

NUMBER GS-12-1706	TYPE GENERAL PRODUCT SPECIFICATION	Amphenol FCI	
TITLE Minitek Pwr CEM-5 12V-2x6 Wire to Board Connectors		PAGE 1 of 11	REVISION B
		AUTHORIZED BY MITHUN PAUL	DATE 15-06-2024
CLASSIFICATION UNRESTRICTED			

1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the Minitek Pwr CEM-5 12V-2x6 Wire to Board Connectors product.

2.0 Scope

This specification is applicable to the termination characteristics of the Minitek Pwr CEM-5 family of products which provides high current rating and signal transmission.

3.0 Ratings

3.1 Operating Voltage Rating = 12V DC

3.2 Operating Power = 600 W @ 12VDC

3.3 Operating Current Rating

For Power Pin = 9.5A/pin (12 power and 4 signal pins energized)

For Signal Pin = 1 A/pin

3.4 Applicable wire size

Termination	Wire Size	Max Outside insulation Diameter
Power	16 AWG	2.20 mm
Signal	28 AWG	1.27 mm

3.5 Operating Temperature Range = -40 ~ 105 (°C) ¹

Note 1: includes the terminal temperature rise when powered

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4.0 Applicable Documents

4.1 AFCI Specifications

4.1.1 Engineering drawings

Series Number	Description
10161719, 10168565	Wire Connector, Receptacle HSG
10160920, 10163894, 10164279, 10164297, 10164298, 10161122, 10166200, 10171623**, 10174235 & 10176941**	Board Connector, Right Angle and Vertical Header with PWR & Signal Terminals
10132447	Wire Connector, Receptacle Crimp PWR Terminal, High mating force version
10166702*	Wire Connector, Receptacle Crimp PWR Terminal, Low mating force version
10161952	Wire Connector, Receptacle Crimp Signal Terminal

*Testing in-progress

**Not yet tooled up

4.1.2 Application specification: GS-20-0704

4.2 Industry or Trade Association standards

- PCI Express CEM Specification, Revision 5.1, Version 1.0

4.3 National or International Standards

4.3.1 Flammability: UL94V-0 or similar applicable specification (Under Testing)

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

4.3.3 IEC 60512: Connectors for Electronic Equipment – Tests and Measurement

4.4 AFCI Laboratory Reports - Supporting Data

- ELX-05/21/021

4.5 Safety Agency Approvals

UL File: In progress

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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

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

5.2.1 Header Housing - Thermoplastic Glass Fiber Filled, UL 94V-0

5.2.2 Receptacle Housing – Thermoplastic, UL 94V-0

5.2.3 Terminal Material – Copper Alloy

5.2.4 Wire – 16 AWG Insulated Stranded Tinned copper conductors for PWR Terminals

5.2.5 Wire – 28 AWG Insulated Stranded Tinned copper conductors for Signal Terminals

5.3 Finish

The finish for applicable components shall be as specified herein or equivalent.

5.3.1 Contact Area:-

- Tin and Gold plating option available (Refer to individual product drawing)

5.3.2 Crimp Area:-

- Refer to individual product drawing

5.4 Design and Construction

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.

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6.0 Performance

6.1 Electrical Requirements

TEST ITEM		REQUIREMENT	PROCEDURE
1	Low Level Contact Resistance	5 milliohms MAXIMUM [initial] For Power Terminal	Mate connectors: apply a maximum voltage of 20 mV and a current of 100 mA. (Does not include wire resistance) (As per EIA 364-23)
		10 milliohms MAXIMUM [initial] For Signal Terminal	
2	Low Level Contact Resistance in side load condition	50% Variation maximum on each conductor from average LLCR of that conductor respective group in each test condition. Maximum LLCR: 6mohm/Pin.	Perform 30 mating cycles, and then apply 20N in each direction as per figure 1. LLCR measurement and test method as per PCI Express card electromechanical specification
3	Insulation Resistance	1000 Mega ohms MINIMUM	Unmate & unmount connectors: apply a voltage of 500 VDC between adjacent terminals and between terminals to ground. (As per EIA 364-21)
4	Dielectric Withstanding Voltage	No breakdown or flashover. Current leakage < 5mA	Unmate connectors: apply a voltage of two times the rated voltage plus 1000volts VAC for 1 minute between adjacent terminals and between terminals to ground (As per EIA-364-20)
5	Temperature Rise (Via Current Cycling)	Temperature rise: +30°C max.	Mate connector: Measure the temperature rise at current after: 1) 96 hours (steady state) 2) 240 hours (45 minutes ON and 15 minutes OFF per hour) 3) 96 hours (steady state) (As per EIA 364-70)

