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EIA STANDARD

EIA-364-53B

TP-53B

Nitric Acid Vapor Test, Gold Finish Test Procedure for Electrical Connectors and Sockets

EIA-364-53B

(Revision of EIA-364-53A)

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Electronic Components, Assemblies & Materials Association

ELECTRONIC COMPONENTS, ASSEMBLIES & MATERIALS ASSOCIATION
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(From Standards Proposal Number 4525, formulated under the cognizance of the CE-2.0 National Connector Standards Committee.)

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A Informative notes A-1

TEST PROCEDURE No. 53A

NITRIC ACID VAPOR TEST, GOLD FINISH TEST PROCEDURE FOR ELECTRICAL CONNECTORS

(From EIA Standards Proposal No. 4525, formulated under the cognizance of EIA CE-2.0 Committee on National Connector Standards, and previously published in EIA- 364-53A.)

1 Introduction

1.1 Scope

This standard establishes test methods to determine the magnitude of porosity as well as other surface defects inherent in application of gold contact finishes.

1.2 Object

It is the intent that the defined method be used as an evaluation technique for the acceptability of gold contact finishes. The method described herein has been selected on the basis of simplicity of equipment, setup and operation. This procedure applies only to gold finishes with or without underplates applied to copper or nickel base alloy contacts. This test procedure does not apply to gold flash, equal to less than 0.25 micrometer (10 microinches), over palladium or palladium alloy systems, see EIA-364-60.

1.3 Definitions

1.3.1 Measurement area

The surface to be examined shall be defined as the measurement area. Unless otherwise specified, the following definitions of measurement area apply:

1.3.1.1 Figure 2 portrays a "line" contact. The measurement area is defined as 0.51 mm (0.020 in) on each side of the theoretical contact point tangent to point R and shall include the total width of the contact.

1.3.1.2 Figure 3 portrays a "point" contact as established by a dimple or elongated dimple. The measurement area shall be defined in terms of the theoretical dimple contact zone plus 0.51 mm (0.020 in). The measurement area of an elongated dimple shall be defined in terms of its theoretical contact zone length D and width W plus 0.51 mm (0.020 in) surrounding this surface.

1.3.1.3 Figure 4 portrays a "surface" contact. The measurement area shall include length D plus 0.51 mm (0.020 in) at each end and the total width of the contact.

1.3.1.4 Figure 5 portrays the measurement area of a round and square pin. The measurement area shall be defined as equal to the maximum wipe distance plus 0.51 mm (0.020 in) with the initial area starting at a point where the lead-in chamfer or radius blends into the shank of the pin. The measurement area shall include the total diameter of a round pin and all sides of a square pin, unless otherwise specified.

1.3.1.5 Figures 6 and 7 portray the measurement area of a multiple tine socket contact. The measurement area shall be defined as a region 0.51 mm (0.020 in) on both sides of the circumferential line of contact.

1.3.1.6 Figure 8 portrays the measurement area of a hermaphroditic contact mating coined surface. The area of measurement shall be defined as the entire coined area plus 0.51 mm (0.020 in) on all sides.

1.3.2 Corrosion product

1.3.2.1 A corrosion product is defined as being usually circular in shape and protruding from or lying upon the plated surface.

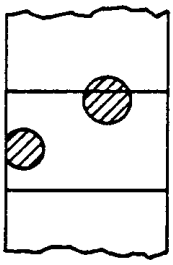
1.3.2.2 The size of a corrosion product shall be defined by the major diameter - the longest straight line or chord that can be passed through the corrosion product.

1.3.2.3 If blisters on the plating surface are observed as a result of the exposure, they shall be counted as a corrosion product as defined above.

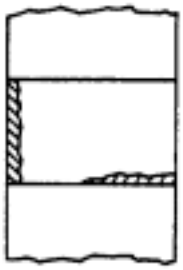
1.3.3 Corrosion product count

1.3.3.1 A corrosion product shall be measured and counted when at least 3/4 of the corrosion product falls within the specified measurement area; see figure 1.

