ENGINEERING PRACTICE STUDY

PROJECT NUMBER: 5961-2008-045

TITLE: REVIEW OF REQUIREMENTS FOR MIL-STD-750 TEST METHOD 2071

12 November 2010

FINAL REPORT

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ATTCH 1

I. OBJECTIVES: To solicit input from custodians, review activities, users (G-12), and manufacturers (JC-13.1) on this proposal for coordination and concurrence.

II. BACKGROUND: Recent studies presented by JC-13.1 members have suggested that additional requirements be added to MIL-STD-750, Test Method 2071. The following additional requirements are being proposed:

a) The required inspection apparatus minimum magnification has been changed from 3X to 20X.
b) Reject criteria has been updated to include any mechanical damage which exposes underplate or base metal.
c) Reject criteria has been updated to include meniscus cracks.

III. RESULTS: Final results of this effort along with recommendations and conclusions are documented in attachment 1.

IV. CONCLUSIONS: The noted changes (attachment 1) shall be incorporated in the next revision of MIL-STD-750.

V. RECOMMENDATIONS:

a) All essential comments must be accepted or resolved through the DLA Land and Maritime spokesmen to the committees generating the drafts of those industry standards.
b) All suggested comments should be addressed by the industry committees or authors responsible for the draft documents.

METHOD 2071.7

VISUAL AND MECHANICAL EXAMINATION

1. Purpose. The purpose of this test method is to verify the workmanship of hermetically packaged devices. This method shall also be utilized to inspect for damage due to handling, assembly, and test of the packaged device. This test is normally employed at outgoing inspection within the device manufacturer's facility, or as an incoming inspection of the assembled device.

2. Apparatus. Apparatus used in this test shall be capable of demonstrating device conformance to the applicable requirements of the individual specification sheet. This includes optical equipment capable of magnification of 20X ~~3X~~ minimum ~~to~~ as specified herein~~, with a large field of view such as an illuminated ring magnifier~~. The preferred instrument is a binocular microscope with 10X eye pieces and 1.0X objective having a magnification range between 20X and 40X.

3. Procedure. Unless otherwise specified, the device shall be examined under a magnification of 20X ~~3X~~ minimum. The field of view shall be sufficiently large to contain the entire device and allow inspection to the criteria listed in 3.1. Where inspection at a lower magnification reveals an anomaly, then inspection at a higher magnification (40X ~~10X~~ maximum, unless otherwise specified) may be performed to determine acceptability. Higher magnification may be used to further examine and characterize observed anomalies.

When a disposition is in doubt for any dimensional criteria, that dimension may be measured for verification.

3.1 Failure criteria. Devices which exhibit any of the following shall be considered rejects.

3.1.1 Rejects. Device construction (package outline), lead (terminal), identification, markings (content, placement, and legibility), and workmanship not in accordance with the applicable specification sheet shall be rejected. This includes the following.

a. Any misalignment of component parts to the extent that the package outline drawing dimensions are exceeded.

b. Visual evidence of corrosion or contamination. Discoloration is not sufficient cause for rejection. The presence of lead carbonate formations in the form of a white/yellow crystalline shall be considered evidence of contamination.

c. Damaged or bent leads or terminals which precludes their use in the intended application.

d. Defective finish: Mechanical damage which exposes underplate or base metal. Evidence of blistering, ~~or evidence of~~ non-adhesion, peeling, or flaking which exposes underplate or base metal.

e. Burrs that will cause lead or terminal dimensions to be exceeded.

f. Foreign material (including solder or other metallization) bridging leads or otherwise interfering with the normal application of the device. Where adherence of foreign material is in question, devices may be subjected to a clean filtered air stream (suction or expulsion) or an isopropyl alcohol wash and then reinspected.

g. Protrusions beyond seating plane that will interfere with proper seating of the device.

h. Missing welds or crimps.

i. Damage causing distortion of a flange beyond its normal configuration.

j. Damage to a stud (thread damage or bending) which restricts normal mounting.

k. Dents in metal lids which precludes their use in the intended application or causing a defect in the finish (see 3.1.1.d).

l. Gaps, separations, or other openings that are not part of the normal design configuration.

m. Tubulation weld: Any fracture or split in the tubulation weld.

n. Weld alignment: Base weld mating surfaces not parallel, or that precludes intended use.

