MILITARY STANDARD

TEST METHODS FOR ELECTRICAL CONNECTORS

TO ALL HOLDERS OF MIL-STD-1344A:

1. THE FOLLOWING METHODS ARE TO BE ADDED:

NEW METHOD	DATE
1017 - POROSITY	
2019 - SOLDER WICKING	

2. THE FOLLOWING PAGES OF MIL-STD-1344A HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
5		5	10 September 1980
6		6	10 September 1980

3. RETAIN THIS NOTICE PAGE AND INSERT BEFORE THE TABLE OF CONTENTS.

4. Holders of MIL-STD-1344A will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or canceled.

Custodians:
Army - CR
Navy - AS
Air Force - 85

Review activities:
Army - MI, AR
Navy - EC
Air Force - 11, 17, 99
DLA - ES

Agent:
DLA - ES

Preparing activity:
Navy - AS

(Project 5935-3283)

METHOD 1017

POROSITY

1. PURPOSE. The purpose of this procedure is to determine the magnitude of porosity as well as other surface defects inherent in application of gold contact finishes. 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.

2. TEST EQUIPMENT. Test equipment and materials shall be as follows.

a. 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.

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

c. Concentrated Reagant Grade nitric acid: 70 ±1 percent HNO_3.

d. Sample holder. The holding fixture shall be of inert material, capable of maintaining the measurement area in a vertical plane. The fixture shall be contructed in such a manner to assure that the test samples shall be not closer than 1 inch (.25 mm) from the wall of the desiccator and 3 inches (.76 mm) from the solution surface. Adjacent contacts shall be not closer than 0.4 inch (10 mm) from each other. The fixture shall not prohibit the measurement area from being exposed to the test environment. The holding fixture shall not cover more than 50 percent of the cross-sectional area of the test chamber.

e. Optical microscope capable of 10X magnification.

f. Collimated incandescent light source capable of oblique angle 15° to 30° to the measurement surface.

3. TEST SAMPLES. The number of samples to be tested shall be specified in the individual specification.

3.1 Sample preparation (measurement area). 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.

a. 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.

b. All socket contacts including tulip, box contacts, and multiple tine contacts shall be opened to expose the measurement area (see figure 6). In case of multiple tine contacts, the number of adjacent tines opened or removed shall be as shown in table I.

TABLE I. Samples.

No. of tines per contact	No. of tines to be opened or removed and disregarded
2	1
3	1
4	2
5	2
6	3

3.2 Sample preparation (cleaning). Cleaning of test specimens prior to testing.

a. A solvent that will remove any organic film that may be present, such as lubricants or fingerprints, shall be used to clean the test specimens. A suitable cleaning solution is one of the chlorinated or fluorinated solvents. Samples shall then be washed in running distilled or deionized water.

b. Contacts shall be rinsed in unused reagent grade isopropyl alcohol and dried.

c. After rinsing, the samples shall be air dried until the alcohol has completely evaporated. If an air blast is used, such air shall be dry and clean. Do not contact samples with bare fingers.

d. 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 a through c.

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

f. 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 samples shall be not closer than 1 inch (.25 mm) from the wall of the desiccator and 3 inches (.76 mm) from the solution surface. Adjacent contacts shall be not closer than 0.4 inch (10 mm) from each other. The fixture shall not prohibit the measurement area from being exposed to the test environment. The holding fixture shall not cover more than 50 percent of the cross-sectional area of the test chamber.

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 transversing air currents to prevent purging of the desiccator of the acid fumes during the test.

a. The desiccator and test samples shall be in an environment with a relative humidity less than 60 percent and a temperature of 23°C ±2°C during desiccator equalization, and during insertion and removal of the samples into the desiccator.

b. 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.

c. Place in the desiccator 50 to 100 ml of acid per liter of the desiccator volume. Each test shall require fresh unused acid.

d. Allow the desiccator to stand for 30 ±5 minutes at 23°C ±2°C (closed desiccator).

e. Contacts shall then be placed in the desiccator and exposed for 75 ± 10 minutes at 23°C ±2°C. The lid shall be removed as briefly as possible when inserting test samples.