1.3.3.2 Corrosion products that originate outside the measurement area but fall within it and that are irregular in shape shall not be counted; see figure 1.



To be counted



Not to be counted if evidence of corrosion products exists on edges or if corrosion products are continuous outside of the measurement zone.

Figure 1 - Corrosion product

1.3.3.3 Corrosion products, as defined in 1.3.2, shall be sized and counted in accordance with table 1 when initially within the specified measurement areas.

Table 1 - Corrosion product size

Corrosion products size	Assigned count
Diameter ≤ 0.05 mm (0.002 in)	0
> 0.05 mm (0.002 in) < 0.51 mm (0.020 in) diameter	1
≥ 0.51 mm (0.020 in) diameter	2
Coverage in excess of 50% of measurement area regardless of size	20

1.3.3.4 The average corrosion count for a sample lot shall be determined by adding all of the assigned counts and dividing by the total number of measurement areas tested.

2 Test resources

2.1 Equipment

2.1.1 Desiccator or sample chamber.

2.1.2 The desiccator or sample chamber shall be constructed from inert materials, having the capability of being sealed with an enclosed volume of 1 to 15 liters.

2.1.3 The size of the desiccator shall be such that no more than 164 cm^3 (10 in^3) of airspace shall be available per 6.5 cm^2 (1 in^2) of nitric acid surface area.

2.1.4 Sample holder as described in 2.3

2.1.5 Optical microscope capable of 10X magnification

2.1.6 Collimated incandescent light source capable of an oblique angle 15° to 30° to the measurement surface

2.2 Material

2.2.1 Concentrated reagent grade nitric acid: 70% ± 1% HNO_3.

2.2.2 Methanol, 2-propanol, or acetone

2.2.3 Detergent: Micro™, Sparkleen™ or equivalent

2.3 Fixture

Contacts shall be placed in a suitable holding fixture of inert material, having the smallest horizontal area necessary, and shall be held so as to maintain the measurement area in a vertical plane. The test fixture shall be constructed in such a manner to assure that the test samples shall not be closer than 25 mm (1 in) from the wall of the desiccator and not closer that 76 mm (3 in) from the solution surface. Adjacent contacts shall not be closer than 10 mm (0.4 in) from each other. The fixture shall not prohibit the measurement area from being exposed to the test environment. A mesh support plate, if used, shall be constructed of nonabsorbing inert material and cover no more than 50% of the cross-sectional area of the test chamber.

3 Test specimen

3.1 Preparation

3.1.1 Prior to being inserted into the test chamber, contacts shall be prepared so that the measurement areas may be easily viewed through a microscope and exposed to the acid fumes.

3.1.2 Contacts shall be tested prior to assembly of shrouds, hoods, or other accessories. During the preparation stage, care shall be taken not to touch or damage the measurement area.

3.1.3 All socket contacts including tulip, box contacts and multiple tine contacts shall be opened to expose the measurement area; see figure 7. In case of multiple tine contacts, the number of adjacent tines opened or removed shall be as shown in table 2.

Table 2 - Tines to be opened or removed

Number of tines per contact	Number of tines to be opened or removed and disregarded
2	1
3	1
4	2
5	2
6	3

3.2 Cleaning

3.2.1 Cleanliness is very important. Coatings or films on the contact may give false negatives by protecting exposed base metals from the test reagents. False positive indications can also occur if plating salts or metal flakes are present and react with the reagents.

3.2.2 Clean samples for 5 minutes in an ultrasonic cleaner or equivalent that contains a hot (65 °C to 85 °C) aqueous solution of a mildly alkaline (pH 7.5 to pH 10) detergent (such as Micro™ or Sparkleen™) or equivalent.

NOTE — If parts are straight off the plating line, one may use, instead of detergent, a 30 second ultrasonic or equivalent degreasing in fresh, clean acetone, followed directly by 3.2.4 to remove traces of inorganic contaminants, such as plating salts.

3.2.3 After cleaning in accordance with 3.2.2, rinse samples thoroughly under warm running tap water for at least 15 seconds.