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6.2 Mechanical Requirements

	TEST ITEM	REQUIREMENT	PROCEDURE
6	Insertion and withdrawal force	<p><u>PWR/GND Terminal</u></p> <p><u>For Terminal series 10132447</u> 8.0 N per circuit Max. Insertion force & 2.4 N per circuit Min. withdrawal force</p> <p><u>For Terminal series 10166702</u> 4.1 N per circuit Max. Insertion force & 0.6 N per circuit Min. withdrawal force</p> <p><u>Side Band 10161952</u> 3.0N per circuit Max. Insertion force & 0.2 N per circuit Min. withdrawal force</p>	Mate and unmate connector (male to female) at a rate of 25±6mm per minute (As per EIA 364-13)
7	Terminal Retention Force (in Housing)	<p>24.5 N Min. retention force For Power Terminal</p> <p>9 N Min. retention force For Signal Terminal</p>	Axial pullout force on the terminal in the housing at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute. (As per EIA 364-05)
8	Terminal Insertion Force (into Housing)	14.7 N Max. insertion force	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute (As per EIA 364-05)

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9	Durability	LLCR: $\Delta 5$ m Ω max. For Power Terminal	Mate connectors up to 50 cycles at a maximum rate of 10 cycles per minute (As per EIA-364-09)
		LLCR: $\Delta 10$ m Ω max. For Signal Terminal	
10	Wire Pullout Force (Axial) (Wire from Terminal)	Min. pullout force 16 awg: 68.6 N 28 awg: 8.9 N	Apply an axial pullout force on the wire at a rate of 25+/-6mm per minute. (As per IEC 60512)
11	Pin to Header Retention	13.7 N Min. pushout force For Power Terminal	Apply axial push force to pin at a rate of 25 \pm 6 mm (1 \pm ¼ inch) per minute. (As per EIA 364-29)
		9 N Min. pushout force For Signal Terminal	
12	Thumb Latch to Ramp Yield Strength	58.0 N MINIMUM Yield Strength	Full mate and then unmated the connector at a rate of 25+/-6mm per minute.
13	Vibration (Random)	LLCR: $\Delta 20$ m Ω max. & Discontinuity < 1 microsecond	Mate connectors and vibrate per EIA 364-28, test condition VII, Letter D. Test Duration: 15 minutes each axis. Vibration Amplitude – 3.10 rms G minimum (As per EIA 364-28)
14	Shock (Mechanical)	LLCR: $\Delta 20$ m Ω max. & Discontinuity < 1 microsecond	Mate connectors and shock at 50 g's with ½ sine wave (11 milliseconds) shocks in the $\pm X, \pm Y, \pm Z$ axes (18 shocks total). (Per EIA-364-27, Test Condition H)

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6.4 Environmental Requirements

	TEST ITEM	REQUIREMENT	PROCEDURE
15	Solderability	Continuous solder coating with a min. 95% coverage	Solder pot temperature: 250 ~255 °C Soldering time: 2.5 seconds Flux: unactivated (As per IEC-60068-2-20)
16	Salt Spray	No evidence of damage.	Mate connectors Orientation: Horizontal with latch on top surface Duration: 48 hours exposure Atmosphere: Salt spray from a 5% solution Temperature: 35 ± 2°C As per EIA-364-26
		LLCR: Δ5 mΩ max. For Power Terminal	
17	Thermal Aging	LLCR: Δ10 mΩ max. For Signal Terminal	(As per EIA 364-17) Mate connectors: expose to 240 hours for Tin plated at 105 ± 2°C or expose to: 1,000 hours at 125 ± 2 °C for gold plated terminals
		LLCR: Δ5 mΩ max. For Power Terminal	
18	Humidity (Steady State)	Dielectric Withstanding Voltage: No Breakdown at 500 VAC	Mate connectors: expose to a temperature of 40 ± 2°C with a relative humidity of 90~95% for 96 hours. Note: Remove surface moisture and air dry for 1 hour prior to measurements. EIA 364-31 method II (steady state)
		Insulation Resistance: 1000 MΩ Min.	
		LLCR: Δ5 mΩ max. For Power Terminal	
		LLCR: Δ10 mΩ max. For Signal Terminal	
19	Resistance to Soldering Heat	Visual: No Damage to insulator material	Dip connector terminal tails in solder: Solder Duration: 10 seconds Max. Solder temperature: 260°C Max. (As per EIA-364-56)
20	Cold Resistance	LLCR: Δ5 mΩ max. For Power Terminal	Mate connectors Duration:96 hrs Temperature: -40±3°C (Per EIA 364-59)
		LLCR: Δ10 mΩ max. For Signal Terminal	

