



ANSI/EIA-364-60B-2020
Approved: April 2, 2020

EIA-364-60B

EIA STANDARD

TP-60B

General Methods for Porosity Testing of Contact Finishes for Electrical Connectors and Sockets

EIA-364-60B

(Revision of EIA-364-60A)

April 2020



Electronic Components Industry Association

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 ECIA 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 ECIA members, whether the standard is to be used either domestically or internationally.

NOTE – The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from the standards developer.

Neither the standards developer nor ANSI is responsible for identifying patents for which a license may be required by an American National Standard or for conducting inquiries into the legal validity or scope of those patents that are brought to their attention.

Standards and Publications are adopted by ECIA in accordance with the American National Standards Institute (ANSI) patent policy. By such action, ECIA does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Standard or Publication.

This EIA Standard is considered to have International Standardization implications, but the International Electrotechnical Commission activity has not progressed to the point where a valid comparison between the EIA Standard and the IEC document can be made.

This Standard does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

(From Standards Proposal No. 5440.08-A, formulated under the cognizance of the CE-2.0 Committee on EIA National Connector and Socket Standards.)

Published by

©Electronic Components Industry Association 2020
EIA Standards & Technology Department
13873 Park Center Road, Suite 315
Herndon, VA 20171

**PLEASE !
DON'T VIOLATE
THE
LAW!**

This document is copyrighted by the ECIA and may not be reproduced without permission.

Organizations may obtain permission to reproduce a limited number of copies through entering into a license agreement. For information, contact:

IHS Markit
15 Inverness Way East
Englewood, CO 80112-5704 or call
USA and Canada (1-877-413-5186), International (303-397-7956)

CONTENTS

Clause	Page
1 Introduction	1
1.1 Scope	1
1.2 Object	1
1.3 Test methods	1
1.4 Definitions	2
2 Test resources	2
2.1 Equipment	2
2.2 Material	4
3 Test specimen	5
3.1 Preparation	5
3.2 Cleaning	6
4 Test procedure	8
4.1 Porosity test methods	8
4.1.1 Method 1, nitric acid vapor	8
4.1.2 Method 2, sulfurous acid / sulfur dioxide	9
4.1.3 Method 3, electrographic dye transfer paper (Deleted)	11
4.1.4 Method 4, electrographic gel bulk	11
4.1.5 Method 5, sodium hypochlorite vapor	16
4.1.6 Method 6, nitric acid immersion	16
4.2 Examination and evaluation of test results	17
5 Details to be specified	18
6 Test documentation	19
Table	
1 Test methods	1
2 Multiple tine contacts	6
3 Sulfur dioxide exposure time	10
4 Guide to gel porosity reaction products	16
5 Porosity indication size	18

CONTENTS (continued)

Figure		Page
1	Typical porosity testing setup using a gel medium	14
2	Porosity indications	18
3	Line contact	20
4	Point contact	20
5	Surface contact	21
6	Round and square pin contact	21
7	Multiple tine contact	22
8	Double or multiple tine contact	22
9	Hermaphroditic contact	23
10	Electrographic gel multiple part test cell	24
Annex		
A	Informative	A-1

TEST PROCEDURE No. 60B

GENERAL METHODS FOR POROSITY TESTING OF CONTACT FINISHES
FOR
ELECTRICAL CONNECTORS AND SOCKETS

(From EIA Standards Proposal No. 5440.08-A, formulated under the cognizance of the CE-2.0 Committee on EIA National Connector and Socket Standards, and previously published in EIA-364-60A.)

1 Introduction

1.1 Scope

This test procedure details the methods for determining the porosity of contact finishes used in electrical connector, contacts and sockets.

1.2 Object

The object of this procedure is to determine the magnitude of porosity as well as other surface defects inherent in the application of noble metal contact finishes. Porosity tests are an indication of the completeness of protection or coverage offered by the finish. It is the intent that the defined methods be used as an evaluation technique to aid in control of noble metal contact finishing processes. Results of contact finish porosity as determined by these methods are not correlated with service performance of electrical connectors. This procedure applies to noble metal finishes with or without underplates applied to copper or nickel base alloy contacts. Noble metal platings include gold, gold alloys, palladium and palladium alloys with and without gold flash overplate.