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

g. 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.

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

4.1.1 Line contact. The measurement area of a line contact (see figure 1) is defined as 0.020 inch (0.51 mm) on each side of the theoretical contact point tangent to point R and shall include the total width of the contact.

4.1.2 Point contact. A point contact (see figure 2) as established by a dimple or elongated dimple shall be defined by the dimple radius at its base plus 0.020 inch (0.51 mm). The measurement area of an elongated dimple shall be defined by its length 'd' and width 'w' as measured at its base plus 0.020 inch (0.51 mm) surrounding this surface.

4.1.3 Surface contact. The measurement area of a surface contact (see figure 3) shall include length 'd' plus 0.020 inch (0.51 mm) at each end and the total width of the contact.

4.1.4 Round and square pin. The measurement area of a round and square pin (see figure 4) shall be defined as equal to the maximum wipe distance plus 0.020 inch (0.51 mm) with the initial area starting at a point where the lead-in chamber or radius blends into the shank of the pin. Unless otherwise specified, the measurement area shall include the total diameter of a round pin and all sides of a square pin.

4.1.5 Multiple tine socket contact. The measurement area of a multiple tine socket contact (see figures 5 and 6) shall be defined as a region 0.020 inch (0.51 mm) on both sides of the circumferential line of contact.

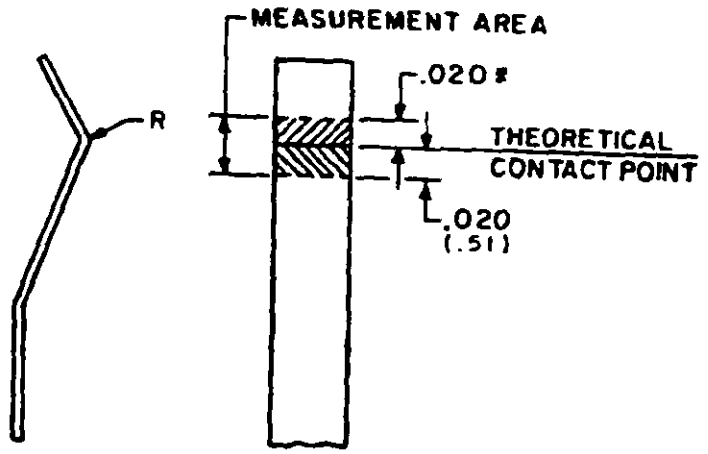
4.1.6 Hermaphroditic contact. The measurement area of a hermaphroditic contact mating coined surface (see figure 7) shall be defined as the entire coined area plus .020 inch (0.51 mm) on all sides.

4.2 Corrosion product definition.

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

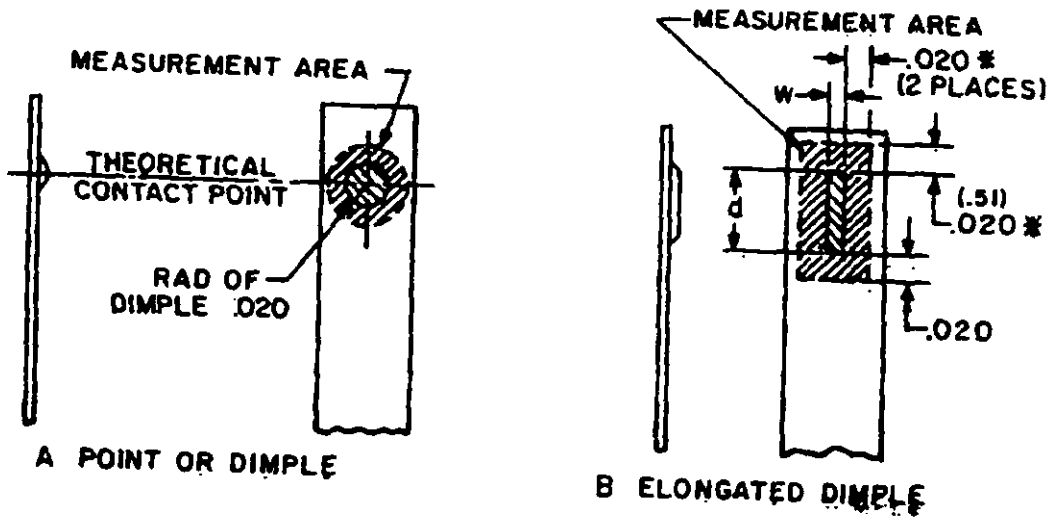
b. The size of a corrosion product shall be defined by the major diameter with the longest straight line or chord that can be passed through the corrosion product.

