

9 SEPTEMBER 2021

This abstract lists the goals of the revision and will attempt to explain the reasons for the proposed changes in the subject test method.

1. Goals and scope of this work effort:

- a. Correct errors on various figures (e.g. Figure 2074-D5 is not the correct figure for the specified inspection).
- b. Compare and correct differences between the paragraph requirements and those on figures to increase clarity and reduce inconsistency and duplication.
- c. Add new figures to illustrate requirement details and identify use of terms.
- D Standardize the format, paragraph organization and requirements of the test method to be aligned with the other visual inspection test methods of MIL-STD-750-2 (i.e. 2072, 2073, etc.).

2. Use of documented terms in both Non-Government Standards (NGS) and Government documents versus colloquial and slang words.

- a. NGS and DoD preferred terms should be used or added.
- b. Non-standard terms should be removed and replaced with preferred terms.

3. Outline and organization of paragraphs in the proposed test method as follows:

- a. Section 1: Scope (includes minor additions, changes, and edits)
- b. Section 2: Apparatus (harmonize where possible to align with TM 2072 and 2073). See EPS justification for visual inspection requirement organization.
- c. Section 3: Definitions (includes foreign material (FM) cross-reference list)
- d. Section 4: General requirements (current section 3. Harmonize where possible to align with TM 2072 and 2073)
- e. Section 5: Detailed requirements (current section 3.1 and higher. Add/change figures as needed)
- f. Section 6: Summary (current section 4)
- g. Appendix A (current appendix A)
- h. Appendix B (current appendix B)
- i. Appendix C (current appendix C)
- j. Appendix D (current appendix D)
- k. Appendix E (current appendix E)
- l. Appendix F (current appendix F)
- m. Appendix G (current appendix G)
- n. Appendix H (current appendix H)
- o. Appendix I (current appendix I)

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4. List of attachments:

1. This file.
- ~~2. NA Abuse and misuse of terms and definitions in current revision and the proposed solutions.~~
- ~~3. NA Test method layout.~~
- ~~4. NA Summary of changes.~~
- ~~5. NA Reader Test Method (Clean TM reader version).~~
6. Source Test Method (Multicolor highlight TM with strike-out).
- ~~7. NA Current revision of TM.~~
- ~~8. NA Other related documents needed to support this EP Study.~~

=====
History and plug alignment differences.

MIL-STD-750 REV B NOTICE 7 (27-MAY-1976) TM 2074.0 ==> No differentiation between Hard/Soft Glass diodes.

All figures illustrate only Soft Glass (category 1) diodes.

MIL-STD-750 REV C NOTICE 3 (30-APR-1991) TM 2074.1 ==> No differentiation between Hard/Soft Glass diodes.

All figures illustrate only Soft Glass (category 1) diodes. Clear requirements, nice figures.

"3.1.6 Alignment.

"3.1.6.1 Internal lead/plug alignment. (Applicable to that portion of each lead/plug within the envelope.) A device whose lead/plug is either misaligned or bent so that it makes an angle with the principal device axis greater than 5 degree for TXV or 2 degree for "S" level shall be rejected. In no case shall the lead or plug tilt to the degree that it touches the chip. For all devices no lead shall touch the oxide (see figures 2074-6A and 2074-6C)."

MIL-STD-750 REV C NOTICE 4 (30-APR-1992) TM 2074.2 ==> No differentiation between Hard/Soft Glass diodes.

All figures illustrate only Soft Glass (category 1) diodes.

"3.1.4.4 Plug alignment (see figures 2074-34 and 2074-35). All devices shall be inspected for proper plug alignment. A plug displacement distance more than one-fourth of the diameter of the plug shall be cause for rejection. The plug shall not tilt to the degree that it touches the chip or is misaligned from the other plug axis more than 5 degree."

MIL-STD-750 REV D NOTICE 2 (23-FEB-1996) TM 2074.3 ==> No differentiation between Hard/Soft Glass diodes.

All figures illustrate only Soft Glass (category 1) diodes.

"3.1.4.4 Plug alignment (see figures 2074-28 and 2074-29). All devices shall be inspected for proper plug alignment. A plug displacement distance more than 25 percent of the diameter of the plug shall be cause for rejection. The plug shall not tilt to the degree that it touches the chip or is misaligned from the other plug axis more than 5 degree."

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MIL-STD-750 REV D NOTICE 5 (12-NOV-2002) TM 2074.4 ==> Differentiation between Hard/Soft Glass diodes.

New requirements added and now there is a differentiation between Hard Glass and Soft Glass diodes.

Soft Glass diode construction (category 2) requirements and figures are covered in appendix C.

Hard Glass diode construction (category 1) requirements and figures are covered in appendix D.

Soft Glass diode requirements and diagrams remain same (see below).

"C.1.4 Plug alignment (see figures 2074-C4 and 2074-C5). All devices shall be inspected for proper plug alignment. A plug displacement distance more than 25 percent of the diameter of the plug shall be cause for rejection. The plug shall not tilt to the degree that it touches the chip or is misaligned from the other plug axis more than 5 degrees."

