

Amphenol

**The Product Specification for
Hybrid Cool Edge Vertical connector**

**Product Spec. #
S-CE-001**

**Date :
09/26/16**

**Rev.
B**

**ECN #
CD0913**

**Page :
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Gen 1.0**

REVISION RECORD

<u>REV</u>	<u>PAGE</u>	<u>DESCRIPTION</u>	<u>ECN#</u>	<u>DATE</u>	<u>Prepare By</u>
A	8	First Release	CDXXXX	2015-01-22	Rz.guo
B	9	Revised	CD0913	2016-09-26	Matt. liu

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1. OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of Amphenol Hybrid Cool Edge vertical connector.

2. SCOPE

This Specification includes the Materials/Finishing, Mechanical Characteristics, Electrical Characteristics and Environmental requirements of Amphenol Hybrid Cool Edge connector.

3. APPLICABLE DOCUMENTS

3.1. Application

3.1.1. Engineering drawings

3.2. Military Standards

3.2.1. MIL-C-45662 : Equipment Calibration

3.3. Other Standards and Specifications

3.4.1. UL94 V-0 : Tests for Flammability of Plastic Materials in Devices and Appliances

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

3.4.3. EIA 364 -1000: Environmental test methodology for assessing the performance of electrical connectors and sockets used in business office applications.

4. REQUIREMENTS

4.1. Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein. Unless otherwise specified, all measurements shall be performed within the following lab conditions:

- a) Temperature: 25°C±10°C.
- b) Relative Humidity : 20% to 80%
- c) Atmospheric Pressure : 650mm to 800mm of Hg (86 ~106Kpa)

4.2. Material

Material for each part shall be specified herein, or equivalent. Substitute material shall meet the performance requirements of this specification.

- a) Contacts: Copper and Copper alloy.
- b) Insulator: High temperature Engineering plastics, UL94 V-0.
- c) Other material: Stainless steel

4.3. Finish

Plated finished for qualification components shall be meet the connector's application.

4.4. Workmanship

Connectors shall be uniform in quality and shall be free from burrs, scratches, cracks, voids, chips, blisters, pin holes, sharp edges, and other defects that will adversely affect product's life or serviceability.

5. RATINGS

- 5.1. Operating temperature: -55°C to +105°C
- 5.2. Storage conditions: -55°C to +105°C and max 95% RH;

6. ELECTRICAL CHARACTERISTIC

6.1. Current Rating

The temperature rise above ambient shall not exceed 30°C at any point in the system when contact positions specified are powered at the power levels specified herein:

- a) Ambient Conditions: still air at 25°C±5°C.
- b) Current Rating for power pin is 20A/pin.
- c) Current Rating for signal pin is 0.5A/pin.
- d) Reference: EIA 364-70.
- e) Mated with applicable PCB.

6.2. Low Level Contact Resistance(Signal contact)

Mated with applicable board, the low-level contact resistance shall not exceed a change of 15mΩ for signal Pin (The maximum initial contact resistance is 30mΩ) after environmental exposure and durability, when measured in accordance with EIA 364-23. The following details shall apply:

- a) Test Voltage: 20mV DC maximum at open circuit.
- b) Test Current: not to exceed 100mA.

6.3. Contact Resistance(Power contact)

Mated with test board, The contact resistance shall not exceed 3mΩ for Power pin before and after environmental exposure and durability, when measured in accordance with EIA 364-06. The following details shall apply:

- a) Current Rating for power pin is 20A/pin.
- b) Mated with applicable PCB.

6.4. Insulation Resistance

The insulation resistance shall not be less than 1000MΩ between adjacent power Pin and 1000MΩ between adjacent signal Pin when measured in accordance with EIA 364-21. The following details shall apply:

- a) Test Voltage: 500V DC.
- b) Preparation: The connectors shall be Unmated.
- c) Electrification Time: 1 minute.
- d) Point of Measurement: Between adjacent contacts.

6.5. Dielectric Withstanding Voltage

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (0.5mA max) when tested in accordance with EIA 364-20. The following details shall apply:

- a) Test Voltage: 1000V DC for power pin and 500VDC for signal pin
- b) Test Duration : 1 minute
- c) Test Conditions: EIA 364-20 Test Conditions I (685~785mm of mercury, and sea level)
- d) Points of measurement: Between adjacent contacts (method B).

7. MECHANICAL CHARACTERISTIC

7.1. Durability

Mating and un-mating with applicable PCB, Durability tested in accordance with EIA-364-09.