c. 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.



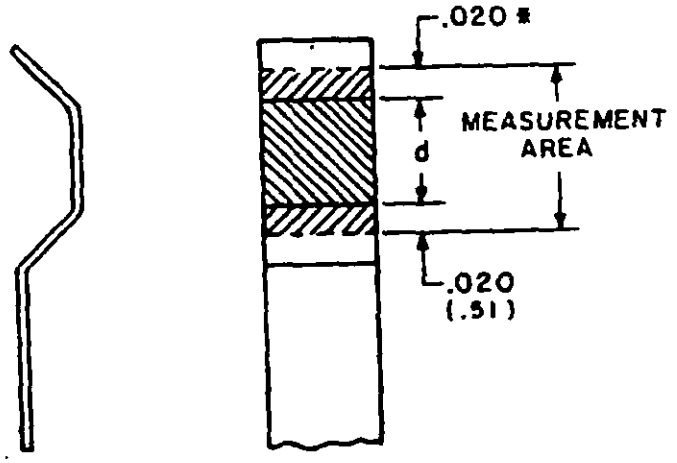
* Or to the edge of the contact, whichever is less.

FIGURE 1. Line contact.



* Or to the edge of the contact, whichever is less.

FIGURE 2. Point contact.



* Or to the edge of the contact, whichever is less.

FIGURE 3. Surface contact.

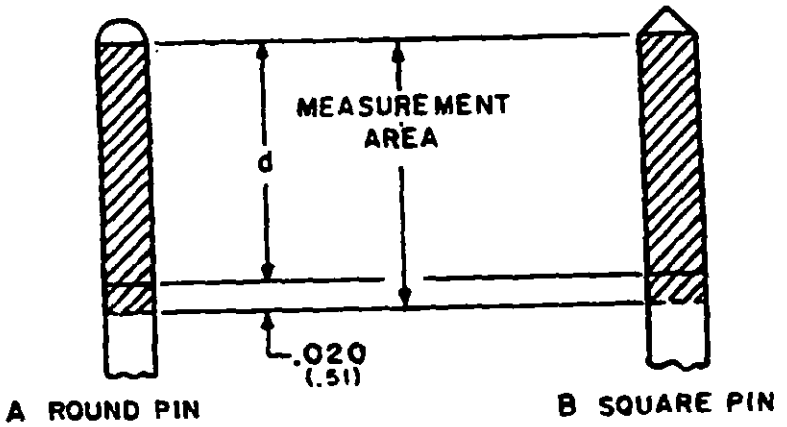
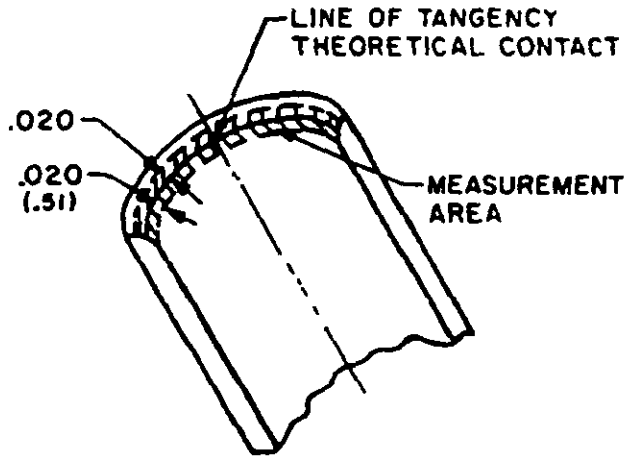
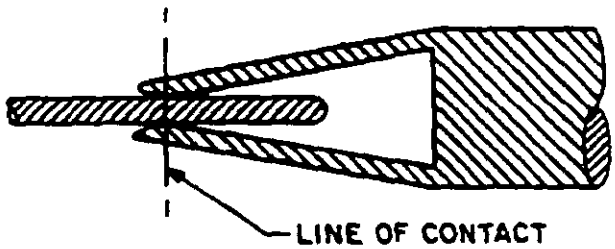