3.1.1.1 Failure criteria for lead/terminal seal area of metal can devices.

a. Radial cracks ~~(except meniscus cracks)~~ that extend more than one-half of the distance from the pin to the outer member (see figure 2071-1). Radial cracks that originate from the outer member.

b. Circumferential cracks ~~(except meniscus cracks)~~ that extend more than 90 degrees around the seal center (see figure 2071-2).

c. Open surface bubble(s) in strings or clusters that exceed two-thirds of the distance between the lead and the package wall.

d. Visible subsurface bubbles that exceed the following:

(1) Large bubbles or voids that exceed one-third of the glass sealing area (see figure 2071-3).

(2) Single bubble or void that is larger than two-thirds of the distance between the lead and the package wall at the site of the inclusion and extends more than one-third of the glass seal depth (see figure 2071-4).

(3) Two bubbles in a line totaling more than two-thirds of the distance from pin to case (see figure 2071-5).

(4) Interconnecting bubbles greater than two-thirds of the distance between pin and case (see figure 2071-6).

e. Except as designed, re-entrant seals which exhibit non-uniform wicking or negative wicking.

f. Twenty-five percent or greater of the radius length from the center of the feedthrough to the edge of the glass eyelet.

g. Glass meniscus cracks that are not located within one-half of the distance between the lead to the case (see figure 2071-7). The glass meniscus is defined as that area of glass that wicks up the lead or terminal.

h. Any chip-out of ceramic or sealing glass that penetrates the sealing glass deeper than the glass meniscus plane. ~~Exposed base metal as a result of meniscus chip outs are acceptable if the exposed area is no deeper than .010 inch (0.25 mm) or 50 percent of lead diameter, whichever is greater (see figure 2071-8).~~

3.1.1.2 Failure criteria for ceramic packages. Failure criteria for ceramic packages (see method 2009 of MIL-STD-883).

3.1.1.3 Failure criteria for opaque glass body devices. Failure criteria for opaque glass body devices (see method 2068 of this general specification).

3.1.1.4 Transparent glass diodes, double plug construction.

a. Any evidence of a crack, fracture, or a chipout closer to the die than 50 percent of the designed seal length shall be rejected. Area of examination shall be as shown on figure 2071-9.

b. Any crack that terminates in the axial direction is cause for rejection

~~c. Meniscus cracks are not cause for rejection.~~

c. Any chip out that exposes base metal shall be rejected.

3.1.1.5 Transparent glass diodes, large cavity (i.e. S-bend, C-bend, or straight-through constructions). Any crack or fracture in the glass over the area of the device cavity shall be rejected.

a. Any crack or fracture in the glass over the area of the device cavity shall be rejected.

b. Any chip out that exposes base metal shall be rejected (this does not apply to chip outs at either end of device where glass joins external lead).

c. Any crack that terminates in the axial direction is cause for rejection.

~~d. Meniscus cracks are not cause for rejection.~~

3.1.1.6 Failure criteria for hermetic packages with ceramic eyelet feedthroughs.

a. Any separation or delamination of the braze metallization from the inner diameter (ID) or outer diameter (OD) of the ceramic eyelet (see figures 2071-10 and 2071-11).

b. Any cracks or separation in the braze between the ceramic eyelet ID and the lead or the ceramic eyelet OD and the package. Any voids, depressions, or pinholes the bottom of which cannot be seen at 30X maximum magnification in the braze between the ceramic eyelet ID and the lead or the ceramic eyelet OD and the package.

c. Any discontinuation in the braze from the ceramic eyelet ID to the lead or the ceramic eyelet OD to the package exposing unplated metallization or bare ceramic (see figures 2071-12).

d. Any conductive material attached to the ceramic eyelet that reduces the designed isolation width by more than one-third unless it is demonstrated that the device voltage isolation requirement can be met with less than two-thirds of the width of the ceramic eyelet (see figures 2071-13 through 14).

e. Any metallization that extends beyond the height of the ceramic that is not adhered to the ceramic.

f. No cracks are allowed. Chipouts greater than .005 inch (0.127 mm) in any direction are not allowed.

4. Summary. The following conditions shall be specified in the applicable acquisition document:

a. Requirements for markings and the lead (terminal) or pin identification.

b. Detailed requirements for materials, design, construction, and workmanship.

c. Magnification requirements, if other than specified.

