE OF CONTENTS:**

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|  |                                      |   |                    |
|--|--------------------------------------|---|--------------------|
| NUMBER<br><b>GS-12-1338</b>  | TYPE<br><b>PRODUCT SPECIFICATION</b> |  |                    |
| TITLE<br><br>Signal Metral HDXS connector for Octis<br><br>Cable to Board I/O Connector System |                                      | PAGE<br>2 of 13   | REVISION<br>1      |
|  |                                      | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                                      | STATUS<br><b>UNRESTRICTED</b>   |                    |


|            |   |           |
|------------|---|-----------|
| <b>1.0</b> | <b>OBJECTIVE</b>                                | <b>4</b>  |
| <b>2.0</b> | <b>SCOPE</b>                                    | <b>4</b>  |
| <b>3.0</b> | <b>APPLICABLE DOCUMENTS</b>                     | <b>4</b>  |
| 3.1        | FCI Specifications                              | 4         |
| 3.2        | Other Standards and Specifications              | 4         |
| <b>4.0</b> | <b>GENERAL REQUIREMENTS</b>                     | <b>4</b>  |
| 4.1        | Operation and storage                           | 4         |
| 4.2        | Materials                                       | 4         |
| 4.3        | Finish  | 4         |
| 4.4        | Design and construction                         | 5         |
| 4.5        | Visual Examination of Product                   | 5         |
| <b>5.0</b> | <b>ELECTRICAL CHARACTERISTICS</b>               | <b>5</b>  |
| 5.1        | Low Level Contact Resistance                    | 5         |
| 5.2        | Working voltage                                 | 5         |
| 5.3        | Insulation Resistance                           | 5         |
| 5.4        | Dielectric Withstanding Voltage                 | 5         |
| 5.5        | Creepage and clearance distance                 | 6         |
| 5.6        | Current Rating                                  | 6         |
| 5.7        | Signal Integrity Performance                    | 6         |
| 5.7.1      | Cross talk                                      | 6         |
| 5.7.2      | Impedance                                       | 6         |
| 5.7.3      | Losses  | 6         |
| 5.8        | Electrical magnetic compatibility               | 7         |
| 5.9        | Electrical static discharge                     | 7         |
| 5.10       | Isolation resistance                            | 7         |
| <b>6.0</b> | <b>MECHANICAL CHARACTERISTICS</b>               | <b>7</b>  |
| 6.1        | Mating / Un-mating Force                        | 7         |
| 6.2        | Contact wipe                                    | 7         |
| 6.3        | Connector IDC Termination Axial and 90°         | 7         |
| 6.4        | Cable Retention tests                           | 7         |
| 6.4.1      | Robustness                                      | 8         |
| 6.4.2      | Resistance to cable rotation                    | 8         |
| 6.4.3      | Resistance to cable pull                        | 8         |
| 6.4.4      | Resistance to cable push                        | 8         |
| 6.5        | Polarization                                    | 8         |
| 6.6        | Loose bulk head's tolerances                    | 8         |
| <b>7.0</b> | <b>ENVIRONMENTAL CONDITIONS</b>                 | <b>8</b>  |
| 7.1        | Thermal Shock                                   | 8         |
| 7.2        | Cyclical Humidity and Temperature               | 9         |
| 7.3        | Halogen free and RoHS compliant                 | 9         |
| 7.4        | Temperature Life                                | 9         |
| 7.5        | Industrial Mixed Flowing Gas (Class IIA, 4-gas) | 9         |
| 7.6        | Vibration                                       | 9         |
| 7.7        | Durability                                      | 10        |
| 7.8        | Mechanical Shock                                | 10        |
| 7.9        | Dust Contamination                              | 10        |
| 7.10       | Disturb   | 10        |
| 7.11       | Field installability                            | 10        |
| <b>8.0</b> | <b>QUALITY ASSURANCE PROVISIONS</b>             | <b>10</b> |
| 8.1        | Equipment Calibration                           | 10        |

