

NUMBER <b>GS-12-1806</b>	TYPE <b>PRODUCT SPECIFICATION</b>	<b>Amphenol FCI</b>	
TITLE <b>DensiStak Board to board connector</b>		PAGE <b>1 of 11</b>	REVISION <b>A</b>
		AUTHORIZED BY <b>LQ.Lei</b>	DATE <b>28 Nov 2023</b>
		CLASSIFICATION <b>UNRESTRICTED</b>	

## 1.0 Objective

This specification defines the performance, test, quality and reliability requirements of DensiStak Board to board connector product.

## 2.0 Scope

This specification is applicable to the termination characteristics of the DensiStak Board to board family of products which provides PCB header-to-PCB receptacle interconnecting

## 3.0 Ratings

- 3.1 Operating Voltage Rating = 100 V<sub>DC</sub>
- 3.2 Operating Current Rating = 0.8 A per signal contact or 4 A per Shield spring(3.2mm pitch)
- 3.3 Operating Temperature Range = -55 °C ~125°C

## 4.0 Applicable Documents

- 4.1 AFCI Specifications
  - Engineering drawing
- 4.2 National or International Standards
  - 4.2.1 Flammability: UL94V-0 or similar applicable specification;
  - 4.2.2 EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications;
  - 4.2.3 IEC 60512: Connectors for Electronic Equipment – Tests and Measurement;
  - 4.2.4 SAE/USCAR-2: Automotive Electrical Connector Systems
  - 4.2.5 IPCECA J-STD-002: Solderability Test.
  - 4.2.6 MIL-STD-202: Test methods for electronic and electrical component parts.
  - 4.2.7 MIL-STD-1344: Test methods for electronic connectors.

## 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.

### 5.2.1 Housing material:

Insulation body: LCP

UL flame rating: UL 94 V-0

MSL JEDEC J-STD-020: Level 1

### 5.2.2 Contact and Shield Material:

Contact material: Copper Alloy

Hold down: Copper Alloy

## 5.3 Finish

The finish for applicable components shall be specified in product drawings with plating area, plating material and plating thickness.

## 5.4 Appearance and Construction (JIS C 54024.14.3)

Connectors shall be of the design, construction, and physical dimensions specified on the applicable product drawing. There shall be no cracks, burrs, or other physical defects that may impair performance.

## 6.0 Electrical Characteristics

### 6.1 Contact Resistance, Low Level (LLCR)

The low level contact resistance shall be in accordance with EIA 364-23.

The following details shall apply

Item	Initial	After treatment or environmental
Signal	Nominal: $\leq 30 \text{ m}\Omega$	Nominal: $\leq 40 \text{ m}\Omega$
Shield	Nominal: $\leq 5 \text{ m}\Omega$	Nominal: $\leq 5 \text{ m}\Omega$

a. Test Voltage - 20 milli-volts DC max open circuit.

b. Test Current - Not to exceed 100 milli-amperes.

### 6.2 Insulation Resistance

Measurements shall be in accordance with EIA 364-21

The insulation resistance of mated connectors shall not be less than 1000 M $\Omega$

The following details shall apply:

a. Test Voltage - 500 volts DC.

b. Electrification Time - 1 minute.

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c. Points of Measurement - Between adjacent contacts (*and between contacts and other conductive surfaces, if applicable*).

### 6.3 Voltage proof

Measurements shall be in accordance with EIA 364-20.

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current > 1mA when mated/Unmated)

The following details shall apply:

- a. Test Voltage - 500 volts ( AC RMS, 60Hz).
- b. Test Duration - 1 minute
- c. Test Condition - 1 (760 Torr - sea level).
- d. Points of Measurement - Between adjacent contacts (*and between contacts and other conductive surfaces, if applicable*).

### 6.4 Derating curve

Measurements shall be in accordance with IEC 60 512 test 5b

The following details shall apply:

- a. Upper temperature limit: 105 °C
- b. Method of measurement reference below figure

## 7.0 Mechanical Characteristics

### 7.1 Total Insertion and Withdrawal force

Measurements shall be in accordance with EIA 364-13

Function	Insertion Force :	Withdrawal Force :
Shield spring	2N Max /spring	1.5N Max/ spring
Signal contact	0.2N Max/contact	0.16N Max/ contact

The following details shall apply:

- a. Cross Head Speed – 25.4 mm per minute.
- c. Utilize free floating fixtures.