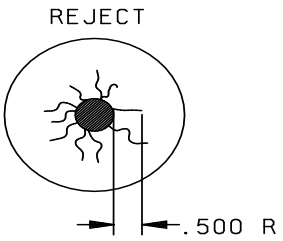


FIGURE 2071-1. Radial cracks extending more than one-half the distance from pin to outer member.

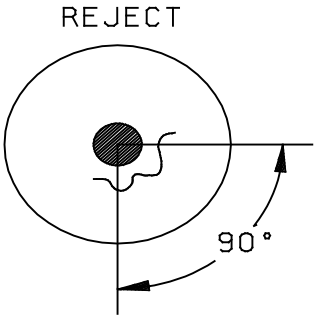


FIGURE 2071-2. Circumferential cracks.

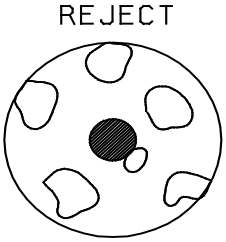


FIGURE 2071-3. Bubbles in glass exceeding one-third of the sealing area.

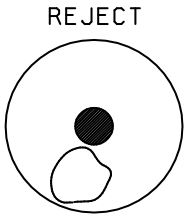


FIGURE 2071-4. Single bubble or void.

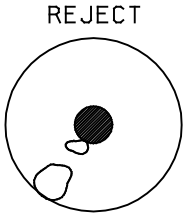


FIGURE 2071-5. Two bubbles in a line.

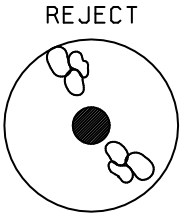


FIGURE 2071-6. Interconnecting bubbles.

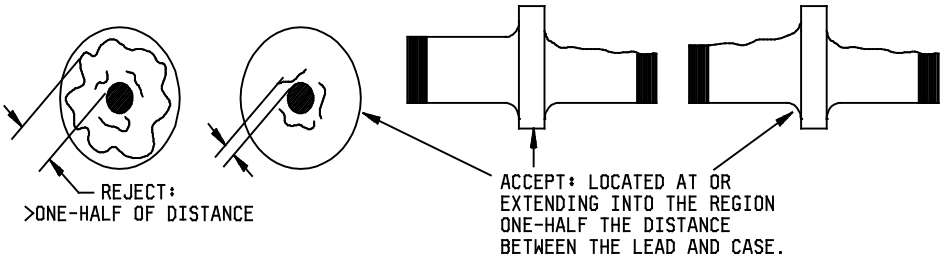


FIGURE 2071-7. Meniscus cracks.

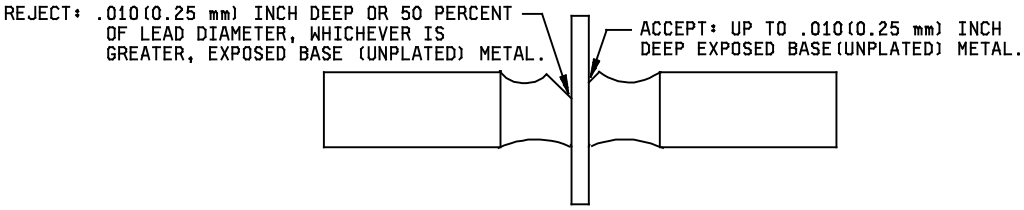


FIGURE 2071-8. Chip outs.

