

1.0 Objective

The objective of this specification is to define the performance, test and quality requirements for the Amphenol cLGA™ chip socket and board stacking system. This specification is intended to satisfy the requirements of both the EIA 540BOAE and the Telcordia GR-1217-CORE specifications.

2.0 Scope

This document specifies the performance, test and quality requirements for all standard and custom Amphenol InterCon Systems LGA socket products. Products in this system connect ceramic and organic modules to circuit boards, parallel circuit boards, and flexible circuits to circuit boards.

3.0 Contents

This document is composed of the following sections:

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2.0	Scope
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4.0 Specification Release and Change Control Rules

- 4.1 Ref. ICS-705-GEN, Master Control Procedure

5.0 Product Requirements

- 5.1 Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawings.

- 5.2 Material

- A. Contacts: Beryllium copper, in accordance with ASTM B-194.
- B. Contact housings: Liquid Crystal Polymer, flame retardant per UL-94 V-0, unless otherwise specified.

B. Housing frames: Glass filled polyetherimide, flame retardant per UL-94 V-0, unless otherwise specified.

5.3 Contact Finish:

- A. 20 microinches hard gold per MIL-G-45204, Type II, Grade C, over 10 microinches soft gold, per MIL-G-45204, over 30 to 70 microinches sulfamate nickel per QQ-N-290 Class 2 in contact area.
- B. 10 microinches hard gold per MIL-G-45204, Type II, Grade C, over 30 to 50 microinches nano crystalline nickel per QQ-N-290 Class 1 in contact area.

5.4 Ratings:

A. Temperature: -65 to 105 degrees Centigrade.

6.0 Performance Requirements and Test Description

6.1 Test Procedures and Requirements

The product is designed to meet the electrical, mechanical, and environmental performance requirements listed in Table 1. All tests are conducted at ambient temperature (25° +/- 5° C), 30 to 60 % relative humidity, and ambient pressure unless otherwise noted.

TABLE 1

TEST	TEST DESCRIPTION	REQUIREMENT	PROCEDURE
6.1.1	EXAMINATION OF PRODUCT	MEETS REQUIREMENTS OF PRODUCT DRAWING.	VISUAL, DIMENSIONAL AND FUNCTIONAL PER APPLICABLE QUALITY INSPECTION PLAN.
6.1.2	LOW LEVEL CIRCUIT RESISTANCE	10 MILLIOHMS MAX. AVG. CHANGE PER CONTACT AFTER TEST (20 MILLIOHMS MAX. CHANGE PER CONTACT PAIR)	FOUR WIRE PROBE TEST BOARD AT 20 mV DC OPEN CIRCUIT VOLTAGE AND 100 mA MAXIMUM CURRENT, PER EIA 364-23, METHOD 1.
6.1.3	DIELECTRIC WITHSTANDING VOLTAGE	NO EVIDENCE OF ARC OVER, INSULATION BREAKDOWN, OR LEAKAGE CURRENT GREATER THAN 1 MILLIAMPERE.	TEST BETWEEN ADJACENT CONTACTS OF UNMATED SOCKETS PER EIA 364-20 AT 500 V AC RMS FOR 60 SECONDS, TEST CONDITION 1 (SEA LEVEL).
6.1.4	INSULATION RESISTANCE	1000 MEGOHMS MINIMUM.	TEST BETWEEN ADJACENT CONTACTS OF UNMATED SOCKETS PER EIA 364-21 AT 500 V DC FOR 2 MINUTES.
6.1.5	CURRENT RATING	MAX. 30° C TEMPERATURE RISE OVER AMBIENT AT ANY POINT IN SYSTEM AT 1 AMP FOR SINGLE CONTACT, AND 0.5 TO 0.75 AMPS PER CONTACT FOR MULTIPLE CONTACTS, PER TABLE 2.	SINGLE AND MULTIPLE CONTACTS POWERED UNTIL 30° C CHANGE IS MEASURED. SEE TABLE 2 FOR CONTACT CONFIGURATIONS AND THERMOCOUPLE POSITIONS.
6.1.6	RANDOM VIBRATION	NO ELECTRICAL DISCONTINUITIES GREATER THAN 2.0 NANOSECONDS; LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED CONNECTOR USING 200 GRAM SIMULATED HEAT SINK TO 7.3 G RMS MINIMUM (TEST CONDITION V-B), 50 TO 2000 Hz, AT 45 MINUTES IN 3 ORTHOGONAL AXES, PER EIA 364-28. READ LLCR AFTER EACH AXIS.