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|  |                                      |   |                           |
|--|--------------------------------------|---|---------------------------|
| NUMBER<br><b>GS-12-1338</b>  | TYPE<br><b>PRODUCT SPECIFICATION</b> |  |                           |
| TITLE<br><br>Signal Metral HDXS connector for Octis<br><br>Cable to Board I/O Connector System |                                      | PAGE<br><b>3 of 13</b>  | REVISION<br><b>1</b>      |
|  |                                      | AUTHORIZED BY<br><b>S. ALOSIOUS</b>   | DATE<br><b>2015-11-17</b> |
|  |                                      | STATUS<br><b>UNRESTRICTED</b>   |                           |

|            |                                       |           |
|------------|---------------------------------------|-----------|
| 8.2        | Inspection Conditions                 | 10        |
| 8.3        | Sample Quantity and Description       | 11        |
| 8.4        | Acceptance                            | 11        |
| 8.5        | Qualification Testing                 | 11        |
| 8.6        | Re-Qualification Testing              | 11        |
|            | Table 003 – Qualification Test Matrix | 12        |
| <b>9.0</b> | <b>REVISION RECORD</b>                | <b>13</b> |

This document is the property of and embodies CONFIDENTIAL and PROPRIETARY information of FCI. No part of the information shown on this document may be used in any way without the written consent of FCI.

|  |                               |   |                    |
|--|-------------------------------|---|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br>PRODUCT SPECIFICATION |  |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                               | PAGE<br>4 of 13   | REVISION<br>1      |
|  |                               | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                               | STATUS<br><b>UNRESTRICTED</b>   |                    |

## 1.0 OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of the Signal/PoE - Metral HDXS connector interface for the Octis Cable to Board Connector System. The test sequences defined in this specification meet the intent of Telcordia GR-1217-CORE performance testing. This specification is based on standard Metral product performance.

## 2.0 SCOPE

This specification is applicable to the product characteristics of the Signal/PoE - Metral HDXS connector interface for the Octis Cable to Board Connector System. The interconnection for differential pairs provide very low crosstalk. This consists of a right angle board connector mated with a straight cable connector intended for outdoor use.

## 3.0 APPLICABLE DOCUMENTS

### 3.1 FCI Specifications

- Applicable FCI product customer drawings
- FCI Connector System, GS-12-002
- Application specification, GS-20-0454
- Packaging specification, GS-14-XXXX

### 3.2 Other Standards and Specifications

- IEC 61076-4-104: Connectors with assessed quality for use in DC, Low Frequency analogue and digital High Speed data applications for 2 part modular connectors on a basic grid of 2.0 mm and terminations on a multiple grid of 0.5 mm.
- UL94V-O: Test for Flammability of Plastic Materials in Devices and Appliances
- EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- GR-1217-CORE: Telcordia Specification "Generic Requirements for Separable Electrical Connectors"
- IEC 60512-9: Electromechanical Components for Electronic Equipment; Basic Testing Procedures and Measuring Methods

## 4.0 GENERAL REQUIREMENTS

### 4.1 Operation and Storage

Operating temperature range: -40°C to 85°C  
Storage temperature range: -65°C to 85°C

### 4.2 Material :

The materials for each component shall be as specified herein or equivalent.


Housing: High temperature glass filled thermoplastic, UL 94 V-0, Halogen free.  
Contacts: Copper Alloy.

### 4.3 Finish

Plating - signal contacts:

Contact area: Performance-based plating, qualified to meet the requirements of this specification, including the Telcordia GR-1217-CORE (November 1995) Central Office test sequence.

Solder tail: Ni under layer with Sn top layer

|  |                               |   |                    |
|--|-------------------------------|---|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br>PRODUCT SPECIFICATION |  |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                               | PAGE<br>5 of 13   | REVISION<br>1      |
|  |                               | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                               | STATUS<br><b>UNRESTRICTED</b>   |                    |

#### 4.4 Design and Construction

The design, construction, physical dimensions, bulk head dimensions, printed circuit board dimensions and stencil layout of the connectors have been specified on the applicable product drawings or applicable FCI specifications.