FIGURE 4. Pin.



A SOCKET CONTACT TINE PORTION



B LONGITUDINAL SECTION

FIGURE 5. Contact, multiple tine, socket.

TABLE I. Cross reference equivalent test methods.

MIL-STD-1344 Method	MIL-STD-202 Method	MIL-STD-810 Method
1001	101	
1002, type II	103 (type I) 106 (type II)	507 (1)
1003	107	
1004 1005 1006 1007 1008 1009 1010	102 and 107	
1011	301	
1012 1013 1015 1016 1017 2001 2002 2003 2004 2005	213 (I, II, III, IV) (V and VI) 201, 204, 214	
2006 2007 2008 2009 2010 2011	212	
2012 2013 2014 2015 2016 2017 2018 2019 3001	105 and 301	
3002 3003 3004 3005 3006 3007 3008		

5. NUMERICAL INDEX OF TEST METHODS

Method Number	Title
	Environmetal tests (1000 class)
1001.1	Salt spray (corrosion)
1002.2	Humidity
1003.1	Temperature cycling
1004.1	Altitude immersion
1005.1	Temperature life
1006.1	Hydrostatic pressure
1007.1	Ozone exposure
1008	Air leakage
1009	Firewall
1010	
1011	Altitude-low temperature
1012	Flammability
1013	
1014	
1015	Simulated life
1016	Fluid immersion
1017	Porosity
	Mechanical tests (2000 class)
2001.1	Contact axial concentricity
2002.1	Maintenance aging
2003.1	Crimp tensile strength
2004.1	Shock (specified pulse)
2005.1	Vibration
2006.1	Probe damage (contacts)
2007.1	Contact retention
2008.1	Crush
2009.1	Cable pull-out
2010.1	Insert retention
2011.1	Acceleration
2012.1	Contact insertion and removal force
2013.1	Mating and unmating forces
2014	Contact engagement and separation force
2015	Impact
2016	Durability
2017	Cable seal flexing
2018	Gage location and retention
2019	Solder wicking
	Electrical tests (3000 class)
3001.1	Dielectric withstanding voltage
3002.1	Low signal level contact resistance
3003.1	Insulation resistance
3004.1	Contact resistance
3005	Standing Wave Ratio (SWR)
3006	Magnetic permeability
3007	Shell to shell conductivity
3008	Shielding effectiveness for multicontact connectors