TABLE 1, CONT'D

TEST	TEST DESCRIPTION	REQUIREMENT	PROCEDURE
6.1.7A	MECHANICAL SHOCK (PER EIA 540BOAE SPECIFICATION)	NO ELECTRICAL DISCONTINUITIES GREATER THAN 2.0 NANOSECONDS ACROSS 2 CONTACT CHAINS, NO ELECTRICAL DISCONTINUITIES GREATER THAN 1.0 MICROSECOND ACROSS PTH CHAINS; LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED CONNECTOR USING 200 GRAM SIMULATED HEAT SINK TO 50 G, 11 ms HALF-SINE SHOCKS (TEST CONDITION A), AT 11.3 FT/SEC VELOCITY, 3 SHOCKS IN EACH DIRECTION ALONG 3 ORTHOGONAL AXES PER EIA 364-27. READ LLCR AFTER EACH AXIS.
6.1.7B	MECHANICAL SHOCK (PER TELCORDIA GR-1217 SPECIFICATION)	NO ELECTRICAL DISCONTINUITIES GREATER THAN 2.0 NANOSECONDS ACROSS 2 CONTACT CHAINS, NO ELECTRICAL DISCONTINUITIES GREATER THAN 1.0 MICROSECOND ACROSS PTH CHAINS; LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED CONNECTOR USING 200 GRAM SIMULATED HEAT SINK TO 30 G, 11 ms HALF-SINE SHOCKS (TEST CONDITION H), AT 6.8 FT/SEC VELOCITY, 3 SHOCKS IN EACH DIRECTION ALONG 3 ORTHOGONAL AXES PER EIA 364-27. READ LLCR AFTER EACH AXIS.
6.1.8	DURABILITY	LLCR REQUIREMENTS PER 6.1.2.	MATE AND UNMATE SOCKET THROUGH 25 CYCLES.
6.1.9	DUST	LLCR REQUIREMENTS PER 6.1.2.	EXPOSE TEST BOARD ONLY TO COMPOSITION 1 DUST (BENIGN) FOR 1 HOUR. CLEAN BOARD FOLLOWING PER SECTION 6.4C.
6.1.10	POWER CYCLING	LLCR REQUIREMENTS PER 6.1.2.	2000 CYCLES AT 30 MINUTES ON/30 MINUTES OFF, AT 20° TO 95° C. READ LLCR EVERY 168 CYCLES.
6.1.11	THERMAL PRECONDITIONING	LLCR REQUIREMENTS PER 6.1.2.	SUBJECT UNMATED SOCKET TO 85° +/- 2° C FOR 24 HOURS.
6.1.12A	THERMAL SHOCK	LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED SOCKET TO 10 CYCLES OF -55° TO 85° C EXPOSURE, 60 MINUTES PER TEMPERATURE AND 5 MINUTES MAXIMUM TRANSFER TIME.
6.1.12B	THERMAL SHOCK	LLCR REQUIREMENTS PER 6.1.2.	PER 6.1.12A, BUT UNMATED. SOCKET ONLY EXPOSED.
6.1.13A	HUMIDITY/TEMPERATURE CYCLING	LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED SOCKET TO 2000 HOURS OF 25° TO 85° C EXPOSURE, 2 HOURS DWELL AT EACH TEMPERATURE, 2 HOURS TRANSITION TIME, WITH 80 +/- 2% RH AT 25° C, 47% MAX AT 85° C. READ LLCR EVERY 168 HOURS. MONITOR SOCKET FOR GLITCH DETECTION CONTINUOUSLY DURING TEST. ^(A)
6.1.13B	HUMIDITY/TEMPERATURE CYCLING	LLCR REQUIREMENTS PER 6.1.2.	PER 6.1.13A, BUT UNMATED. SOCKET ONLY EXPOSED.




TABLE 1, CONT'D

TEST	TEST DESCRIPTION	REQUIREMENT	PROCEDURE
6.1.14	ACCELERATED THERMAL CYCLING	LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED SOCKET TO 3500 CYCLES OF 0° +/- 2° TO 100° +/- 2° C EXPOSURE, 90 MINUTE CYCLES. READ LLCR EVERY 168 CYCLES. MONITOR SOCKET FOR GLITCH DETECTION CONTINUOUSLY DURING TEST. ^(A)
6.1.15	HIGH TEMPERATURE LIFE	LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED SOCKET TO 90° C FOR 2000 HOURS. READ LLCR EVERY 250 HOURS.
6.1.16	MIXED FLOWING GAS	LLCR REQUIREMENTS PER 6.1.2.	SUBJECT MATED SOCKET TO EITHER 7 OR 20 DAYS (SEE TABLE 2) OF EXPOSURE TO CLASS 2a GAS PER EIA 364-65: 10+/-3 PPB Cl ₂ 10+/-5 PPB H ₂ S 200+/-50PPB NO ₂ 100+/-20 PPB SO ₂ AT 30° +/- 2° C, 70% +/- 2% RH.
6.1.17	NORMAL FORCE	35 GRAMS MINIMUM PER CONTACT.	TEST PRODUCT BETWEEN TWO POLISHED STEEL PLATES USING SPHERICAL TIP PROBE ON TOP OF UPPER PLATE. A 20 X 20 POSITION MINIMUM CONTACT ARRAY IS MOST DESIRABLE FOR ACCURATE MEASUREMENTS.