3.2.4 Rinse samples in an ultrasonic cleaner or equivalent for 2 minutes in fresh deionized water to remove the last detergent residues.

3.2.5 Immerse samples in fresh methanol, 2-propanol, or acetone, and agitate ultrasonically or equivalent for at least 30 seconds in order to remove the water from the samples.

3.2.6 Remove and air dry samples until the chemical used in 3.2.5 has completely evaporated. If an air blast is used as an aid to drying, the air shall be oil free, clean and dry.

3.2.7 Do not touch measurement area of samples after cleaning.

3.2.8 After cleaning, samples shall be visually inspected under 10X magnification for evidence of particulate matter remaining on the surface. If particulates remain on the surface, samples shall be recleaned per 3.2.1 through 3.2.7.

3.2.9 Contacts shall be placed in a suitable holding fixture; see 2.3.

3.2.10 Materials that absorb vapors (e.g., paper tags, string, tape, etc.) shall be removed from the samples prior to cleaning and placing samples into the desiccator.

4 Test procedure

CAUTION —-Perform all work in an exhaust hood since the vapors given off are toxic. Chemical goggles completely enclosing eyes shall be worn. Normal precautions in handling corrosive acids should be observed. It is recommended that the exhaust hood be of such a design as to minimize transverse air currents to prevent purging of the desiccator of the acid fumes during the test.

4.1 The desiccator and test samples shall be in an environment with a relative humidity less than 60% and a temperature of 23 °C ± 2 °C (73 °F ± 4 °F) during desiccator equalization and during insertion and removal of the samples into the desiccator.

4.2 Prior to each test, desiccators, sample chambers and other equipment shall be thoroughly cleaned and dried to remove any contaminant or residue remaining from past use.

4.3 Place in the desiccator 50 ml to 100 ml of acid per liter of desiccator volume. Each test shall require fresh unused acid. If support plate is to be used, it shall also be placed in the desiccator at this time.

4.4 Allow the desiccator to stand for 30 minutes ± 5 minutes at 23 °C ± 2 °C (73 °F ± 4 °F) (closed desiccator).

4.5 Place fixture with samples on the inside rim of the desiccator and exposed for 75 minutes ± 5 minutes at 23 °C ± 2 °C (73 °F ± 4 °F). The lid shall be removed as briefly as possible when inserting test samples.

4.6 The fixture with the contacts shall then be removed and immediately placed in an air circulating oven for 10 minutes to 15 minutes at 125 °C ± 5 °C (257 °F ± 9 °F).

4.7 The fixture shall be removed from the oven and allowed to cool to room ambient. Contacts shall be examined within 1 hour of exposure. Each measurement area shall be examined for corrosion products at 10X magnification. Proper illumination is critical in the examination process. A recommended illumination technique is the use of a collimated incandescent light source at an oblique angle 15° to 30° to the measurement surface.

5 Details to be specified

The following details shall be specified in the referencing document:

5.1 Number of samples

5.2 Average corrosion count allowed

5.3 Measurement area

6 Documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

6.1 Title of test

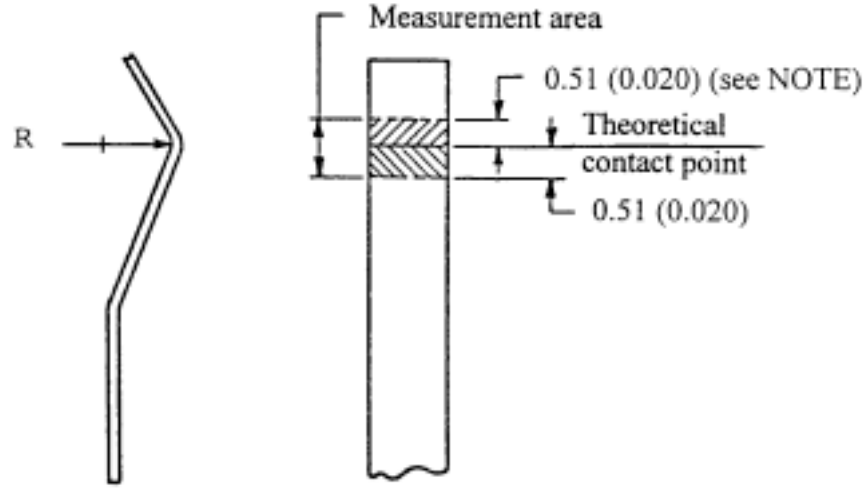
6.2 Specimen description, including fixturing if applicable (photographs may be used)