#### 4.5 Visual Examination of Product

Visual examinations shall be performed using 10 x magnifications. Parts should be free from blistering, cracks, discoloration, etc.

### 5.0 ELECTRICAL CHARACTERISTICS

#### 5.1 Low Level Contact resistance

Resistance measurements shall be performed using a four-wire method per EIA 364-23B. The maximum initial signal contact resistance depends on the row where the contact is positioned, as shown in table 001.

**Table 001 – Low Level Contact Resistance, maximum**

| Arrangement     | Rows | Signal<br>[mΩ] |
|-----------------|------|----------------|
| Contact/contact | A    | 25             |
|                 | B    | 35             |
|                 | C    | 40             |
|                 | D    | 45             |

The LLCR is measured from PCB hole to wire. The increase in resistance for any position shall not exceed 10 mΩ. The following details apply:

- a. Test voltage: 20 mV maximum open circuit
- b. Test current: 100 mA maximum
- c. Number of readings: for full contacts

#### 5.2 Working voltage

Unshielded headers: max. 300V AC (r.m.s.)

#### 5.3 Insulation Resistance


The insulation resistance of mated connectors shall not be less than 5000 MΩ after environmental exposure when measured in accordance with EIA 364-21C. Measurement on a cable receptacle with cable only inside connector (cable cut at inlet), mated with a board connector. The following details shall apply:

- a. Test voltage: 100V DC
- b. Electrification time: 60 seconds
- c. Points of measurement: All Inter pairs (between different pairs), Intra pairs (between tip and ring of same pair) and pairs to cover.

#### 5.4 Dielectric Withstanding Voltage

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (> 0.5 mA) when the mated connectors are tested in accordance with EIA 364-20C. Measurement on a

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|  |                                      |   |                           |
|--|--------------------------------------|---|---------------------------|
| NUMBER<br><b>GS-12-1338</b>  | TYPE<br><b>PRODUCT SPECIFICATION</b> |  |                           |
| TITLE<br><br>Signal Metral HDXS connector for Octis<br><br>Cable to Board I/O Connector System |                                      | PAGE<br><b>6 of 13</b>  | REVISION<br><b>1</b>      |
|  |                                      | AUTHORIZED BY<br><b>S. ALOSIOUS</b>   | DATE<br><b>2015-11-17</b> |
|  |                                      | STATUS<br><b>UNRESTRICTED</b>   |                           |

cable receptacle with cable only inside connector (cable cut at in inlet), mated with a board connector. The following details shall apply:

- a. Test voltage: 1000V AC
- b. Test duration: 60 seconds
- c. Points of measurement: All Inter pairs (between different pairs), Intra pairs (between tip and ring of same pair)

### 5.5 Creepage and Clearance distance

**Table 002 – Creepage and Clearance distances, minimum**

| Interaction   | Creepage distance<br>[mm] | Clearance distance<br>[mm] |
|---|---------------------------|----------------------------|
| <b>Intra pair</b><br>Between Tip and Ring of same pair                    | 1                         | 1                          |
| <b>Inter pair</b><br>Between 2 different pairs<br>Between pair and shield | 1.5                       | 1.5                        |

### 5.6 Current Rating

Perform in accordance with EIA 364-70A. Measure temperature Vs. applied current for all contacts powered. The following details shall apply:

- a. Ambient conditions: still air at 25°C
- b. Thermocouple location: mechanically attached to the base of the header mating contacts
- c. Copper trace weight: 1 oz
- d. Quantity and location of thermocouples: 4 (2 on an interior column at positions A, C; 2 on an outside column at positions A, C)

The temperature rise above ambient shall not exceed 30°C when all signal contacts are powered at 1A.

