

NUMBER <b>GS-12-1260</b>	TYPE <b>PRODUCT SPECIFICATION</b>	<b>Amphenol FCI</b>	
TITLE <b>PwrBlok™ Connector System</b>		PAGE <b>1 of 11</b>	REVISION <b>G</b>
		AUTHORIZED BY <b>Yong. Zhang</b>	DATE <b>08/26'20</b>
		CLASSIFICATION <b>Released</b>	

## 1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the PwrBlok™ connector system.

## 2.0 Scope

This specification is applicable to the termination characteristics of the PwrBlok™ family of products which provides power interface between:

- PC Boards
- Busbars
- PC Boards and Busbars

## 3.0 Ratings

3.1 Operating Voltage Rating = See Table 3 for product ratings

3.2 Operating Current Rating = See Table 3 for product ratings

3.3 Operating Temperature Range = -55°C ~ 105°C

## 4.0 Applicable Documents

4.1 FCI Specifications

4.1.1 GS-14-2432 Packaging Specification

4.1.2 GS-20-0424 Application specification

4.2 National or International Standards

4.3.1 UL94: Flammability

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

4.3.3 MIL-STD-1344A: Federal Specifications, Test Methods for Electrical Connectors.

4.3 Industry or Trade Association standards

Telcordia GR-1217 requirement for Temperature Life

4.4 FCI Laboratory Reports - Supporting Data

EL-2015-04-058

EL-2015-04-059

EL-2015-05-011

EL-2015-05-013

4.5 Safety Agency Approvals

TBD

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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.

- Connector Body –

Table 1: Connector Body Material

<u>Product Series</u>	<u>Product Style</u>	<u>Material</u>
BBS	Pins and Sockets	Cu Alloy
CBS	Plugs and Receptacles	Zinc Alloy

- Band Contact – Cu Alloy
- Press-fit Contact – Cu Alloy
- Cover – High-temp Thermoplastic, Halogen-free, UL94V-0

### 5.3 Finish

- Connector Body – Silver over Nickel
- Band Contact – Silver over Nickel
- Press-fit Contact – Tin over Nickel

### 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.

### 5.5 Workmanship

Finished parts are to be free from blistering, cracks, discoloration, etc.

### 5.6 Examination

Visual and dimensional inspection per product drawings, must meet requirements of product drawing in accordance with EIA-364-18.

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## 6.0 Electrical Characteristics

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

The low level contact resistance shall not exceed 2 milliohms initially and after any treatment and/or environmental exposure. Part under test shall be mated to a pin of matching diameter. Termination to PCB shall be included in measurement.

Measurements shall be in accordance with EIA 364-23.

The following details shall apply:

- a. Test Voltage - 20 millivolts DC max open circuit.
- b. Test Current - Not to exceed 100 milliamperes.

### 6.2 Contact Resistance, Specified Current

The contact resistance at rated current shall not exceed the values defined in Table 2.

Table 2: Maximum Contact Resistance

<b>Product Series</b>	<b>Pin Diameter (mm)</b>	<b>Maximum Contact Resistance (mOhms) *</b>
BBS & CBS	3.6	0.5
BBS	5.7	0.3
CBS	3.0	1.0
CBS	6.0	0.4
CBS	10.0	0.2

\* End-of-life conditions – after environmental exposure as defined in Section 9.4

Measurements shall be in accordance with EIA 364-06.

The following details shall apply:

- a. Test Current – Shown in Table 3.

### 6.3 Insulation Resistance

The insulation resistance of mated connectors shall not be less than 1,000 megohms initially and 1,000 megohms after environmental exposure.

Measurements shall be in accordance with EIA 364-21.

The following details shall apply:

- a. Test Voltage – 500 volts DC.
- b. Electrification Time - 2 minutes, unless otherwise specified.
- c. Points of Measurement - Between adjacent connectors.

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#### 6.4 Dielectric Withstanding Voltage

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current > 1 milliamperes when mated connectors are tested in accordance with EIA 364-20.

The following details shall apply:

- a. Test Voltage – 5000 volts
- b. Test Duration - 60 seconds.
- c. Test Condition - 760 Torr - sea level.
- d. Points of Measurement - Between adjacent connectors

There is no DWV requirement for uninsulated, single-circuit PwrBlok BBS pins and sockets.

#### 6.5 Current Rating

The temperature rise above ambient shall not exceed 30 deg C at any point in the system when all contacts are powered at specified amperes in Table 3.