6.3 Test equipment used, and date of last and next calibration

6.4 Test and procedure

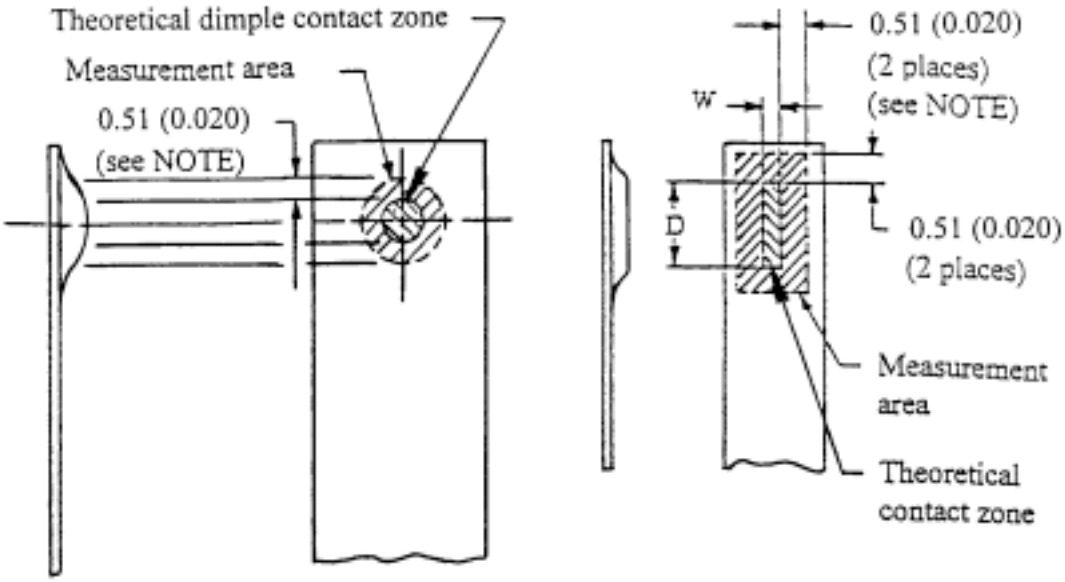
6.5 Values and observations

6.6 Name of operator and date of test



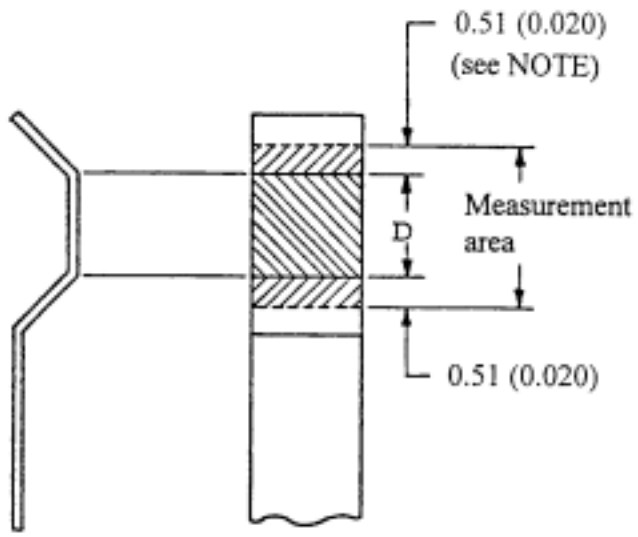
NOTE - Or to the edge of the contact, whichever is less. First dimension shown is in millimeters and the second dimension in ( ) is in inches.