### 5.7 Signal Integrity performance

Signal Integrity performance is specified from connector footprint (via holes not included) to cable termination (cable not included). The HDXS Connector is designed to reach the following requirements:

#### 5.7.1 Cross-talk

Male + Female: NEXT and FEXT Pair to pair @ 20 MHz < -60dB

Male + Female: NEXT and FEXT of all pairs to one victim @ 20 MHz < -54dB (Powersum)


#### 5.7.2 Impedance

Impedance of the pairs: 100 Ohm +/-10% @ 30 MHz

#### 5.7.3 Losses

Insertion Loss: < 0.1 dB @ 30 MHz

Return Loss : < -37 dB @ 20 MHz

|  |                               |   |                    |
|--|-------------------------------|---|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br>PRODUCT SPECIFICATION |  |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                               | PAGE<br>7 of 13   | REVISION<br>1      |
|  |                               | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                               | STATUS<br><b>UNRESTRICTED</b>   |                    |

### 5.8 Electrical Magnetic Compatibility

The cable connector is designed to connect shielded cables to a conductive front panel to meet EMC system requirements. The connector has contact features all around the mating area, on a maximum distance of 5 mm. In *fastened* situation, the maximum contact resistance of shielding, measured from drain wire to front panel, is 10 mΩ.

### 5.9 Electrical Static Discharge

The cable connector has shielding necklaces around the connector which has a contact with bulk head feature in mated state. These features guarantee an electrical discharge before signal contacts are mated. The ESD shall be tested by positioning the Cable connector at a fixed distance of 0.5mm from the shielding necklace on the front panel. A static load of 4KV is then applied to the Cable Connector. A discharge must be observed between Cable connector and panel. 1 test specimen must be tested 3 times.

### 5.10 Isolation Resistance

Isolation Resistance: 5000MΩ/km

## 6.0 MECHANICAL CHARACTERISTICS

### 6.1 Mating / Unmating Force

Perform in accordance with EIA 364-13B. The force to mate a receptacle connector and compatible header shall not exceed 0.75N per contact.

The force to un-mate a receptacle connector and compatible header shall not be less than 0.15N per contact

The following details shall apply:

- a. Cross head speed: 1 inch per minute
- b. Lubrication: None
- c. Utilize free-floating fixtures
- d. Number of mate/un-mate cycles: 3

### 6.2 Contact wipe

All signal contacts shall have a contact wipe of 1.55 +/-0.55 mm prior to the connector halves arriving at their fully mated position. A normal force of at least half the nominal value shall exist over this wipe distance.


### 6.3 Connector IDC Termination Axial and 90°

There shall be no loosening of the IDC termination or the contact in the insulator or damage to the IDC termination when a force is applied to a wire, in accordance with GS-20-003. The following details shall apply:

- a. Axial force of 6 Newton
- b. At 90° a force of 5 Newton
- c. Gradual increase of force: 10N/sec. maximum
- d. Min sample size 10 contacts per specimen for axial force and 10 contacts per specimen for 90° force

### 6.4 Cable Retention tests

Tests shall be performed on complete cable assemblies which have been assembled according to GS-20-091. All individual cables per cable connector will be treated as one cable for test purposes.

|  |                               |   |                    |
|--|-------------------------------|---|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br>PRODUCT SPECIFICATION |  |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                               | PAGE<br>8 of 13   | REVISION<br>1      |
|  |                               | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                               | STATUS<br><b>UNRESTRICTED</b>   |                    |

#### 6.4.1 Robustness

Test per IEC 512-9, test 17a. The following details shall apply:

- a. Applied force 10 N
- b. Distance = 20 cm from cable strain relief
- c. Max. 2 mm movement of cable jacket in cover

#### 6.4.2 Resistance to Cable Rotation

Test per IEC 512-9, test 17b. The following details shall apply:

- a. 2 rotations with 5 seconds/cycle
- b. Distance 20 cm from cable strain relief
- c. Max. 2 mm movement of cable jacket in cover

#### 6.4.3 Resistance to Cable Pull

Test per IEC 512-9, test 17c. The following details shall apply:

- a. Pull force 100 N per cable outlet
- b. Distance 20 cm from cable strain relief
- c. Max. 2mm movement of cable jacket in cover

#### 6.4.4 Resistance to Cable Push

The following details shall apply:

- a. Push force 50 N per cable outlet
- b. Distance 20 cm from cable strain relief
- c. Max. 2mm movement of cable jacket in cover

#### 6.5 Polarization

The polarization which prevents the cable connector to be inserted in the board connector when rotated 180°, shall withstand an axial force of 200 N per board connector, which will not result in functional damage.

