

EIA ENGINEERING BULLETIN

Gold Plating Study Test Report

CB-12

SEPTEMBER 1990

ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT



NOTICE

EIA Engineering Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of EIA from manufacturing or selling products not conforming to such Standards and Publications, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than EIA members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by EIA without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, EIA does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Recommended Standard or Publication.

Technical Publications are distinguished from EIA Recommended Standards or Interim Standards, in that they contain a compilation of engineering data or information useful to the technical community, and represent approaches to good engineering practices that are suggested by the formulating committee.

This Publication is not intended to preclude or discourage other approaches that similarly represent good engineering practice, or that may be acceptable to, or have been accepted by, appropriate bodies. Parties who wish to bring other approaches to the attention of the formulating committee to be considered for inclusion in future revisions of this Publication are encouraged to do so. It is the intention of the formulating committee to revise and update this Publication from time to time as may be occasioned by changes in technology, industry practice, or government regulations, or for other appropriate reasons.

(CB-12 was formulated under the cognizance of the EIA P-5.1 Task Group on Gold Plating.)

Published by

ELECTRONIC INDUSTRIES ASSOCIATION

Engineering Department
2001 Pennsylvania Ave., N.W.
Washington, D.C. 20006

PRICE: \$16.00

Copyright 1990

All Rights Reserved
Printed in U.S.A.

TABLE OF CONTENTS

<u>ITEM</u>	<u>PAGE NUMBER</u>
Introduction	2
Test Samples and Preparation	3
Sample Size	4
Applicable Documents	4
Test Selection	4
Contact Coding	5
Contact Allocation	5
Table 1	6
Evaluation Program Chart	7
Porosity	8
Gold Finish Thickness	9
Contact Engagement and Separation Forces	9
Low Level Circuit Resistance	9
Durability	10
Vibration	11
Thermal Cycling with Humidity	12
Temperature Life (Elevated Temperature)	13
Salt Spray	14
Examination (Gold Finish)	14
Special Notes	15
Summarized Test Results	16
Contact Engaging and Separation Forces	17
Electrical Resistance Monitoring	19
Plating Thickness	24
Porosity	24

INTRODUCTIONSCOPE:

The purpose of this study is to evaluate the performance characteristics of gold plating thicknesses when exposed to a severe series of environmental sequences. The sequences as established were chosen for their impact on phenomenon which could potentially cause contact interface degradation. The program is designed to stress the component system beyond normal military qualification test sequences. No pass/fail criteria was established. The data as generated is used for comparative purposes only.

PARTICIPATING COMPANIES AND BASIC REPORTING FORMAT

Three companies participated in performing the test program as established. For reporting purposes, all data is anonymous and grouped. Participating companies chose the product to be tested per the slash sheets of MIL-C-39029. Testing was performed by qualified laboratories. All said laboratories had current suitability status in effect as issued by DESC for the products involved.

Upon completion of testing, all data was submitted to an independent agency. Said agency summarized and presented the data in the format contained herein as approved by the EIA P-5.1 Task Group on gold plating. Upon completion of the report, all data was returned to the submitting companies for their own disposition. Copies of the report were submitted to each participating company only.

The data presented herein is "grouped". That is, the averages are the grand average of all data submitted from all participating companies. The maximum data point was the maximum observed from all data submitted from all participating companies.

The committee wishes to acknowledge all participating companies for their time and resources in generating the data contained herein. Companies participating in the test program were:

- a) Dupont
- b) Elco
- c) Texas Instruments

The independent agency collating the data was Contech Research, Inc.

CB-12
Page 2

TEST SAMPLES AND PREPARATION

1. Unless otherwise indicated all materials were certified by the manufacturer to be in accordance with the applicable product specification.
2. The connectors as tested and submitted were certified by the manufacturer as being fabricated and assembled utilizing normal production techniques common for this type of product and inspected in accordance with the quality criteria as established for the product involved.
3. All connectors were coded and identified to maintain continuity throughout the test sequences.
4. Test lead attachment for electrical resistance monitoring was in accordance with the applicable product specification.
5. Unless otherwise specified in the test procedures used, no further preparation was performed.
6. Three different connector styles were evaluated in this study. These connectors are categorized as follows:
 - a) Style A -- Pin (dia.) and socket type
 - b) Style B -- Square post and contact type
 - c) Style C -- Blade and dual tine stamped contact



Documents
Document Sharing Hub

SAMPLE SIZE

Unless otherwise specified, the number of connectors submitted to the exposures and the number of data points monitored were in accordance with the indicated test plan.