Figure 2 - Line contact



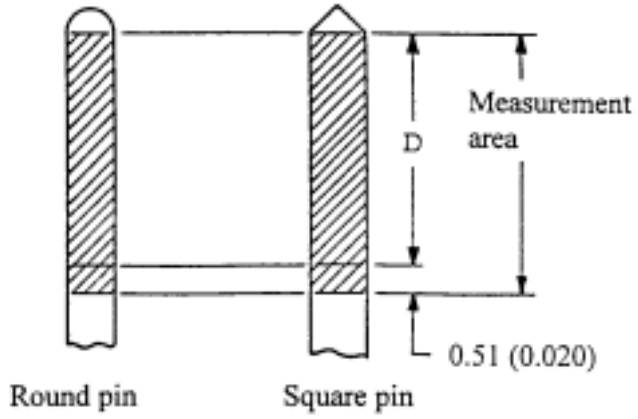
NOTE - Or to the edge of contact, whichever is less. First dimension shown is in millimeters and the second dimension in ( ) is in inches.

Figure 3 - Point contact



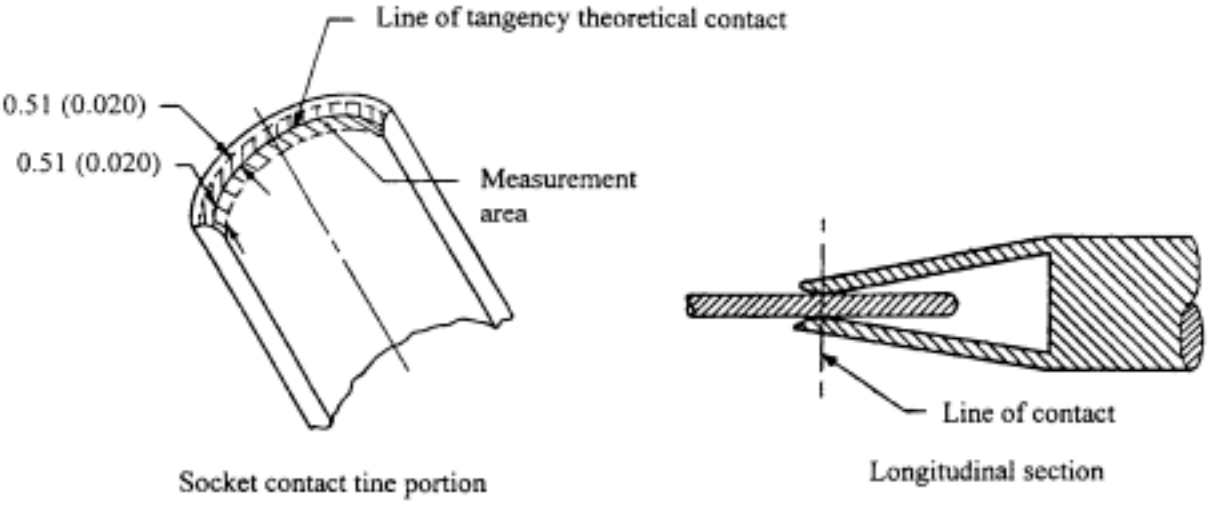
NOTE - Or to the edge of the contact, whichever is less. First dimension shown is in millimeters and the second dimension in ( ) is in inches.

Figure 4 - Surface contact



NOTE - First dimension shown is in millimeters and the second dimension in ( ) is in inches.

Figure 5 - Round and square pin contact



NOTE - First dimension shown is in millimeters and the second dimension in ( ) is in inches.