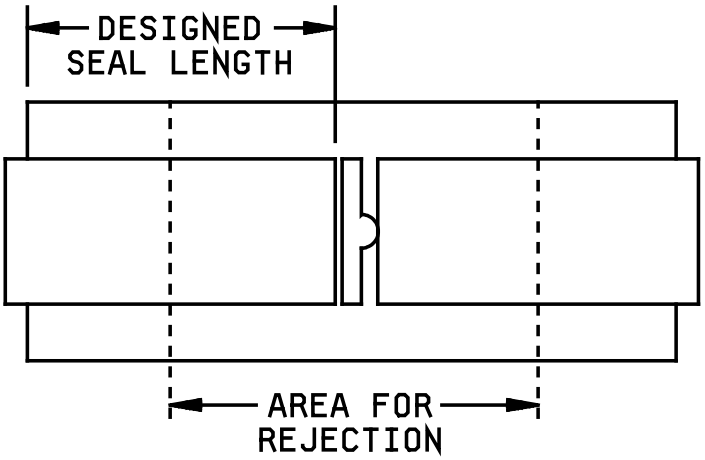
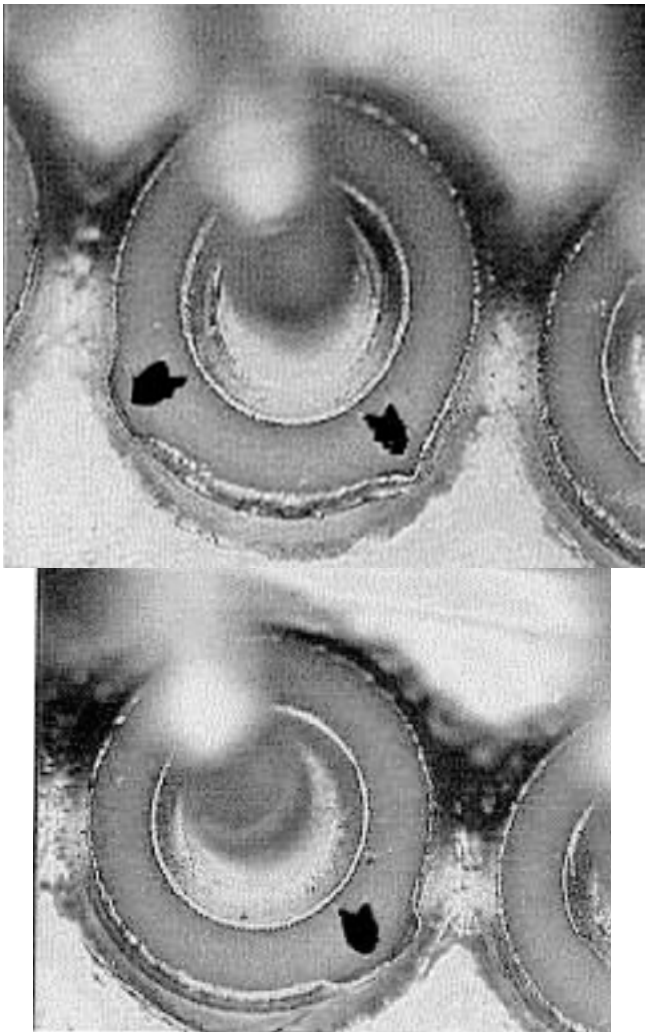
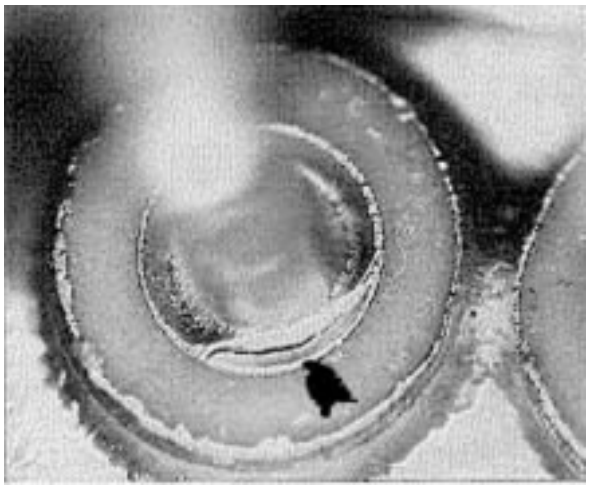


FIGURE 2071-9. Transparent glass diode (double plug construction).



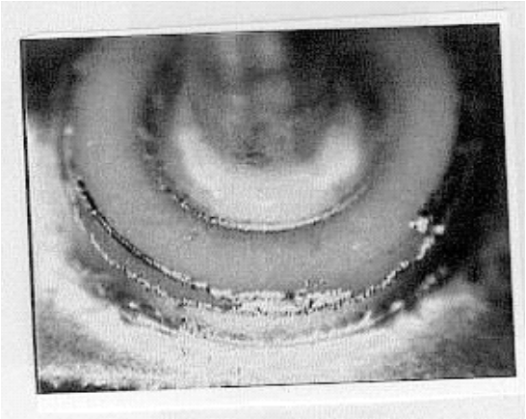
Arrows on both pictures illustrate rejectable conditions of braze separation/delamination.