Hard Glass diode requirements listed below:

D.1.3.b

"b. Plug alignment. Plugs that are not axially aligned other in the die area to within 1/8 (12.5 percent) of the diameter of the plug are cause for rejection. (Figure 2074-D8.) Any plug that tilts more than 5 degrees with respect to the other or that tilts sufficiently to make any unintended contact with the die is cause for rejection (Figure 2074-D9)."

MIL-STD-750 REV E (20-NOV-2006) TM 2074.5 ==> Very little changes to soft glass requirements from previous revision.

Hard Glass diode requirements listed below:

"D.1.3.b

"b. Plug alignment. Plugs that are not axially aligned other than in the die area to within 12.5 percent of the diameter of the plug are cause for rejection. (See figure 2074-D7.) Any plug that tilts more than 5 degrees with respect to the other or that tilts sufficiently to make any unintended contact with the die is cause for rejection (see figure 2074-D8)."

MIL-STD-750-2 (03-JAN-2012) TM 2074.6 ==> Very little changes to soft glass requirements from previous revision.

Hard Glass diode requirements listed below:

"D.1.3.b

"b. Plug alignment. Plugs that are not axially aligned other than in the die area to within 25 percent of the diameter of the plug are cause for rejection (see figure 2074-D7). Any plug that tilts more than 5 degrees with respect to the other or that tilts sufficiently to make any unintended contact with the die is cause for rejection (see figure 2074-D8)."

This working draft, dated 09 September 2021, prepared by DLA-CC, has not been approved and is subject to modification. DO NOT USE PRIOR TO APPROVAL. (Project 5961-2021-022). Comments are due no later than DAY MONTH 2022. P.O.C. is David Corbett; telephone 614-692-0526 / electronic-mail: 750.TestMethods@dla.mil

METHOD 2074.6 7

INTERNAL VISUAL INSPECTION (DISCRETE SEMICONDUCTOR DIODES)

1. Purpose. The purpose of this test method is to ~~check~~ verify that the internal materials, design, construction, and workmanship of discrete semiconductor diodes and other two-terminal semiconductor devices (hereafter referred to as "device") are in compliance with the requirements described herein and the applicable acquisition document.

1.1 Application. All examinations and inspections shall be performed to ~~detect~~ identify and ~~eliminate~~ reject those devices with defects that could lead to device failures. The following details apply:

- a. ~~Clear~~ Transparent glass construction devices shall be examined after encapsulation.
- b. The die for opaque glass ~~type~~ construction devices shall be examined before encapsulation. (After encapsulation, ~~see~~ the requirements of test method 2068 of this standard apply).
- c. ~~Metal can~~ Internal cavity construction devices using soldered contact style construction (e.g. DO, TO, etc.) shall be examined before capping or sealing. (After capping or sealing, ~~see test method 2074 of this standard~~).
- d. Internal cavity construction devices using bonded wire or ribbon style construction (e.g. DIP, LCC, UB, etc.) shall be inspected to the requirements of test method 2078.

1.2 Exclusions and limitations. The inspections of this test method excludes button, disc and plastic encapsulated package types.

2. Apparatus. ~~a-~~ The apparatus for ~~these inspections shall include~~ this test method shall consist of the following.

- a. ~~b-~~ Optical equipment (a monocular, binocular, or stereo microscope) capable of the specified magnification, ~~from 20X minimum to 30X maximum, shall be used unless otherwise specified. The inspection shall be performed under suitable illumination.~~
- b. Light sources of sufficient intensity to adequately illuminate the devices being inspected.
- c. ~~a-~~ Any Adequate ~~necessary~~ fixturing for handling the devices during examination to promote efficient operation without causing contamination or damage ~~damaging the units shall be provided.~~
- d. Adequate covered storage and transportation containers to protect devices from mechanical damage and environmental contamination.
- e. ~~a-~~ and Any Visual standards (e.g., gauges, drawings, photographs) necessary to perform an effective examination and enable the ~~operator~~ inspector to make objective decisions ~~on~~ as to the acceptability of the devices being examined.

3. Definitions. The following definitions shall apply:

3.1 Examples of foreign material. Examples of terms used to describe foreign material that are used in this test method include the following: chips, conductive contaminants, extraneous matter, flaked plating, foreign matter, foreign stains, opaque material, particulate matter, semiconductor material, and unattached solder balls.

3.2 Controlled environment. A controlled environment is an environment which controls airborne particle count and relative humidity.

4. General requirements.

4.1 ~~3.~~ Procedure.

4.1.1 **General.** The devices or die shall be examined in a suitable sequence of operations and at the specified magnifications to determine compliance with the requirements of the applicable acquisition document sections and the criteria specified herein and in the appendices of this test method based on device design and construction.

4.1.2 **Sequence of inspection.** The order in which acceptability criteria are presented herein is not a required order of examination and may be varied at the discretion of the manufacturer. The following details apply:

- a. Examinations for transparent glass body devices may be performed anytime prior to body coating or painting.
- b. Axial construction devices shall be viewed at approximate right angles to their major axis while being rotated through 360 degrees.