APPLICABLE DOCUMENTS

1. The following test standards were used in the performance of this evaluation.
 - a) MIL-STD-1344
 - b) EIA RS 364
2. The following products were submitted to the exposure in accordance with the following specifications:
 - a) MIL-C-55302

TEST SELECTION

1. All test were performed in accordance with the sequences and procedures as specified herein.
2. See Test Plan Flow Diagram, Figure #1, for test sequences used.

CB-12
Page 4

CONTACT CODING

The contacts shall be coded as shown below as a convenience for comparative evaluation. It is important that the initial measurements for contact engagement and separation forces, crimp contact resistance, low level circuit resistance and the final measurements, be carefully recorded so that a comparison can be made between the initial and final measurements on the same contact.

Contact Type:	F - Female M - Male
Plating Thickness:	1 - 50 +9, -0 microinches 2 - 30 +9, -0 microinches 3 - 20 +9, -0 microinches
Test Sequence:	A - Unmating/Environment B - Mated/Environment C - Mated/Durability/Environment D - Mated/Durability/Vibration/Environment E - Mated/Vibration/Environment
Durability:	1 - Standard durability (500 cycles) 2 - High durability (625 cycles) 3 - Low durability (250 cycles)
Environmental Exposure:	T - Thermal cycling E - Elevated temperature S - Standard salt spray as per specification L - 240 Hour salt spray
Contract Condition:	M - Mated U - Unmated
Individual Contact Designator:	X - Substitute individual contact number without group (i.e., -2)

Example - Typical Contact Code

F2BTU-4 - Female contact 30 millionths gold, test sequence "B", thermal cycled, unmated, contact 4 within test group.

M1C2EM-2 - Male contact, 50 millionths gold, sequence "C", high durability test, elevated temperature, mated, contact 2 within test group.

CONTACT ALLOCATION

The allocation of contacts by contact code for each test sequence are shown on Table 1.

TABLE I

CONTACT REQUIREMENTS (FOR EACH TYPE, MALE, FEMALE, HERMAPHRODITIC)

(The Quantities Shown Include All Samples Subjected To The Phase II Conditioning Sequence)

<u>Thermal Cycling</u>			<u>Elevated Temperature</u>			<u>Salt Spray Unmated</u>		
<u>10 Each</u>			<u>10 Each</u>			<u>6 Each</u>		
<u>Unmated</u>	<u>Mated</u>		<u>Unmated</u>	<u>Mated</u>		<u>Std.</u>	<u>240 Hr.</u>	
1A	1B 1C1 1D1 1E	1E	1A	1B 1C1 1D1 1E	1E	1A 1C1 1D1 1E	1A 1C1 1D1 1E	1E
2A	2B 1C2 1D2 2E	2E	2A	2B 1C2 1D2 2E	2E	2A 1C2 1D2 2E	2A 1C2 1D2 2E	2E
3A	3B 1C3 1D3 3E	3E	3A	3B 1C3 1D3 3E	3E	3A 1C3 1D3 3E	3A 1C3 1D3 3E	3E
	2C1 2D1			2C1 2D1		2C1 2D1	2C1 2D1	
	2C2 2D2			2C2 2D2		2C2 2D2	2C2 2D2	
	2C3 2D3			2C3 2D3		2C3 2D3	2C3 2D3	
	3C1 3D1			3C1 3D1		3C1 3D1	3C1 3D1	
	3C2 3D2			3C2 3D2		3C2 3D2	3C2 3D2	
	3C3 3D3			3C3 3D3		3C3 3D3	3C3 3D3	
<u>27x10 = 270 Contacts</u>			<u>27x10 = 270 Contacts</u>			<u>24x6 = 144</u>		