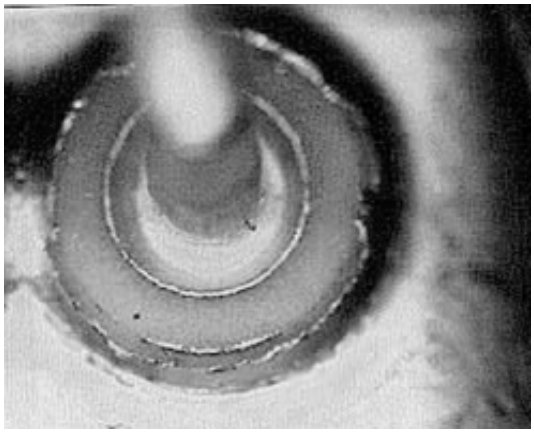
FIGURE 2071-10. Braze separation/delamination.

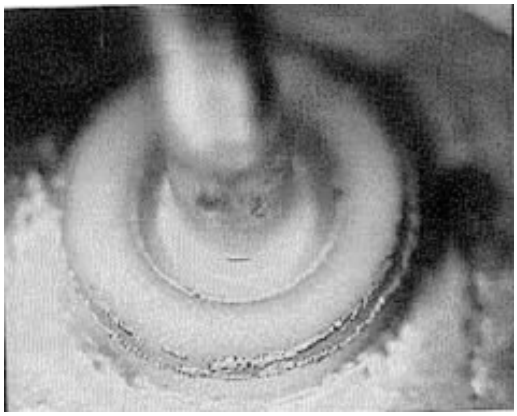


Reject: Arrow indicates a crack on the inner diameter braze metallization of the ceramic eyelet.

FIGURE 2071-11. Crack (braze metallization.







Reject: All three figures illustrate discontinuous braze metallization on the outer diameter of the ceramic eyelet.

FIGURE 2071-12. Discontinuous braze metallization.