The following details shall apply:

- a) Number of Cycles: 200 cycles.
- b) Cycling Rates: 500±50 cycles/hour.
- c) No physical damage.

7.2. Durability(Preconditioning)

Mating and un-mating with applicable PCB, Durability tested in accordance with EIA-364-09.

The following details shall apply:

- a) Number of Cycles: 20 cycles.
- b) Cycling Rates: 500±50 cycles/hour.
- c) No physical damage.

7.3. Mating/un-mating Force

Mating with the applicable PCB, the following details shall apply:

- a) Reference: EIA 364-13.
- b) Speed Rate: 25.4±3mm/minute.
- c) Mating force: 10N/pin Max for power pin; 0.6N/pin Max for signal pin.
- d) Un-mating force: 1.5N/pin Min for power pin; 0.06N/pin Min for signal pin.

7.4. Contact Retention Force

The contact and the insulator are axially pull out at the speed rate of 25.4±3mm/minute

- a) Reference: EIA 364-29.
- b) Contact Retention force for power pin: 10N/pin Min.
- c) Contact Retention force signal pin: 1.5N/pin Min.

7.5. Reseating

- a) Test condition: Manually mating and un-mating the connector with applicable PCB.
- b) Requirement: Perform 3 such cycles.

8. ENVIRONMENTAL CHARACTERISTIC

8.1. Thermal Shock.

Mated with applicable card. No physical damage shall be observed after tested in accordance with EIA 364-32.

The following details shall apply:

- a) Reference: EIA 364-32, method A,
- b) Test condition : test condition I
 - step 1: -55°C, 30minutes min
 - step 2: 25°C, 5minutes max
 - step 3: 85°C, 30minutes min
 - step 4: 25°C, 5minutes max
- c) Number of cycles: test duration A-4 (10 continuous cycles).

8.2. Humidity- Temperature Cycling

Mated with applicable card. No physical damage shall be observed after tested in accordance with EIA 364-31. The following details shall apply:

- a) Test condition : Cycle the connector between $25\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ at $80\% \pm 3\% \text{ RH}$ and $65\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ at $50\% \pm 3\% \text{ RH}$. Ramp times should be 0.5 hour and dwell times should be 1.0 hour
- b) Test Duration : 24 hours per cycle
- c) Number of cycles: Perform 24 continuous cycles.

8.3. Thermal Cycling

Mated with applicable card. No physical damages shall be observed after tested in accordance with EIA-364-110,

- a) Test condition : Cycle the connector between $15^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and $85^{\circ}\text{C} \pm 3^{\circ}\text{C}$, Humidity is not controlled
- b) Test Duration : Ramps should be a minimum of $2\text{ }^{\circ}\text{C}$ per minute, and dwell times should insure that the contacts reach the temperature extremes (a minimum of 5 minutes)
- c) Number of cycles: Perform 500 such cycles.

8.4. Thermal Disturbance

Mated with applicable card. No physical damages shall be observed after tested in accordance with EIA-364-110,

- a) Test condition : Cycle the connector between $15^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and $85^{\circ}\text{C} \pm 3^{\circ}\text{C}$, Humidity is not controlled
- b) Test Duration : Ramps should be a minimum of $2\text{ }^{\circ}\text{C}$ per minute, and dwell times should insure that the contacts reach the temperature extremes (a minimum of 5 minutes)
- c) Number of cycles: Perform 10 such cycles.

8.5. Dust Contamination

Perform in accordance with EIA 364-91 Dust contamination 1 (benign), unmated receptacle connectors.

8.6. Temperature Life.

Mated with applicable card. No physical damage shall be observed after tested in accordance with EIA-364-17. The following details shall apply:

- a) Test Duration: 240 hours.
- b) Temperature: $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

8.7. Temperature Life (Preconditioning).

Mated with applicable card. No physical damage shall be observed after tested in accordance with EIA-364-17. The following details shall apply:

- a) Test Duration: 120 hours.
- b) Temperature: $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

8.8. Physical Shock

No discontinuities greater than $1\text{ }\mu\text{s}$ and no physical damage shall be observed after tested in accordance with EIA 364-27. The following details shall apply:

- a) Test condition: A (490 m/s^2 , 11 ms, half-sine).

- b) 3 shocks in both directions along each of three orthogonal axes (18 totals).
- c) Mounting: Rigidly mount assemblies.
- d) Apply current: 10mA.