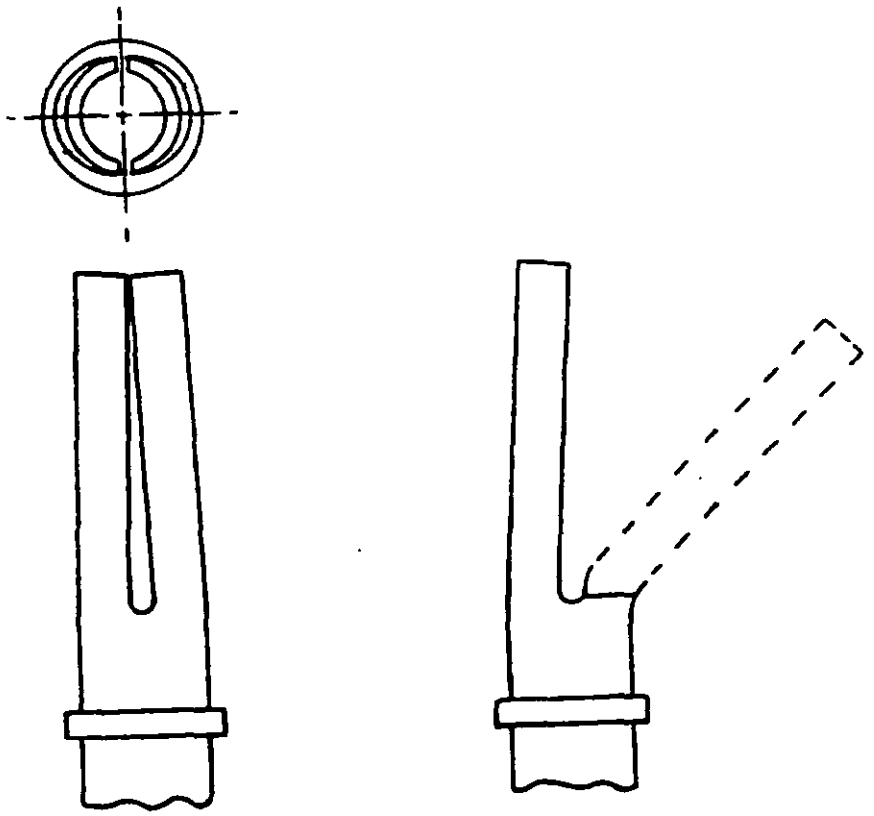


FIGURE 6. Double or multiple tine contact, socket.

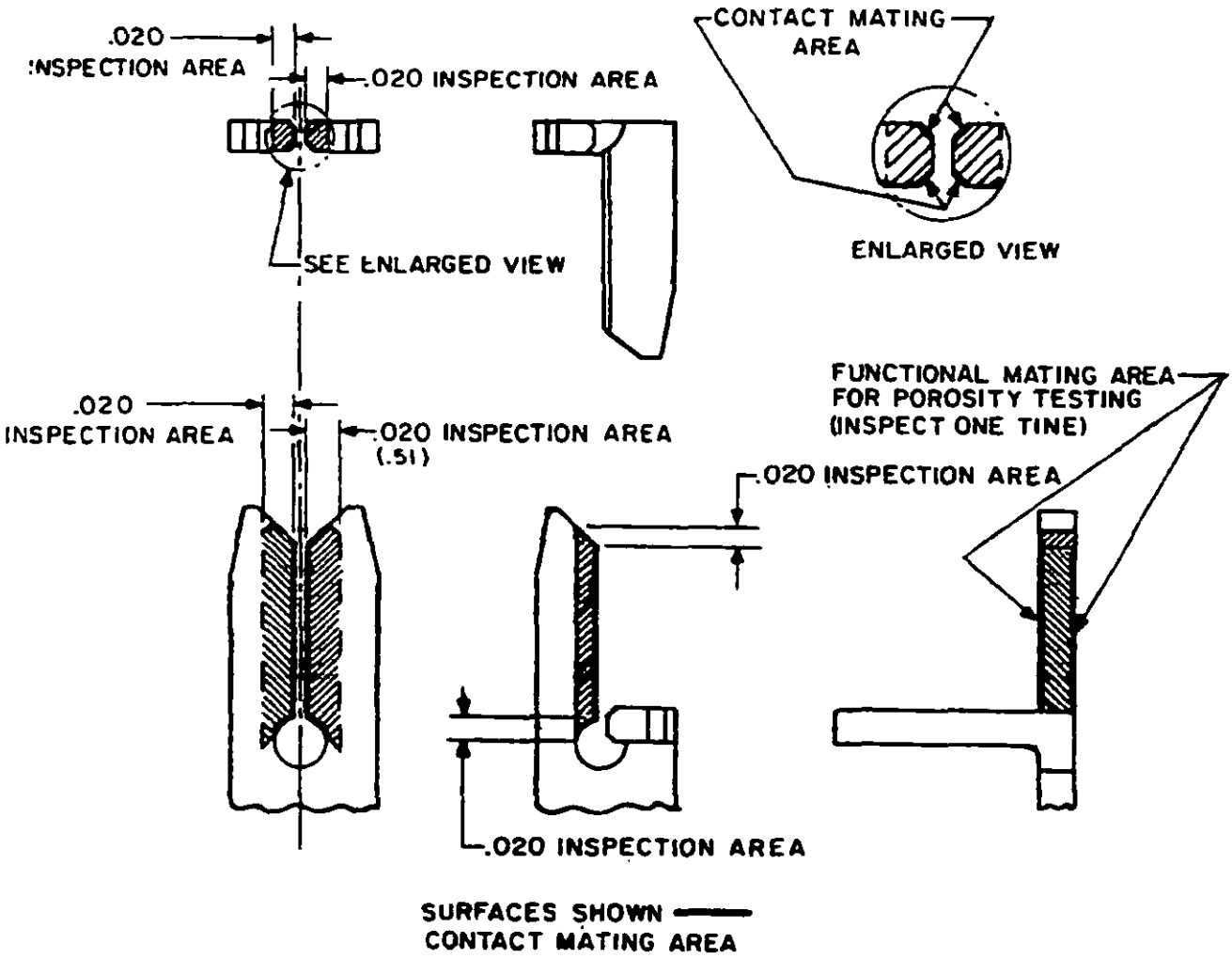
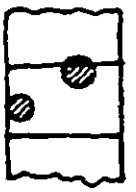