1.3 Test methods

The test methods indicated in table 1 are contained herein.

Table 1 - Test methods

Method	Title	Procedure and applicability
1	Nitric acid vapor	See 4.1.1
2	Sulfur dioxide	See 4.1.2
3	Electrographic dye transfer paper	See 4.1.3 (Deleted)
4	Electrographic gel bulk	See 4.1.4
5	Sodium hypochlorite vapor	See 4.1.5
6	Nitric acid immersion	See 4.1.6

1.4 Definitions

1.4.1 Measurement area

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

1.4.1.1 Figure 3 portrays a "line" contact. The measurement area is defined as 0.50 millimeters (0.020 inch) on each side of the theoretical contact point tangent to point R and shall include the total width of the contact.

1.4.1.2 Figure 4 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 0.50 millimeters (0.020 inch). The measurement area of an elongated dimple shall be defined in terms of its theoretical contact zone length D and width W plus 0.50 millimeters (0.020 inch) surrounding this surface.

1.4.1.3 Figure 5 portrays a "surface" contact. The measurement area shall include length D plus 0.50 millimeters (0.020 inch) at each end and the total width of the contact.

1.4.1.4 Figure 6 portrays the measurement area of a round and square pin. The measurement area shall be defined as equal to the maximum wipe distance plus 0.50 millimeters (0.020 inch) 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.

1.4.1.5 Figures 7 and 8 portray the measurement area of a multiple tine socket contact. The measurement area shall be defined as a region 0.50 millimeters (0.020 inch) on both sides of the circumferential line of contact.

1.4.1.6 Figure 9 portrays the measurement area of a hermaphroditic contact mating coined surface. The area of measurement shall be defined as the entire coined area plus 0.50 millimeters (0.020 inch) on all sides.

2 Test resources

2.1 Equipment

2.1.1 Method 1, nitric acid vapor and Method 2, sulfur dioxide

2.1.1.1 Desiccator or specimen chamber

2.1.1.1.1 Desiccator, 250 millimeters inside diameter preferred (2 required): or specimen chamber constructed from inert materials, having the capability of being sealed with an enclosed volume of 1 liter to 15 liters. No sealants (e.g., stopcock, grease, etc.) shall be applied to the mating surfaces of the desiccator cover. Sealants may cause these to stick together and any method employed to release a stuck cover is likely to be extremely hazardous.

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

2.1.1.2 Specimen holder

Contacts shall be placed in a suitable holding fixture of inert material 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 specimens shall not be closer than 25 millimeters (1 inch) from the wall of the desiccator and at least 75 millimeters (3 inches) from the solution surface. Opposing measurement areas shall not be closer than 10 millimeters (0.4 inch) from each other. The fixture shall not prohibit the measurement area from being exposed to the test environment. If the test fixture does not rest directly on the inside rim of the desiccator, stainless steel, or other nonabsorbing inert material mesh plates (no porcelain plates) may be used. The holding fixture and support plate shall not cover more than 50% of the cross-sectional area of the test chamber. A porcelain plate may only be used in the storage desiccator.

2.1.1.3 Dehumidifier (If room is not environmentally controlled)

2.1.1.4 Cylinder, graduated, 500 ml

2.1.1.5 Ambient temperature and humidity gauge.

2.1.1.6 Oven, air circulating, capable of maintaining $125^\circ\text{C} \pm 5^\circ\text{C}$ ($257^\circ\text{F} \pm 9^\circ\text{F}$)

2.1.2 Method 4, electrographic gel bulk

2.1.2.1 Power supply, regulated, dc, constant current $\pm 5\%$: 0 volt to 10 volts dc, 0 ampere to 1 ampere maximum.

2.1.2.2 DC milliammeter, 0 to 50 milliamperes with an accuracy of 2% full scale and 1 milliamperes resolution.

2.1.2.3 Voltmeter, dc: 0 to 10 volts with an accuracy of 5% of the reading.

2.1.2.4 Test cell shall be sized to accommodate test specimen as indicated in Figure 1 or in Figure 10. It shall be constructed of clear uncolored glass or acrylic. Cathode shall be either heavily plated or solid gold or platinum. Cathode shall not obstruct view of the measurement area. Anode surface area shall be 0.5 times to 3 times the surface area of the cathode, with the preferred ratio being 1 to 1.