8.9. Vibration

No discontinuities greater than 1 μ s and no physical damage shall be observed after tested in accordance with EIA 364-28 The following details shall apply:

- a) Test condition: EIA 364-28, Test condition VII, test condition letter D
- b) Test Duration: 15 minutes in each of 3 mutually perpendicular directions
- c) Mounting: Rigidly fixed assemblies.

8.10. Salt Spray

No abnormal nicks, cracks, or scratches on finished surfaces that indicate the removal of the normal protective coating. The following details shall apply:

- a) Reference: EIA 364-26, Test Condition B.
- b) Temperature: 35°C+1/-2°C.
- c) Humidity: 95%~98% RH.
- d) Concentration: 5%;
- e) Duration: 48 hours.

8.11. Porosity Testing

Tested in accordance with EIA 364-53, minimum of 10 contacts from 3 samples must be tested, optical microscope of 10X magnification concentrated reagent grade nitric acid: 75%+/-1% HNO₃.

8.12. Mix Flowing Gas (MFG)

The following details shall apply:

- a) Reference: EIA 364-65, Class IIA
- b) Gas Concentration: Cl₂ 10± 3ppb, NO₂ 200± 50ppb, H₂S 10± 5ppb, SO₂ 100± 20ppb
- c) Temperature: 30± 1°C;
- d) Humidity: 70± 2% RH
- e) Test Duration: exposed 160hours un-mating with applicable PCB and 80hours mating with applicable PCB

8.13. Solder ability

The termination is at least 95% covered by a contact In accordance with EIA 364-52. The following details shall apply:

- a) Solder Time: 2~3seconds.
- b) Solder Temperature: 245°C ± 5°C.

8.14. Resistance to Soldering Heat.

No physical damage shall be observed after tested, the following details shall apply:

- c) Reference: EIA 364-56, procedure 6
- d) Test Temperature: test level 3(250°C+10°C/-0°C)

9. 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.

9.2. Inspection Condition

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

- a) Temperature: 25°C±10°C.
- b) Relative Humidity : 20% to 80%
- c) Atmospheric Pressure : 650mm to 800mm of Hg (86 ~106Kpa)

9.3. Sample Quantity and Description

The sample size to be tested in each group shown in Qualification Testing Sequences should follow **Table 1**; All samples must be free of defects that would impair normal connector operation. All samples must meet dimensional requirements of connector.

9.4. Acceptance

- 9.4.1. Electrical and mechanical requirements placed on test samples as indicated in Paragraphs 5 and Paragraphs 6 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 set up, or operator error shall not disqualify the product. If product failure occurs, corrective actions 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 shown in Qualification Testing Sequences
Visual Examination : EIA 364-18

9.6. 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 matrix Table 1.

- 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.

Table 1: Qualification Testing Sequences

TEST OR EXAMINATION	TEST GROUP														
	item	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Examination of connector(s)	4.4	1,11	1,14	1,14	1,17	1,14	1,14	1,11	1	1	1	1	1	1	1
Current Rating	6.1								2						
LLCR(signal)	6.2	2,6,9	2,6 9,12	2,6 9,12	2,6,9 12,15	2,6 9,12	2,6 9,12	4,7							
Contact Resistance(power)	6.3	3,7,10	3,7 10,13	3,7 10,13	3,7,10 13,16	3,7 10,13	3,7 10,13	5,8							
Insulation Resistance	6.4							3,10							
Dielectric Withstanding Voltage	6.5							2,9							
Durability	7.1							6							
Durability (Preconditioning)	7.2	4	4	4	4	4	4								
Matting/un-mating Force	7.3									3,6					
Contact Retention Force	7.4										2				
Reseating	7.5	8	11		14	11	11			2,5					
Thermal Shock	8.1		5												
Humidity-Temperature Cycling	8.2		8												
Thermal Cycling	8.3					8									
Thermal disturbance	8.4				11		8								
Dust contamination	8.5						5								
High Temperature Life	8.6	5								4					
High Temperature Life (Preconditioning)	8.7			5	5	5									
Physical Shock	8.8			11											
Vibration	8.9			8											
Salt Spray	8.10											2			
Porosity Testing	8.11												2		
Mix Flowing Gas(MFG)	8.12				8										
Solder ability	8.13													2	
Resistance to Soldering Heat	8.14														2
Sample size		10	10	10	10	10	10	10	5	5	5	5	5	5	5