FIGURE 7. Hermaphroditic contact.

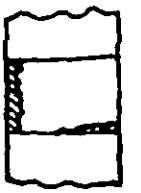
4.3 Corrosion product count.

a. A corrosion product shall be measured and counted when at least 3/4 of the corrosion product falls within the specified measurement area.

b. Corrosion products which initiate outside the measurement area but fall within it which are irregular in shape shall not be counted.



To be counted



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

c. Corrosion products, as defined in 4.2 shall be sized and counted in accordance with table II when initiating within the specified measurement areas.

TABLE II. Corrosion products.

Corrosion products size	Assigned count
Diameter up to and including 0.002 inch (0.05 mm)	0
> 0.002 inch (0.05 mm) and < 0.020 inch (0.51 mm) < diameter	1
Diameter ≥ 0.020 inch (0.51 mm)	2
Coverage in excess of 50 percent of measurement area regardless of size and point of initiation	20

d. 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.

4.4 Recommended acceptance criteria. Unless otherwise specified, the recommended average corrosion count for the sample lot shall be 1.0 or less.

5. DOCUMENTATION. Data sheets shall contain the following:

   a. Title of test, date, and name of operator.

   b. Sample description: Include fixture, if applicable.

   c. Test equipment used and date of latest calibration.

   d. Test procedure.

   e. Values and observations.

6. SUMMARY. The following details shall be specified in the detail specifications:

   a. Number of samples.

   b. Average corrosion count allowed.

   c. Measurement area.

6.1 Notes.

   a. 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.

   b. This test method is valid for gold or gold alloy (75 percent or more of gold) surfaces applied to copper or nickel base alloy contacts.

   c. It is recommended that a 2 to 3 inch length of bare copper wire be placed with the samples to serve as an indicator that proper reactions occur. However, this test procedure is not valid for underplates which are inert to nitric acid vapors (such as 65-35 tin nickel).