2.1.2.5 Watchglass, funnel, beakers, and graduated glassware of appropriate sizes

2.1.2.6 Refrigerator

2.1.2.7 Thermometer, 0 °C to 100 °C (32 °F to 212 °F)

2.1.2.8 Timer, 0 to 10 minutes, with the capability of measuring seconds.

2.1.2.9 Stirrer / hot plate & polytetrafluoroethylene (PTFE) coated magnetic stir bar.

2.1.2.10 Gram scale, triple beam balance or equiv. accurate to 0.1 gram.

2.1.3 Method 6, Nitric acid immersion

2.1.3.1 Specimen container, beaker or other glass container of sufficient size to accommodate the specimen

2.1.3.2 Beaker, 250 milliliters

2.1.3.3 Graduated cylinder

2.1.3.4 Ambient temperature gauge

2.2 Material

2.2.1 Method 1, nitric acid vapor

2.2.1.1 Concentrated reagent grade nitric acid: 70 % $\pm$ 1% HNO₃.

2.2.1.2 Desiccant, indicating Drierite.

2.2.1.3 Lacquer, stop-off.

2.2.2 Method 2, sulfur dioxide

2.2.2.1 Acid, sulfurous, 6 percent minimum, AR grade (500 ml bottle required).

CAUTION — Perform all work in a hood since the vapors given off are extremely irritating. Chemical goggles or face shield, protective clothing and gloves shall be worn. Eye wash facilities shall be readily available. Consult an environmental engineer for proper disposal of solutions.

2.2.2.2 Pressure sensitive PTFE tape with silicone adhesive backing.

2.2.2.3 Desiccant, indicating Drierite.

2.2.2.4 Lacquer, stop-off.

2.2.3 Method 4, electrographic gel bulk

2.2.3.1 Gold or platinum wire.

2.2.3.2 Brush, artist's, fine.

2.2.3.3 Dithiooxamide (rubeanic acid), AR grade.

2.2.3.4 Sodium carbonate, AR grade.

2.2.3.5 Sodium nitrate, AR grade.

2.2.3.6 Deionized water.

2.2.3.7 Gelatin, food grade, Knox brand.

2.2.3.8 Whatman 541 filter paper.

2.2.3.9 Lacquer, stop-off.

2.2.3.10 Ethanol or reagent alcohol, AR grade.

2.2.4 Method 6, Nitric acid immersion

2.2.4.1 Acid, nitric, 69% – 71%, AR grade

2.2.4.2 Distilled or deionized water

3 Test specimen

3.1 Preparation

3.1.1 Prior to subjection of specific tests, contacts shall be prepared so that the measurement areas may be easily viewed through a microscope.

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 8. In case of multiple tine contacts, the number of adjacent tines opened or removed shall be as specified in Table 2.

Table 2 - Multiple tine contacts

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
NOTE— Care should be taken to remove different tines from contact specimens. This will avoid missing bad sections of tines.	

3.2 Cleaning

3.2.1 Omit the cleaning steps for specimens having corrosion-inhibiting or lubricating coatings, or both, if it is desirable to determine the efficacy of the coating in the test exposure.

3.2.2 All peripheral hardware, housings and wires shall be removed prior to cleaning. Plated parts shall be removed from plastic housings whenever possible, prior to cleaning. Material that absorbs vapors (e.g., paper tags, string, tape) shall be removed from the specimens prior to cleaning, taking care to maintain specimen identity.

3.2.3 Keep individual contacts separated if there is a possibility of damage to measurement area during the various cleaning steps below.

3.2.4 Equipment for cleaning

3.2.4 1 Ultrasonic cleaning apparatus, preferably with an integrated heater

3.2.4 2 Tongs or forceps

3.2.4.3 Air, oil free, clean and dry (optional)

3.2.5 Materials for cleaning

3.2.5.1 Acetone, Optima grade

3.2.5.2 Detergent, Sparkleen or Micro or equivalent

3.2.5.3 Methanol, AR grade

3.2.5.4 2-propanol, 99.0% Min, certified ACS grade