The following details shall apply:

- a. Ambient Conditions – Still air at 25°C
- b. Stabilize at a single current level until 3 readings at 5 minute intervals are within 1°C.
- c. Test with single energized contact and with all adjacent contacts energized.
- d. Reference - EIA 364-70, method 1.

Table 3: Rated current and voltage table

<u>Product Style</u>	<u>USR Current Rating (Amperes)</u>	<u>CNR Current Rating (Amperes)</u>	<u>Voltage (Vdc)</u>
3.0mm – CBS Plugs and Receptacles	85	65	1667 <sup>1</sup>
3.6mm –BBS Pins and Sockets	70	70	Not Applicable <sup>2</sup>
3.6mm – CBS Plugs and Receptacles	80	80	1667 <sup>1</sup>
5.7mm – BBS Pins and Sockets	120	120	Not Applicable <sup>2</sup>
6.0mm – CBS Plugs and Receptacles	180	140	1667 <sup>1</sup>
10.0mm – CBS Plugs and Receptacles	250	250	TBD <sup>1</sup>

<sup>1</sup>Voltage rating = 1/3 DWV Voltage between 2 adjacent connectors.

<sup>2</sup>Voltage rating does not apply to non-insulated, single-circuit PwrBlok BBS pins and sockets.

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## 7.0 Mechanical Characteristics

### 7.1 Mating/Unmating Force

The force to mate a receptacle connector and compatible header pin shall not exceed values provided in Table 4.

The following details shall apply:

- Cross Head Speed – 12.7mm [0.5 in.] per minute.
- Lubrication – None
- Utilize free floating fixtures.
- Reference – EIA 364-13.

Table 4: Mating/Unmating force

<b>Product Size</b>	<b>F<sub>mating</sub> (N) (max)</b>	<b>F<sub>un-mating</sub> (N) (min)</b>
3.0mm	60	3.0
3.6mm	43	3.0
5.7mm	68	4.0
6.0mm	90	4.0
10.0mm	100	4.0

### 7.2 Compliant Pin Insertion Force

The force necessary to correctly apply a specimen to a printed circuit board.

- Average force to insert one EON: 58 N maximum
- Cross Head Speed – 12.7mm [0.5 in.] per minute max.
- Reference – EIA 364-5.

### 7.3 Compliant Pin Retention Force – EIA 364-05

The force necessary to remove a specimen to a printed circuit board.

- Average force to remove one EON: 24 N minimum
- Cross Head Speed – 12.7mm [0.5 in.] per minute max.
- Reference – EIA 364-5.

### 7.4 Radial Hole Distortion and PTH Wall Damage

0.070mm [0.00276in] maximum radial distortion.

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0.008mm [0.00032in] minimum copper hole wall remaining.

There shall be no copper cracks, separation between conductive interfaces, or laminate to copper separations.

The following details shall apply:

- a) Measure at 0.2 to 0.5mm [0.008 to 0.020in] depth.
- b) Reference – EIA 364-96.

#### 7.5 Durability

The connector pairs shall be capable of withstanding 200 mating/unmating cycles.

When used for pre-conditioning treatment, 10 mating/unmating cycles shall be applied prior to mechanical/environmental exposure. Reference EIA-364-09.

#### 7.6 Mechanical Shock – EIA 364-27

- a. Condition - A (50G, 11millisecond, half-sine wave)
- b. Shocks – 3 shocks in both directions along each of three orthogonal axes (18 shocks total)
- c. Mounting - Rigidly mount assemblies.
- d. No discontinuities greater than 1.0microseconds.

#### 7.7 Vibration (Random) –EIA 364-28, Condition V, Letter C

- a. Vibration Amplitude – 9.26 rms G minimum
- b. Duration - 2 hours along each of three orthogonal axes (6 hours total)

### 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 3 test sequences. Unless specified otherwise, assemblies shall be mated during exposure.

#### 8.1 Thermal Shock – EIA 364-32, Method A, Condition II

- a. Number of Cycles – 25 cycles
- b. Temperature Range - Between -65 and 105 deg C
- c. Time at Each Temperature - 30 minutes, minimum

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d. Transfer Time – 5 minutes, maximum

8.2 Cyclic Temperature and Humidity – EIA 364-31, Method IV (cyclic temperature), Condition B, Omit step 7b (vibration).

a. Relative Humidity – 80 - 98 %

b. Temperature – 25 to 65 deg C

c. Duration – 10 cycles, 10 days

8.3 High Temperature Life –EIA 364-17, Method A, Condition 4

a. Test Temperature - 105 deg C

b. Test Duration - 1000 hours

When used for pre-conditioning treatment, 72 hours @ 105 deg C (represents 10 years @ 60 deg C) shall be applied prior to mechanical/environmental exposure. Reference: EIA-364-1000, Table 9.