### 7.2 Durability (Mechanical operation)

Measurements shall be in accordance with EIA-364-09

Applicable to no one-time use product

Contact area plating	Number Cycles
Gold flash	50
8u" Gold/GXT	100
15u" Gold/GXT	200
30u" Gold/GXT	500

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- a. Cycling Rate – 25.4mm/min max
- b. Latches disabled (If applicable)
- c. Use free floating fixtures

7.3 Pre-Conditioning cycles  
Measurements shall be in accordance with EIA-364-09

Number Cycles -20 cycles

- a. Cycling Rate – 25.4mm/min max
- b. Use free floating fixtures

7.4 Contact retention  
Measurements shall be in accordance with EIA 364-29  
Apply to right angle product, Test force  $\geq 2$  N

- a. Cross Head Speed – 25.4mm per minute.
- b. Hold 10s than removed
- c. Require 6 contacts/specimen

## 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.

*Use recommended details or select others as appropriate*

8.1 Thermal Shock  
Measurements shall be in accordance with SAE/USCAR-2, 5.6.1

- a. Number of Cycles - 100
- b. Temperature Range - Between -40 deg C and +125 deg C
- c. Time at Each Temperature - 30 minutes
- d. Transfer Time - 5 minutes, maximum

8.2 Mixed Flowing Gas corrosion (MFG)  
Measurements shall be in accordance with IEC 60512-11-7 or EIA 364-65

- a. Class –IIA
- b. Test Duration see below table:

Contact area plating	Total mixed flowing gas exposure, hours	Unmated exposure, hours	Mated exposure, hours	Field life
Gold flash	120	80	40	3 Years
8u" Gold/GXT	168	112	56	5 Years

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15u" Gold/GXT	240	160	80	7 Years
30u" Gold/GXT	336	224	112	10 Years

c. Mechanical operation: 1 time between unmated duration and mated duration

8.3 Vibration Random

Measurements shall be in accordance with SAE/USCAR-2,5.4.6.3

- a. Class: V2
- b. Accelerated speed- 12.1 G.rms
- c. Frequency Range -60 to 1200 Hz,
- d. Sweep Time and Duration – 8 Hours per axis, Total 24 hours
- e. Mounting - Rigidly mount assemblies; specify cable length and mounting location if appropriate.
- f. No discontinuities greater than 1 microsecond

8.4 Mechanical Shock

Measurements shall be in accordance with SAE/USCAR-2,5.4.6.3

- a. Class: V2
- b. 35G, 10 millisecond, half-sine pulse type
- c. Shocks - 10 shocks in both directions along each of three orthogonal axes (30 shocks total)
- d. Mounting - Rigidly mount assemblies; specify cable length and mounting location if appropriate.
- e. No discontinuities greater than 1 microsecond

8.5 Temperature life

Measurements shall be in accordance with USCAR-2,5.6.3

- a. Temperature: 125 °C
- b. Duration : 1008 hours
- c. LLCR measured @ Initial, 250/ 500/1008 hours

8.6 Temperature life (preconditioning)- EIA364-1000, Table 9

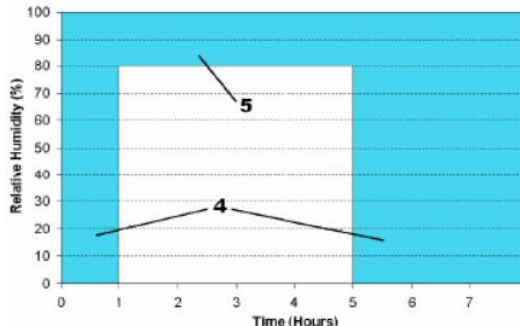
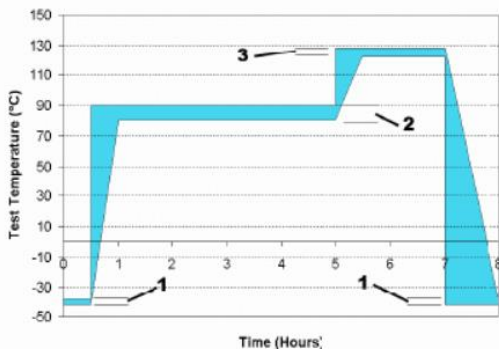
- a. Mated/Unmated: Mated
- b. Test Temperature: 125 °C
- c. Test Duration: 500 hours

8.7 Temperature/ Humidity cycling

Measurements shall be in accordance with USCAR2-7,5.6.2

- a. Temperature: -40°C to 125 °C;
- b. Relative Humidity: see below figure
- c. Duration: Perform 40 cycles

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Key: 1 (-40)°C 2 (80 – 90)°C 3 Test temperature per Table 5.1.4.1 (Class 3 shown for illustration only)  
4 Relative Humidity, uncontrolled. Do not vent chamber at hour 5. 5 (80 – 100)% Relative Humidity