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

   e. This procedure is not intended to eliminate the need for specifying gold thickness in the measurement area in the detail product specification.

   f. This test shall be classified as a destructive test.

   g. Except as noted in 6.1h this procedure is valid when testing loose contacts prior to assembly to their plastic housing as well as those conditions specified in paragraph 3.1a. If this test method is to be used as an incoming inspection procedure, it is recommended that such action be negotiated between manufacturer and user.

   h. Pins which 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 exist relative to the plastic used.

   i. This procedure is not to be substituted for performance requirements, and 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 detail specifications should be used.

   j. This test procedure was developed for qualification and periodic requalification purposes for contacts utilizing localized gold contact finishes.

   k. This test procedure is recommended for evaluating gold contact finishes of less than 50 microinches thick.

   l. For military purposes, this test procedure is recommended for qualification/requalification of gold contact finishes less than 50 microinches thick.

METHOD 2019

SOLDER WICKING

1. PURPOSE. The purpose of this test is to assure that a connector can be wave soldered to a printed circuit board, without sustaining damage caused by solder wicking onto the contacting surfaces.

2. TEST EQUIPMENT.

a. A machine capable of providing all wave solder variables listed in 4.1a through 4.1e shall be used.

b. A 10X microscope or magnifying glass shall be used for final examination of the sample.

3. TEST SAMPLE. A test sample shall consist of a connector.

3.1 Sample preparation. The sample shall be mounted on a printed wiring board with terminals inserted in plated-thru-holes. The printed wiring board shall be NEMA grade G10 or FR-4 glass epoxy with 2 ounces (56 grams) copper on both sides, .062 inch (1.59 mm) thick. The terminal holes shall be plated-thru in accordance with MIL-P-55110. Hole size shall be such that diametral clearance between the plated-thru-holes and the test connector terminals shall not exceed .015 inch (.38 mm). The physical dimensions of the printed wiring board and the number of samples mounted shall be as specified.

4. TEST PROCEDURE. The printed wiring board with test samples installed shall be mounted on a conveyor and at a controlled speed, shall pass through the following processes:

a. Foam flux: The bottom surface of the board shall pass through a mildly activated warm flux, type RMA per MIL-F-14256 or equivalent.

b. Pre-heat: The board shall pass through electric heaters which raise the top surface of the board to 100°C ±5°C.

c. Solder wave: The board shall pass through the solder wave (see 4.1).

4.1 Solder wave description.

a. The solder alloy shall be composition SN60 or SN63 per QQ-S-571.

b. Soldering fluid, if used, shall be mixed with the molten solder for reduction of solder surface tension. If used, the soldering fluid shall be water soluble or petroleum based.

c. A solder temperature of 260°C ±3°C shall be maintained and measured at the top of the wave.

d. The printed wiring board shall be immersed to a depth of 1/2 to 2/3 the board thickness while traversing the solder wave.

e. Solder wave contact length (see 4.2) shall be not less than 1 inch (25.4 mm), and not greater than 3 inches (.76 mm).

4.2 Time duration of exposure to the solder wave.

Let S = Speed of the conveyor in feet/minute.
Let D = Solder wavelength (distance a point on the printed wiring board must travel within the solder wave) (inches).
Let T = Time for a point on the printed wiring board to traverse the solder wave (seconds).

Then $T = \frac{5D}{S}$

5 = Conversion constant for Ft/Min to In/Sec.

4.3 Examination. At the conclusion of the test, the connector shall be disassembled and examined under 10X magnification for any solder damage. Solder damage is defined as any solder on the contact mating surface, solder that interferes with the operation of spring pressure mechanisms, or solder that interferes in any way with the intended mating function of the contact.

5. DOCUMENTATION. Data sheets shall contain the following:

a. Title of test, date, and name of operator.

b. Description of sample connector and printed wiring board.

c. Test equipment.

d. Test procedure.

e. Results. A description of the condition of the contacts following solder exposure.

6. SUMMARY. The following details shall be specified in the individual connector specification.

a. Special preparation or conditions, if required.

b. The inside diameter of plated-thru-holes in the printed wiring board.

c. The diameter (if round) or width (if flat) of the test connector terminals.

d. Examination of specimen.

e. Define test connector. Any special conditions.

f. Number of samples to be tested.

g. The dimensions of the printed wiring board.