#### 6.6 Loose bulkhead's tolerances

Perform in accordance with CDC

Tolerances:-

X- direction: +/-0.6

Y- direction: +/-0.4

Z- direction: +/-0.3


### 7.0 ENVIRONMENTAL CONDITIONS

#### 7.1 Thermal Shock

Perform in accordance with EIA 364-32C. The following details shall apply:

- a. Number of cycles: 5
- b. Temperature range: -55 to + 85°C
- c. Time at each temperature: 30 minutes minimum
- d. Transfer time: 30 seconds maximum



|  |                                      |   |                           |
|--|--------------------------------------|---|---------------------------|
| NUMBER<br><b>GS-12-1338</b>  | TYPE<br><b>PRODUCT SPECIFICATION</b> |  |                           |
| TITLE<br><br>Signal Metral HDXS connector for Octis<br><br>Cable to Board I/O Connector System |                                      | PAGE<br><b>9 of 13</b>  | REVISION<br><b>1</b>      |
|  |                                      | AUTHORIZED BY<br><b>S. ALOSIOUS</b>   | DATE<br><b>2015-11-17</b> |
|  |                                      | STATUS<br><b>UNRESTRICTED</b>   |                           |

**7.2 Cyclical Humidity and Temperature**

Mated samples are to be exposed to cyclical humidity and temperature in accordance with GR-950 R5-25/CR5-26/R5-27/R5-28 GR-3108- Core Section 4.3.1

Exposure to 46°C + Solar Loading (Category 2, 753 W/m<sup>2</sup>)

- a. Elastomeric material only
- b. ASTM D 518 : 40°C , 70h
- c. Ozone : 50mPa (ASTM D 1149)

**7.3 Halogen free and RoHS compliant**

**7.4 Temperature Life**

Perform in accordance with EIA 364-17B. Headers and receptacles shall remain mated without any electrical load. The following details shall apply:

- a. Temperature: 85°C
- b. Duration: 504 hours

**7.5 Industrial Mixed Flowing Gas (Class IIA, 4-gas)**

Samples are to be exposed to an industrial gas mixture in accordance with Telcordia GR-1217-CORE, November 1995, Section 9.1.3. The total amount of samples is divided in 2 population of which one population will be tested in MATED situation while the other population will be tested UNMATED. Both populations will simultaneously be exposed for 10 days to the gas mixture detailed below in table 005.

- a. Temperature: 30°C
- b. Relative humidity: 70%
- c. Mandatory readings after the 10<sup>th</sup> day.
- d. Gas compositions, per **Central Office** requirements:


**Table 002 – Composition of gas mixture**

| Gas Type         | Gas Concentration<br>[ppb] |
|------------------|----------------------------|
| NO <sub>2</sub>  | 200                        |
| Cl <sub>2</sub>  | 10                         |
| H <sub>2</sub> S | 10                         |
| SO <sub>2</sub>  | 100                        |

**7.6 Vibration**

Perform in accordance with Telcordia GR-1217-CORE, November 1995, Sections 6.3.5 and 9.1.2.1. The following details shall apply:

- a. Vibration amplitude: 1.5 mm (0.06 inch) double amplitude or 10G acceleration
- b. Frequency range: 10 to 500 to 10 Hz
- c. Sweep time: 15 minutes per cycle
- d. Duration: 8 hours along each of three orthogonal axes (24 hours total)
- e. Mounting: rigidly mounted assemblies
- f. No discontinuities greater than 1 micro-second

|  |                               |   |                    |
|--|-------------------------------|---|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br>PRODUCT SPECIFICATION |  |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                               | PAGE<br>10 of 13  | REVISION<br>1      |
|  |                               | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                               | STATUS<br><b>UNRESTRICTED</b>   |                    |

### 7.7 Durability

Perform in accordance with EIA 364-09C. Use standard laboratory procedure as applicable to the specific product. The following details shall apply:

- a. Number of cycles: 200 total mating cycles
- b. Cycling rate: 12.5 cm (5 inches) per minute

### 7.8 Mechanical Shock

Perform in accordance with Telcordia GR-1217-CORE, November 1995, Sections 6.3.5 and 9.1.2.1. The following details shall apply:

- a. Amplitude: half sine 30G
- b. Duration: 11 milliseconds
- c. Number of shocks: 3 shocks along each of three orthogonal axis (18 total)
- d. Mounting: rigidly mounted assemblies
- e. Take resistance measurements after shock in each axis
- f. No discontinuities greater than 1 micro-second
- g. Setup as shown above

### 7.9 Dust Contamination

Perform in accordance with Telcordia GR-1217-CORE, November 1995, Section 9.1.1.1 & Table 9-1. Unmated headers shall be subjected to a one-hour dust exposure using a benign dust composition as specified in Table 9-1 of Telcordia GR-1217-CORE, November 1995.

### 7.10 Disturb

Perform in accordance with Telcordia GR-1217-CORE, November 1995, Section 9.1.3.3 paragraph 7. The mated connectors shall be subjected to an interface disturbance that consists of slightly unmating the sample approximately 0.10 mm (0.004 inch). The sample is then resealed and measurements are made.

### 7.11 Field installability

This is described in GS-20-0454.

Plugs to be assembled in the field with usual tools (Screw driver) and crimping tool if needed.

## 8.0 QUALITY ASSURANCE PROVISIONS

### 8.1 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 ISO 9000.

### 8.2 Inspection Conditions


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

- a. Temperature: 25 ± 5°C
- b. Relative humidity: 20% to 80%
- c. Barometric pressure: Local ambient

### 8.3 Sample Quantity and Description

The test sequences for qualification testing and connector sample sizes for each are shown in Table 003. The number of readings is specified in the description for each test.

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|  |                               |   |                    |
|--|-------------------------------|---|--------------------|
| NUMBER<br>GS-12-1338   | TYPE<br>PRODUCT SPECIFICATION |  |                    |
| TITLE<br>Signal Metral HDXS connector for Octis<br>Cable to Board I/O Connector System |                               | PAGE<br>11 of 13  | REVISION<br>1      |
|  |                               | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                               | STATUS<br><b>UNRESTRICTED</b>   |                    |

#### 8.4 Acceptance

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

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


#### 8.5 Qualification Testing

Qualification testing shall be performed on sample units build with equipment and procedures normally used in production. The test sequence is shown in the table 003, Qualification test matrix.

#### 8.6 Re-Qualification Testing

If any of the following conditions occur, the responsible product engineer shall initiate re-qualification testing consisting of all applicable parts of the qualification test matrices.

- 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, pin/contact surface geometry, insulator or housing design, pin/contact base material or pin/contact lubrication.
- 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.

|  |                                      |   |                           |
|--|--------------------------------------|---|---------------------------|
| NUMBER<br><b>GS-12-1338</b>  | TYPE<br><b>PRODUCT SPECIFICATION</b> |  |                           |
| TITLE<br><br>Signal Metral HDXS connector for Octis<br><br>Cable to Board I/O Connector System |                                      | PAGE<br><b>12 of 13</b>   | REVISION<br><b>1</b>      |
|  |                                      | AUTHORIZED BY<br><b>S. ALOSIOUS</b>   | DATE<br><b>2015-11-17</b> |
|  |                                      | STATUS<br><b>UNRESTRICTED</b>   |                           |