^(A) Glitch detection: monitoring for an electrical resistance greater than 400 ohms which lasts longer than 200 nanoseconds.

6.2 Current Rating Contact Configurations

Table 2 shows the contact configurations to test for current rating, defined as the maximum current per contact at a 30° C measured temperature rise over ambient. The current rating test is to be performed per section 6.1.5.

DESCRIPTION	1 X 2 ARRAY	2 X 2 ARRAY	4 X 4 ARRAY
CONTACT CONFIGURATION			
CURRENT RATING	3.7 AMPS	3.7 AMPS	2.1 AMPS


x : THERMOCOUPLE LOCATION
 : POWERED CONTACT

TABLE 2

6.3 Test Hardware Description

Aluminum plates, alloy 6061 T6, and stainless steel screws are to be used as test hardware except where indicated otherwise. The plates should be .200 inches thick, 2.46 inches long, and 1.96 inches wide. Clearance holes for # 4-40 screws should be located on center with the socket mounting holes in the upper plates. Tapped holes for # 4-40 screws should be located on center with the socket mounting holes in the lower plates. Stainless steel # 4-40 screws should be used for assembly. Plastic insulators approximately .010 inches thick should be used between the lower plate and circuit board. For test groups 1 and 9 in Table 3, 200 gram simulated heat sinks should be used in place of the upper plates described above. These plates should be of the same material and the same length and width as the upper plates described above, but should be thickness adjusted to achieve a 200 gram weight.

6.4 Test Hardware Assembly

Use the following procedure to assemble the socket and hardware to the test board:

- A. Sockets should always be handled by the outer frame only. Contacts should not be touched with fingers, tools, wipes, or any other devices. Sockets should be left in the manufacturer's original shipping trays, with tray covers intact, until assembly. Sockets should be returned to their original trays if removed for incoming inspection purposes. The socket should not be exposed to liquids or dry chemicals.
- B. If board pad array cleaning is required, the array should be cleaned using electronic/reagent grade isopropyl alcohol and a lint free clean room cloth (no chemical residue, polyester/polypropylene/polyolefin type). Subsequent drying of the pad array per section 6.4C must be done following cleaning.
- C. Immediately following cleaning per section 6.4B, or immediately prior to assembly, the board pad array, ceramic device pad array, and socket contact array should be blown off with clean, oil free, dry air or nitrogen to remove loose debris. The cleaning process should be started by aiming away from the array areas, then sweeping across the pad and contact arrays in a repeated motion to remove loose debris.
- D. Place socket onto board. Locator pins on socket frame are press fit into board holes.
- E. Place device into socket by gently setting it into place loosely in the frame, then pressing evenly and gently downward into frame.
- F. Place 4 stainless steel screws through clearance holes in upper bolster plate, and assemble upper plate to device side of assembly.
- G. Put insulator and lower bolster plate onto bottom of board.
- H. Start screws into lower plate.
- I. Press evenly with fingers on upper bolster plate while turning screws down to snug on all four corners. Turn screws a small amount each, one at a time, when they are close to snug.
- J. Use a torque wrench to incrementally set all four screws to 5 to 7 inch pounds per screw.

7.0 Product Qualification and Requalification

7.1 Equipment Calibration

Any 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.

7.2 Qualification Testing

7.2.1 Sample Selection

Sockets shall be prepared in accordance with the applicable product and process documentation. The samples shall be selected at random from current production.

7.2.2 Test Sequence

Samples shall be subjected to the test sequences specified in Table 3.

7.2.3 Sample quantities

The following list shows the number of sockets required for each test group in Table 3. An equal quantity of devices and test boards is required for every test group but group 3, which requires no devices or boards.

- Test group 1A: 4
- Test group 1B: 4
- Test group 2: 4
- Test group 3: 4
- Test group 4A: 4
- Test group 4B: 4
- Test group 5: 4
- Test group 6: 4
- Test group 7: 2
- Test group 8: 2
- Test group 9: 4
- Test group 10: 2

7.2.4 Acceptance

Acceptance is based upon the verification that the product meets the qualification test requirements of Table 3. Failures attributed to equipment, test set-up, or operator deficiencies shall not disqualify the product.