8.4 Mixed Flowing Gas corrosion (MFG) – EIA 364-65

a. Class - IIA

b. Duration - 14 days

c. 7 days unmated, then 7 days mated

8.5 Dust – EIA 364-91, Dust Composition 1

Unmated socket/receptacle and pin/plug samples shall be exposed to circulating dust for 1 hour, then exposed to non-circulating dust (settling exposure) for an additional hour.

8.6 Thermal Disturbance – EIA 364-110, condition A (+15C to +85C) for 10 cycles.

Samples shall remain mated after dust exposure through completion of Thermal Disturbance cycles.

## 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 conditions:

a. Temperature: 25+/- 5°C

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- b. Relative Humidity: 30% to 60%
- c. Barometric Pressure: Local ambient

9.3 Acceptance

9.3.1 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.

9.3.2 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.

9.4 Qualification Testing

9.4.1 Qualification testing shall be performed on randomly selected sample units produced with equipment and procedures normally used in production.

9.4.2 Test Sequence – as specified in Table 3.

9.5 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, Table 3.

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



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9.6 Sample Quantity and Description

FCI PN	Style	Product Size	Samples per Test Group
10132197	Receptacle	3.0mm	10
10132198	Receptacle		0 <sup>1</sup>
10132199	Plug		10
10130542	Socket	3.6mm	10
10136511	Receptacle	3.6mm	10
tbd	Plug		10
10130544	Socket	5.7mm	10
10132093	Receptacle	6.0mm	10
10132094	Plug		10
10152538	Receptacle	10.0mm	5
10152537	Plug		5

<sup>1</sup> Part number 10132198 qualified “by similarity”, based on 10132197 test results.

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Table 5: Qualification Test Table

Description	TEST	PARA	1	2	3	4	5	6	7	8
			Temp Life	Cyclic T&H	Shock / Vibe	MFG	Dust	Durability	Current / T-rise	Mate / Unmate
Examination of Product		5.6	1, 5, 9	1, 5, 8, 12	1, 5, 8, 12	1, 5, 11	1, 5, 8, 12	1, 5	1, 5	1, 4
Contact Resistance at Rated Current		6.2	2, 6, 8	2, 6, 9, 11	2, 6, 9, 11	2, 6, 8, 10	2, 6, 9, 11	2, 4	2, 4	
Current Rating (Temp. Rise vs Current)		6.5							3	
Vibration, Random		7.7			10					
Mechanical Shock		7.6			7					
Durability		7.5						3		
Durability (preconditioning)		7.5	3	3	3	3	3			2
Mating/Unmating Force		7.1								3
Compliant Pin Insertion		7.2								
Radial Hole Distortion		7.4								
Compliant Pin Retention		7.3								
Thermal Shock		8.1		4						
Cyclic Temperature and Humidity		8.2		7						
Temperature Life		8.3	4							
Temperature Life (preconditioning)		8.3			4	4				
Mixed Flowing Gas (7d unmated + 7d mated)		8.4				7, 9				
Dust		8.5					4			
Thermal Disturbance		8.6					7			
Reseating (1 time)			7	10			10			

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**REVISION RECORD**

<b>Rev</b>	<b>Page</b>	<b>Description</b>	<b>EC#</b>	<b>Date</b>
A	All	Initial Release	-	6/30/2015
B	5	Update 3.0mm CBS mating force spec from 30 to 36 N	ECN -ELX -V-21341-1	7/7/2015
C	3,4,5,6,9	Add DWV, Operating Voltage ratings, add 3.6mm CBS to applicable tables, and add press-fit tail insertion, retention & repair specs. To Section 7.	ECN-ELX-V-21840	9/3/2015
D	4	Update Table 3 for USR & CSR current ratings		
E	5	Update Table 4 base on mass production actual test.	ELX-N-23829	11/4/2016
F	all	Change name BarGuide to PwrBlok	ELX-N-29388	2/23/2018
G	3,4,5,9 4	Delete 8.0mm type and add 10.00mm type Change 10.0mm type current rating to 250A		10/11/2019 8/26/2020