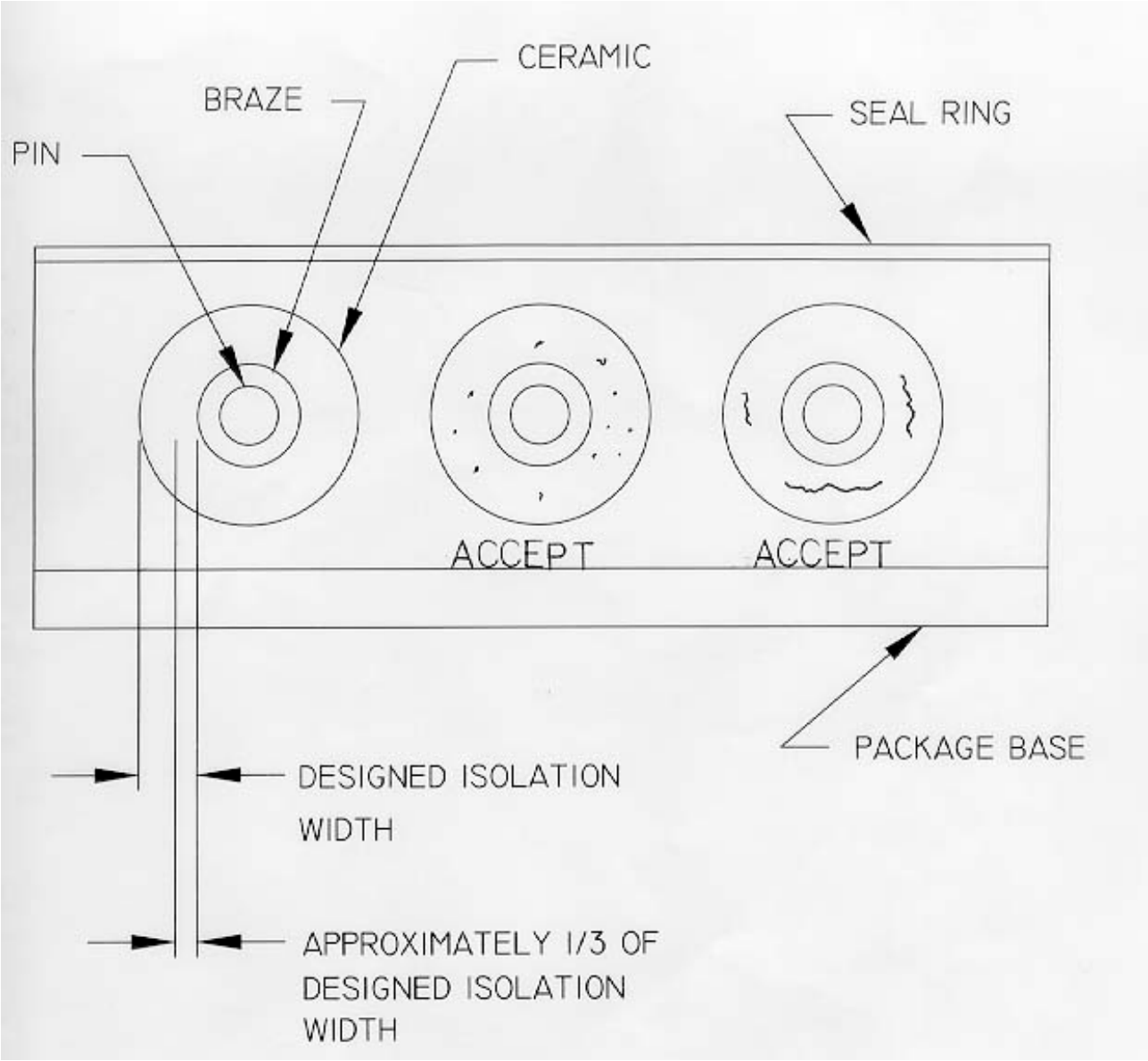
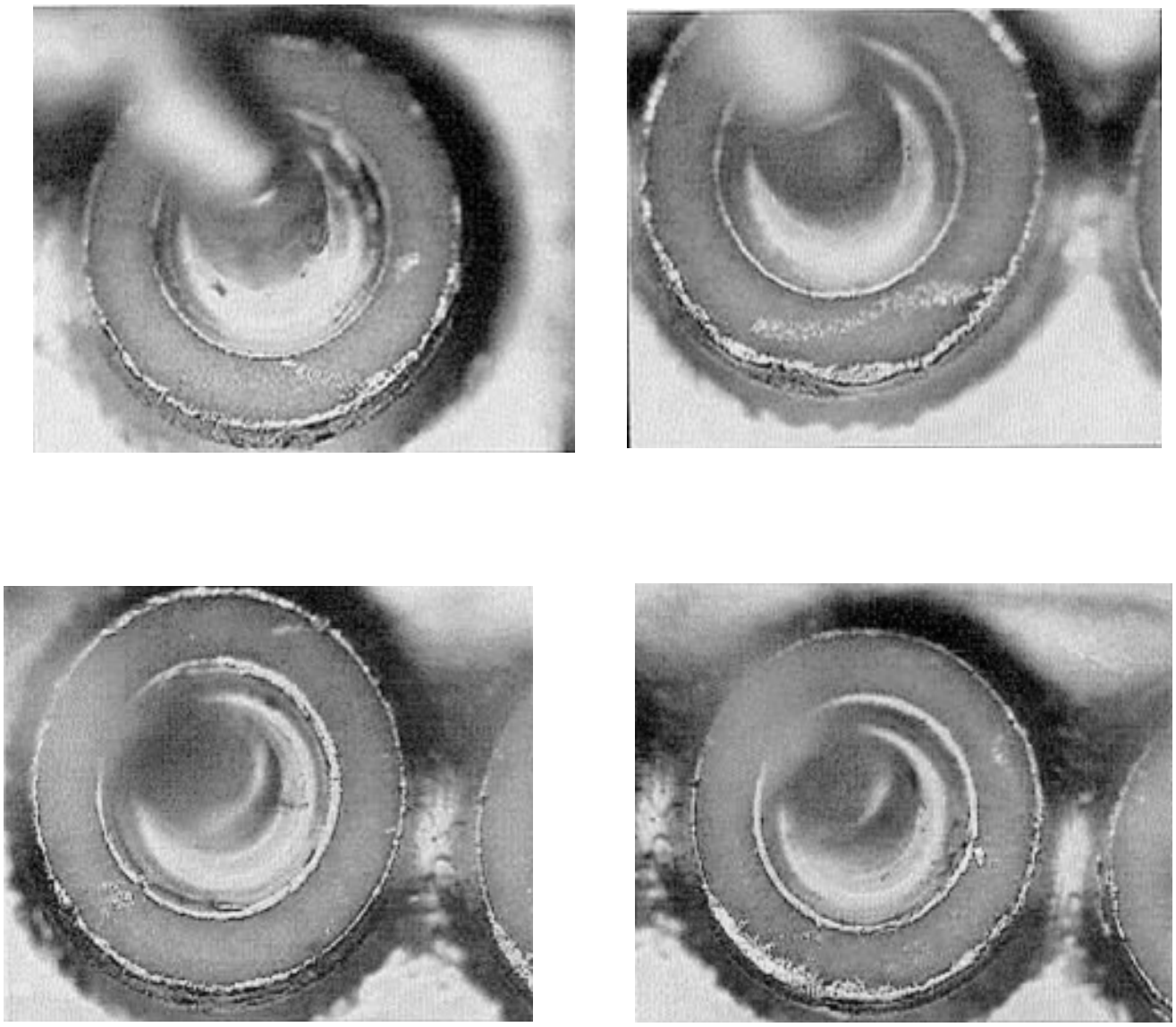
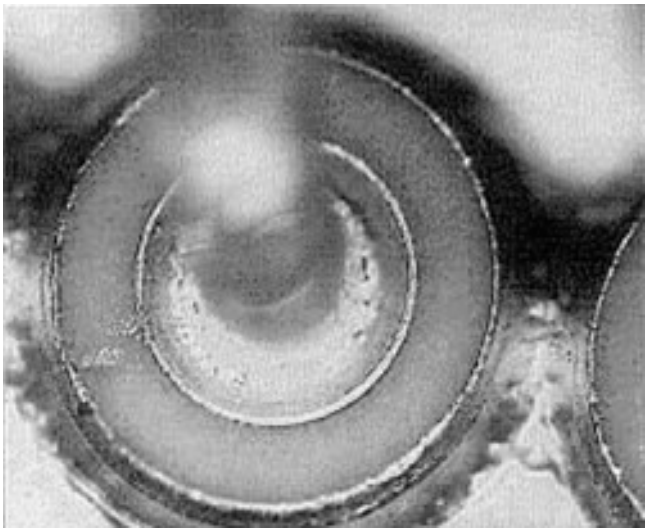