7.3 Requalification Testing

In the event that a significant change is made to the product design or manufacturing process that affects an existing product previously qualified under this specification, Quality Assurance shall initiate requalification testing. A significant change shall be defined as, but not limited to, changes in contact material composition or temper, contact material

thickness, contact force, contact surface geometry, contact plating composition, contact plating thickness, or contact lubrication requirements.

TABLE 3 - QUALIFICATION TESTING

TEST	PARA	TEST GROUP											
		1	1	2	3	4	4	5	6	7	8	9	10
		A	B			A	B						
TEST SEQUENCE													
Examination of Product	6.1.1	1, 9	1, 8	1, 11	1, 8	1, 8	1, 8	1, 8	1, 9	1, 5	1, 3	1, 12	1, 3
Contact Resistance Low Level	6.1.2	3, 6, 8	2, 5, 7	2, 4, 6, 8, 10		3, 5, 7	2, 4, 6	2, 5, 7	2, 4, 6, 8	2, 4		2, 5, 7, 9, 11	
Insulation Resistance	6.1.4				2, 6								
Dielectric Withstanding Voltage	6.1.3				3, 7								
Current Rating	6.1.5									2			
Normal Force	6.1.17												2
Durability	6.1.8			3					3 ⁽³⁾ , 7 ⁽⁴⁾			3 ⁽³⁾ , 10 ⁽⁴⁾	
Thermal Preconditioning	6.1.11	2				2							
Thermal Shock	6.1.12A			7									
Thermal Shock	6.1.12B				4								
Humidity/Temperature Cycling	6.1.13A			9									
Humidity/Temperature Cycling	6.1.13B				5								
High Temperature Life	6.1.15					4	3						
Mixed Flowing Gas – 7 day exposure	6.1.16					6 ⁽¹⁾	5 ⁽¹⁾						
Mixed Flowing Gas – 20 day exposure	6.1.16								5 ⁽²⁾				
Accelerated Thermal Cycling (ATC)	6.1.14	7	6										
Vibration, Random	6.1.6	5	4					4				6	
Mechanical Shock	6.1.7A	4	3					3					
Mechanical Shock	6.1.7B											8 ⁽⁵⁾	
Power Cycling	6.1.10							6					
Dust	6.1.9			5						3		4	

Notes:

- (1) = 7 day mated exposure only
- (2) = intermediate 10 day LLCR reading to be taken
- (3) = 12 mating cycles
- (4) = remaining mating cycles to equal 25 total
- (5) = LLCR measured after each axis.

8.0 Record Keeping

8.1 Ref. ICS-218, Records Management Procedure

9.0 References

- 9.1 ISO 9001, Handbook of Quality Standards and Compliance
- 9.2 InterCon Systems Quality Manual applicable specifications
- 9.3 Applicable documents

The following documents shall form a part of this specification to the extent specified herein. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

Military

MIL-G-45204	Gold Plating, Electrodeposited
MIL-C-45662	Calibration System Requirements
MIL-F-55110	Printed Wiring Boards
MIL-STD-202F	Test Methods for Electronic and Electrical Components
MIL-STD-275	Printed Wiring for Electronic Equipment

Industry Specifications/Standards

ASTM B-194	Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar
UL-94	Tests for Flammability of Plastic Materials
EIA 364	Electrical Connector Test Procedure
EIA 540BOAE	Detail Specification for Production Land Grid Array (LGA) Socket For Use in Electronic Equipment
Telcordia GR-1217-CORE	Generic Requirements for Separable Electrical Connectors Used in Telecommunications Hardware

10.0 Revision Record

<u>Rev.</u>	<u>Page(s)</u>	<u>Description of Change</u>	<u>ECR#</u>	<u>Date</u>
1	All	Preliminary release	5707	7/6/01
2	3, 4, 7	Added glitch detection to 6.1.13, 6.1.14; changed 6.1.15 from 85° to 90° C, 500 to 2000 hours. Changed test groups 1 and 2 in Table 3.	5720	7/10/01
3	2, 3, 4, 7	Added LLCR requirements to Table 1, changed 6.1.14 from 75° to 100° C. Changed 6.1.11 from 100 to 24 hours. Added test groups 1A and 4 A in Table 3.	5804	8/10/01
A	2, 3, 4, 7	Modified Test 6.1.2, 6.1.4, 6.1.7A, 6.1.7B, 6.1.14, deleted Test 6.1.6B in Table 1; modified Table 2; replaced 6.1.6B with 6.1.6A in Table 3; released spec.	6048	1/11/02
B	1, 2	Modified 1.0, 2.0, Added 5.3 B, 5.4	11686	10/17/14