**Table 003 – Qualification Test Matrix**

| Table 003-Qualification Test Matrix   |         |                           |           |                          |                          |                         |                |         |                      |                  |    |     |
|---------------------------------------|---------|---------------------------|-----------|--------------------------|--------------------------|-------------------------|----------------|---------|----------------------|------------------|----|-----|
|                                       |         | GENERAL CONTACT INTERFACE |           |                          |                          |                         |                |         |                      |                  |    |     |
| TESTGROUP ID                          |         | 1                         | 2         | 3a                       | 3b                       | 4 <sup>(1)</sup>        | 5              | 6       | 7                    | 8                | 9  | 10  |
| QTY OF 8 POS. SIGNAL CABLE ASSEMBLIES |         | 4                         | 4         | 3                        | 4                        | 5                       | 1              | 1       | 3                    | 3                | 2  |     |
| QTY OF 8 POS. SIGNAL BOARD HEADERS    |         | 4                         | 4         | 3                        | 4                        | 5                       | 1              | 1       | 3                    | 0                | 2  |     |
| QTY OF LLCR TEST BOARD SETS           |         | 4                         | 4         |                          | 4                        | 4                       |                |         |                      |                  |    |     |
| QTY OF CONTINUITY BOARDS (BACKPLANE)  |         |                           |           |                          |                          | 1                       | 1              |         |                      |                  |    |     |
| QTY OF SI BOARDS                      |         |                           |           |                          |                          |                         |                |         |                      |                  | 2  |     |
| FRONT PANEL                           |         |                           |           |                          |                          |                         |                |         | 3                    |                  |    | *   |
| TEST DESCRIPTION                      | SECTION | MIXED FLOWING GAS         | TEMP LIFE | THERMAL SHOCK & HUMIDITY | THERMAL SHOCK & HUMIDITY | VIBRATION & MECH. SHOCK | CURRENT RATING | VOLTAGE | RIGIDITY & SHIELDING | CABLE ROBUSTNESS | SI | EMC |
| VISUAL EXAMINATION OF PRODUCT         |         | 1,4                       | 1,5       | 1,11                     | 1,16                     | 1,4                     | 1,3            | 1,5     | 15,7                 | 1,3,5,7,9        | 1  | 1,9 |
| MATE HEADER AND RECEPTACLE            |         | 2,8                       |           | 2                        | 2,10                     | 2,8                     |                | 2       |                      |                  |    | 2   |
| UNMATE HEADER & RECEPTACLE            |         | 6                         |           |                          | 8                        | 6                       |                |         |                      |                  |    | 8   |
| <b>ELECTRICAL</b>                     |         |                           |           |                          |                          |                         |                |         |                      |                  |    |     |
| LOW LEVEL CONTACT RESISTANCE(CTS)     |         | 3,5,9,11,13               | 2,4       |                          | 3,5,7,11,13,15           | 3,5,9,11,13             |                |         |                      |                  |    | 3,5 |
| CONTACT RESISTANCE SHIELDING          |         |                           |           |                          |                          |                         |                |         | 3                    |                  |    |     |
| FMLB                                  |         |                           |           |                          |                          |                         |                | 3       | 2                    |                  |    |     |
| INSULATION RESISTANCE                 |         |                           |           | 3,6,9                    |                          |                         |                | 4       |                      |                  |    |     |
| DIELECTRIC WITHSTANDING VOLTAGE       |         |                           |           | 4,7,10                   |                          |                         |                |         |                      |                  |    |     |
| CURRENT RATING                        |         |                           |           |                          |                          |                         | 2              |         |                      |                  |    |     |
| IMPEDANCE                             |         |                           |           |                          |                          |                         |                |         |                      |                  | 2  |     |
| CROSSTALK                             |         |                           |           |                          |                          |                         |                |         |                      |                  | 3  |     |
| INSERTION LOSS                        |         |                           |           |                          |                          |                         |                |         |                      |                  | 4  |     |
| RETURN LOSS                           |         |                           |           |                          |                          |                         |                |         |                      |                  | 5  |     |