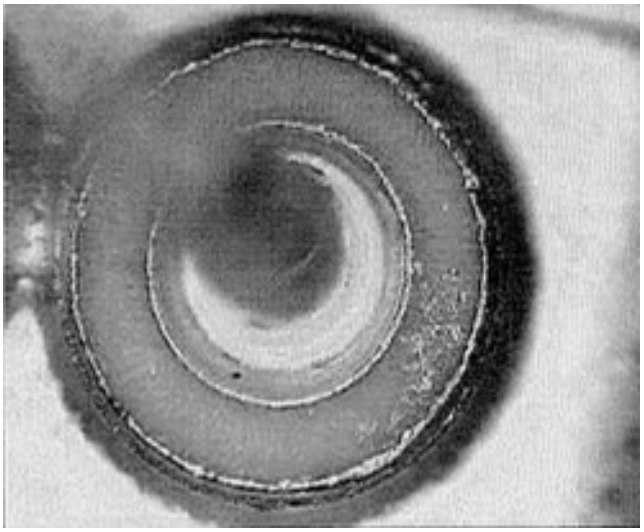
FIGURE 2071-13. Ceramic feedthrough visual inspection criteria.

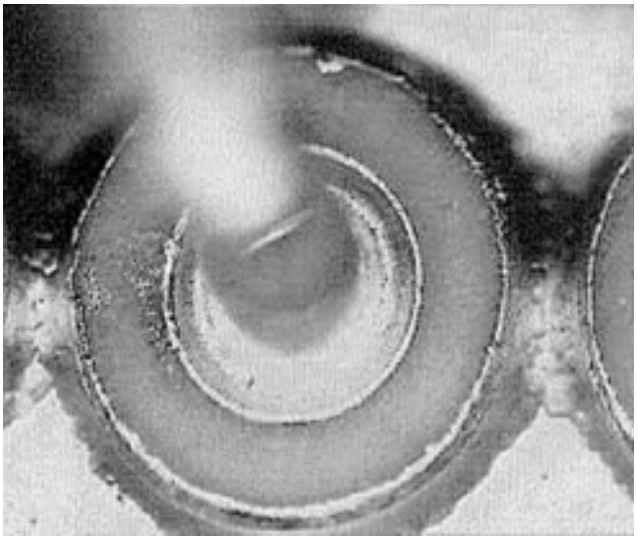


Reject: All figures indicate rejectable foreign material conditions.