### 8.8 Thermal disturbance

Measurements shall be in accordance with EIA-364-110

- Temperature: 15 °C ± 3 °C to 85 °C ± 3 °C;
- Duration: Ramps: 2°C per minute, reach the temperature extremes (a minimum of 5 minutes) perform 10 cycles

### 8.9 Solderability

Measurements shall be in accordance with IPCECA J-STD-002

- Test condition:S1
- Steam or dry aging 4 hours
- Minimum solder coverage: 95 %

**Pb-free Reflow Parameter Requirements**

	Temperature	Time
Vapor Phase Reflow	217-240°C [423-464°F]	45-90 seconds dwell at reflow
IR/Convection Reflow	150-180°C [302-356°F] Preheat	60-120 seconds
	230-250°C [446-482°F] Reflow	30-60 seconds
Oven	230-250°C [446-482°F]	2-5 minutes (until reflow is assured)

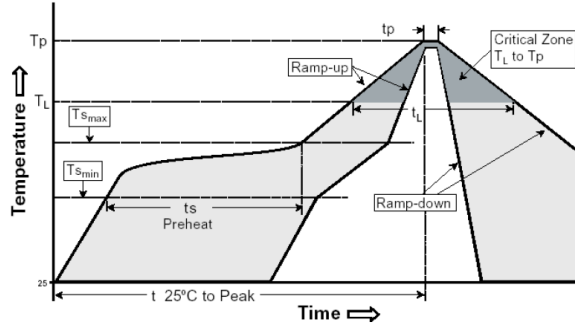
### 8.10 Heat resistance

Measurements shall be in accordance with EIA-364-56

- Test Number of cycles: 3 cycle
- There shall be no evidence of physical or mechanical damage
- No deformation of case or excessive Looseness of the terminal.

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Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (T <sub>Smax</sub> to T <sub>p</sub> )	3°C/ second max.
<b>Preheat</b>	
- Temperature Min (T <sub>Smin</sub> )	150°C
- Temperature Max (T <sub>Smax</sub> )	200°C
- Time (t <sub>Smin</sub> to t <sub>Smax</sub> )	60-180 seconds
Time maintained above:	
- Temperature (T <sub>L</sub> )	217°C
- Time (t <sub>i</sub> )	60-150 seconds
Peak/Classification Temperature (T <sub>p</sub> )	260°C (+0/-5°C)
Time within 5 °C of actual Peak Temperature (t <sub>p</sub> )	20-40 seconds
Ramp-Down Rate	6°C/second max.
Time 25 °C to Peak Temperature	8 minutes max



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## 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 ANSI Z-540 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 deg C
- b. Relative Humidity: 30% to 60%
- c. Barometric Pressure: Local ambient

### 9.3 Sample Quantity And Description

Use this paragraph to describe the test samples required for the specific Test Groups in the qualification test table. Include information such as: number and size of plug and receptacle connectors and/or mated pairs, terminated or not terminated, printed wiring board conditions, wire size, crimp conditions, lubrication conditions, etc. Attach and reference drawings if necessary to clarify the description.

Unless otherwise specified in the application specification, sample quantities for each test group shall be specified in this section and/or the qualification test table. Refer to GS-01-029 section 5.9 for sample quantity recommendations.

### 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 sequences shall be as shown in the qualification test table. Data shall be provided with the samples noting production history: production lot codes for components and assemblies, components and assemblies produced to print revision \_\_\_, verification of plating composition and thickness, etc.

### 9.6 Re-Qualification 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.



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- 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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### 9.7 Qualification Test Table

Test	Para.	Test Sequences									
		Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	
Visual Examination	5.4	1,6	1,6	1,11	1,7	1,10	1,11	1	1,3		
Contact Resistance, Low Level (LLCR)	6.1	2,5	2,5	2,7	2,,6	2,5,7,9	2,8				
Insulation Resistance	6.2			3,8			3,9				
Voltage proof	6.3			4,9			4,10				
Current Rating	6.4							2			
Insertion and Withdrawal force	7.1			10			5,7				
Durability	7.2						6				
Pre-Durability	7.3	3	3	5	3	3					
Contact retention	7.4									1	
Thermal Shock	8.1		4								
MFG	8.2					6					
Vibration Random	8.3				5						
Mechanical Shock	8.4				4						
High Temperature Life	8.5	4									
Temperature life (preconditioning)	8.6					4					
Temperature/ Humidity cycling	8.7			6							
Thermal disturbance	8.8					8					
Solderability	8.9									1	
Heat resistance	8.10								2		
Sample size		3	6	3	6	3	3	3	3	2x3	

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**REVISION RECORD**

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A	All	Initial released	/	27 Nov 2022