| ELECTRICAL MAGNETIC COMPATIBILITY     |         |                           |           |                          |                          |                         |                |         |                      |                  |    | 4   |
| ELECTRICAL STATIC DISCHARGE           |         |                           |           |                          |                          |                         |                |         |                      |                  |    | 6   |
| ISOLATION RESISTANCE                  |         |                           |           |                          |                          |                         |                |         |                      |                  |    | 7   |
| <b>MECHANICAL</b>                     |         |                           |           |                          |                          |                         |                |         |                      |                  |    |     |
| MATING UNMATING FORCE                 |         |                           |           |                          |                          |                         |                |         |                      |                  |    |     |
| ABUSIVE FORCES                        |         |                           |           |                          |                          |                         |                |         | 6                    |                  |    |     |
| POLARIZATION                          |         |                           |           |                          |                          |                         |                |         | 4                    |                  |    |     |
| CABLE ROBUSTNESS                      |         |                           |           |                          |                          |                         |                |         |                      | 2                |    |     |
| CABLE ROTATION                        |         |                           |           |                          |                          |                         |                |         |                      | 4                |    |     |
| CABLE PULL                            |         |                           |           |                          |                          |                         |                |         |                      | 6                |    |     |
| CABLE TORSION                         |         |                           |           |                          |                          |                         |                |         |                      | 8                |    |     |
| <b>ENVIRONMENTAL</b>                  |         |                           |           |                          |                          |                         |                |         |                      |                  |    |     |
| THERMAL SHOCK                         |         |                           |           | 5                        | 4                        |                         |                |         |                      |                  |    |     |
| CYCLICAL HUMIDITY AND TEMPERATURE     |         |                           |           | 8                        | 12                       |                         |                |         |                      |                  |    |     |
| TEMPERATURE LIFE                      |         |                           | 3         |                          |                          |                         |                |         |                      |                  |    |     |
| MFG;10-DAYS                           |         | 7                         |           |                          |                          |                         |                |         |                      |                  |    |     |
| VIBRATION                             |         |                           |           |                          |                          | 10 <sup>(1)</sup>       |                |         |                      |                  |    |     |
| MECHANICAL SHOCK                      |         |                           |           |                          |                          | 12 <sup>(1)</sup>       |                |         |                      |                  |    |     |
| DURABILITY 99 CYCLES                  |         | 4,12                      |           |                          | 6,14                     | 4                       |                |         |                      |                  |    |     |
| DUST CONTAMINATION                    |         |                           |           |                          | 3                        | 7                       |                |         |                      |                  |    |     |
| DISTURB                               |         | 10                        |           |                          |                          |                         |                |         |                      |                  |    |     |

(1) Discontinuity is measured only on the set of connectors that are not being monitored for LLCR (Test Group 4)

**NOTES:**

\*(Test Group 4) Discontinuity is to be measured only on the set of connectors that are not being monitored for LLCR

|  |                                      |   |                    |
|--|--------------------------------------|---|--------------------|
| NUMBER<br><b>GS-12-1338</b>  | TYPE<br><b>PRODUCT SPECIFICATION</b> |  |                    |
| TITLE<br><br>Signal Metral HDXS connector for Octis<br><br>Cable to Board I/O Connector System |                                      | PAGE<br>13 of 13  | REVISION<br>1      |
|  |                                      | AUTHORIZED BY<br>S. ALOSIOUS  | DATE<br>2015-11-17 |
|  |                                      | STATUS<br><b>UNRESTRICTED</b>   |                    |

**11.0 REVISION RECORD**

| REV | PAGE | DESCRIPTION       | EC # | DATE       |
|-----|------|-------------------|------|------------|
| 1   | ALL  | PRELIMINARY DRAFT | -    | 2015-11-17 |
|     |      |                   |      |            |
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