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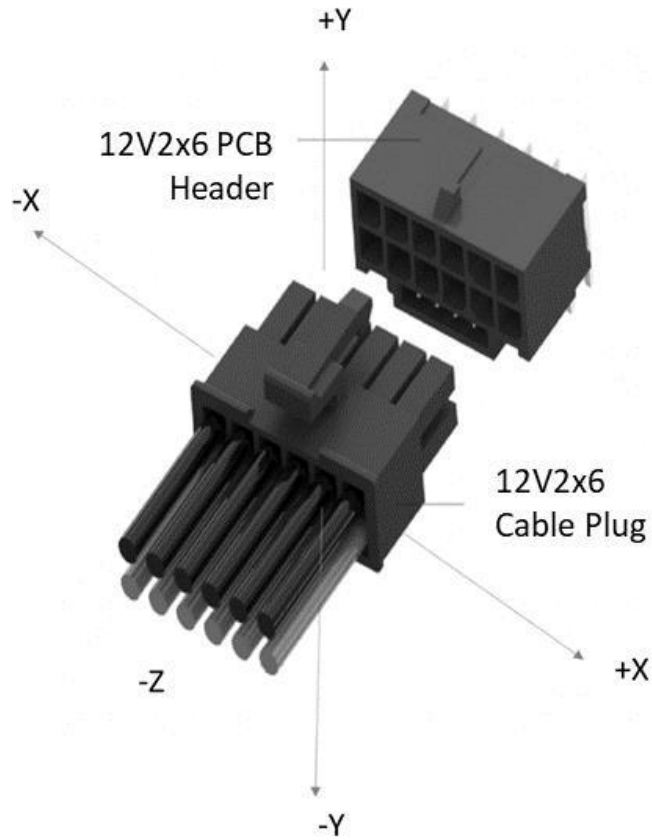


Figure-1

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7.0 QUALITY ASSURANCE PROVISIONS

7.1 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.

7.2 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

7.3 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.

7.4 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.

7.5 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.

- 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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7.6 Qualification Test Table

Test or Examination	Test Group											
	A	B	C	D	E	F	G	H	I	J	K	L
	Test Sequence											
Examination of Product	1,9	1,11	1,5	1,3	1	1	1	1	1,3	1,5	1,3	1,6
Low Level Contact Resistance	2,8	2,6, 10	2,4		2,4					2,4		2,5
Insulation Resistance		3,8										
Dielectric Withstanding Voltage		4,9										
Temperature Rise (Via Current Cycling)			3									
Insertion Force	3,6											
Withdrawal Force	4,7											
Terminal Insertion Force in Housing for Cable assembly						2						
Terminal Retention Force in Housing for Cable assembly						3						
Wire Pullout Force (Axial) (Wire from Terminal)							2					
Thumb Latch to Ramp Yield Strength								2				
Durability	5											
Pin to header Retention											2	
Vibration												3
Shock												4
Solderability				2								
Salt Spray					3							
Thermal Aging		5										
Humidity (Steady State)		7										
Resistance to Soldering Heat									2			
Cold Resistance										3		
Sample Size per Test Group	5	5	5	5	5	5	5	5	5	5	5	5

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REVISION RECORD

Rev	Page	Description	EC#	Date
A	ALL	New Release	-	23-06-2021
B	ALL	<ul style="list-style-type: none"> • Added Part No: 10163895 • updated vibration , shock details & Thermal Aging • Note for Current rating updated • Added Part No: 10164279, 10164297 & 10164298 • Added Part No: 10163894, 10161122 & 10166200 • Plating detail updated • Added Temperature rise test standard • Title updated 12V-2x6 • Added Part No. 10166702 • Updated insertion and withdrawal force • Added connector series 10171623 • Updated Temperature rise test spec • Added connector series 10174235 • Added LLCR with side load test condition & image • Added connector series 10176941 	ELX-I-51842	15-06-2024