Figure 6 - Multiple tine contact

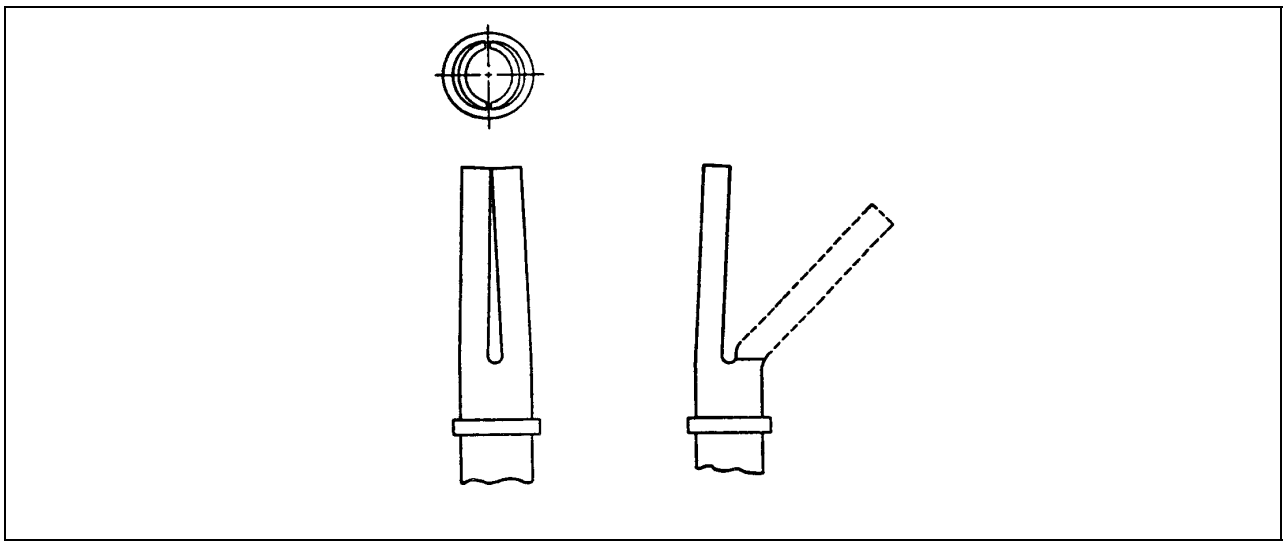


Figure 7 - Double or multiple tine contact

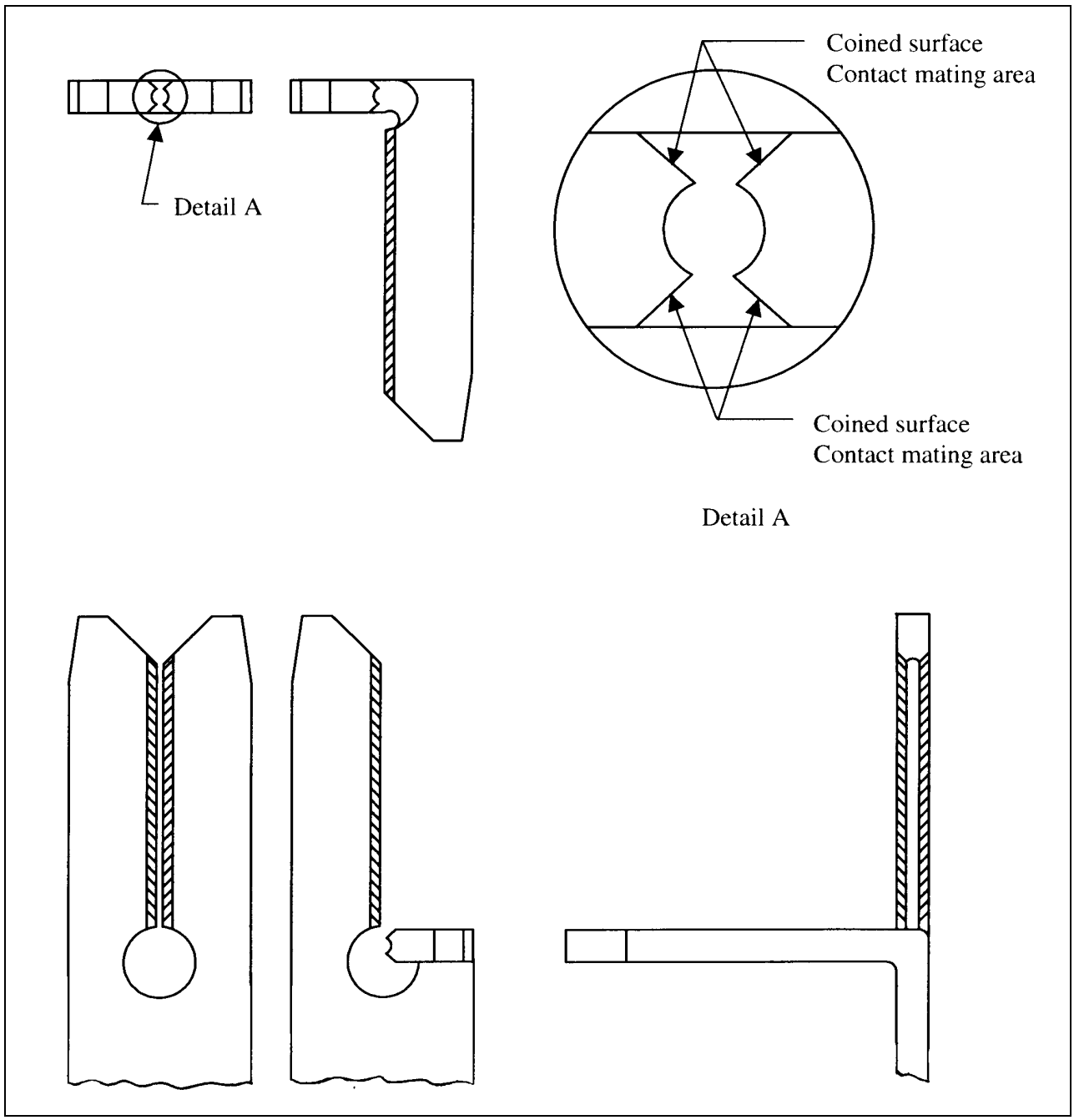


Figure 8 - Hermaphroditic contact

Annex

A Informative

A.1 No conclusions relative to oxide or film growth based on discoloration should be made relative to the reliability of the product. The method described herein does not represent harsh environments found in normal operating areas. This method has been developed to detect pores and should not be construed as an accelerated life test.

A.2 This test procedure is valid for gold or gold alloy (75% or more of gold) surfaces applied to copper or nickel base alloy contacts. However this test procedure is not valid for underplates that are inert to nitric acid vapors (e.g., 65-35 tin nickel).

A.3 It is recommended that a 51 mm to 76 mm (2 in to 3 in) length of bare copper wire be placed with the samples to serve as an indicator that proper reactions occur.

A.4 This test is not recommended for durability (wear) evaluation of contact surfaces.

A.5 This procedure is not intended to eliminate the need for specifying gold thickness in the measurement area in the referencing document.

A.6 This test shall be classified as a destructive test.

A.7 Except as noted in A.7.1, this procedure is valid when testing loose contacts prior to assembly to their plastic housing as well as those conditions specified in 3.1.1. If this test procedure is to be used as an incoming inspection procedure, it is recommended that such action be negotiated between manufacturer and user.

A.7.1 Pins that are molded in their insert may be exposed to this procedure if the assembly is unshrouded and it has been determined that no side effects exists relative to the plastic used.

A.8 This procedure is not to be substituted for performance requirements, but is to be used to evaluate the integrity of contact surfaces. For correlation with contact performance, this procedure in combination with performance requirements as specified in the referencing document shall be used.

A.9 This procedure may be used for contacts with localized gold finishes.

A.10 This test procedure may be used for evaluating gold contact finish thicknesses that are less than 0.75 micrometer (30 microinches) with the understanding that as precious metal plating thickness is reduced, porosity is expected to increase.

A.10.1 Below 0.50 micrometer (20 microinches), porosity results from small sampling numbers will become erratic, with one sample having significantly different results from an adjacent sample. Actual counting of pore levels is less important than assuring consistent process control by examining the samples for catastrophic changes in pore count. These changes will be seen with pore counts on the order of 50 to 100 times higher than typical.

A.10.2 It should be remembered that porosity is a means of testing consistency of manufacturing process control and does not necessarily relate to product performance.

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