FIGURE 2071-14. Rejectable foreign material conditions.

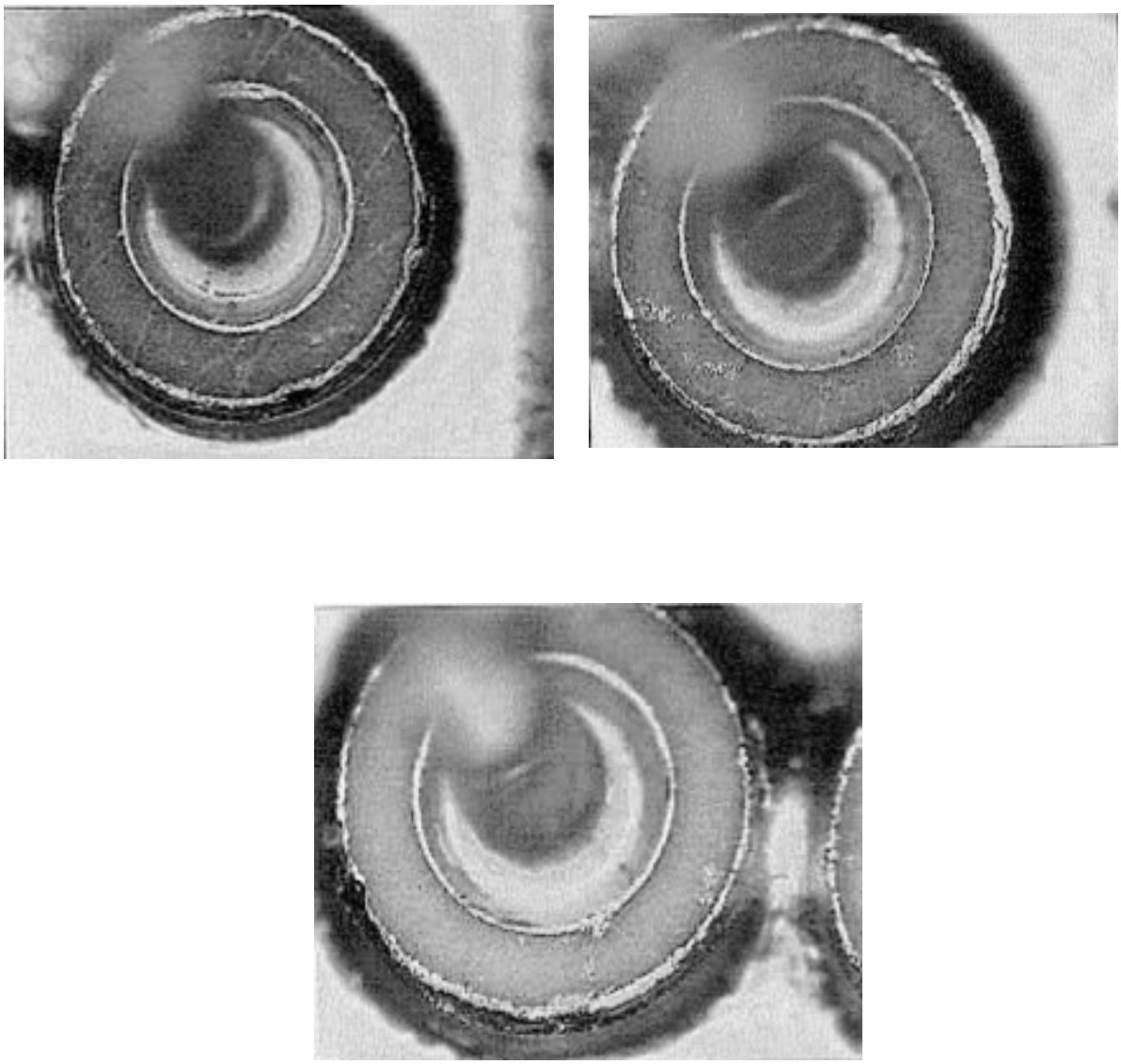






Reject: All figures indicate rejectable foreign material conditions.

FIGURE 2071-14. Rejectable foreign material conditions - continued.



Reject: All figures indicate rejectable foreign material conditions.

FIGURE 2071-14. Rejectable foreign material conditions - continued.