4.2 **Control of environment.** Within ~~For~~ the time interval, if any, between visual inspection and package sealing, devices shall be stored, handled, and processed in a manner in a controlled environment to avoid contamination and in a manner to preserve the integrity of the devices as inspected. The use of an inert gas environment, such as dry nitrogen, shall satisfy the requirements for storing in a controlled environment.

4.3 **Magnification.** Unless otherwise specified, examinations shall be performed at magnification ranges between 20X minimum and 30X maximum.

4.4 **Illumination.** The visual inspection shall be performed under suitable illumination.

5. Detailed requirements.

5.1 **Examinations of die for acceptability (accept and reject criteria).** ~~3.1 Die criteria (applicable to all body styles).~~ The following die criterion are applicable to the die of all body styles (see 5.2). Any die that exhibits any of the following defects shall be rejected.

- a. Chipouts (see figure 2074-1). Reject for chipouts that extend more than 50 percent of the way up the moat area (mesa devices) or that extend to within ~~2-0 mils~~ .002 inch (0.051 mm) of the junction.

NOTE: Actual junction location will vary depending on specific device die characteristics.

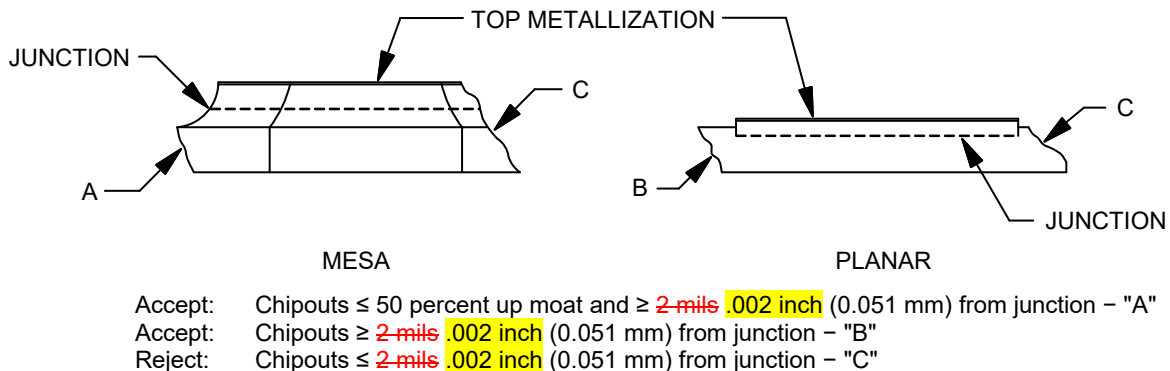
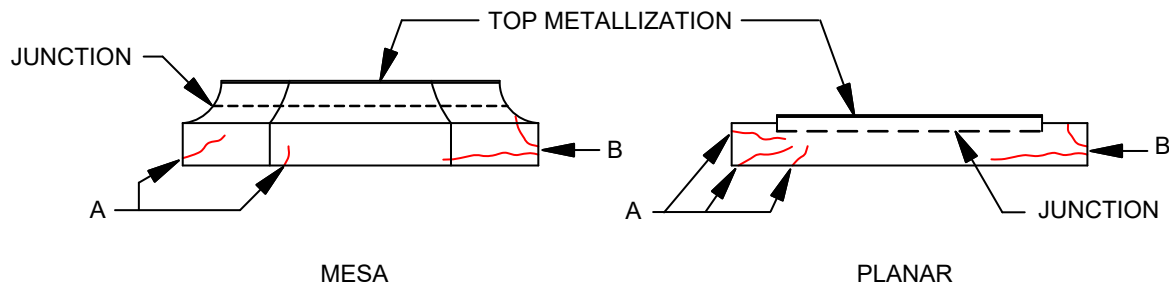


FIGURE 2074-1. Die chipouts.

- b. Cracks (see figure 2074-2). Reject for cracks that extend to within ~~2.0 mils~~ .002 inch (0.051 mm) of the junction or propagate in the direction of the junction.

NOTE: The junction may be in a different place than shown depending on specific ~~device~~ die characteristics.



Reject: "A" Cracks $\leq$ ~~2 mils~~ .002 inch (0.051 mm) from junction or propagating toward junction. —"A"
Accept: "B" Cracks $\geq$ ~~2 mils~~ .002 inch (0.051 mm) from junction and propagating away from junction. —"B"

FIGURE 2074-2. Die cracks.

5.2 3.2 Applicable body styles. The devices shall be examined in accordance with the following appendixes as applicable for the design and construction of the body style involved.

- Appendix A: Glass body (transparent), axial lead, ~~transparent body~~, pressure contact design.
- Appendix B: Glass body (transparent), axial lead, ~~transparent body~~, straight through lead to die contact design.
- Appendix C: Glass body (transparent), axial lead and surface mount, double plug, ~~transparent body~~ (dumet plug, round end-cap, soft glass) design.
- Appendix D: Glass body (transparent), axial lead and surface mount, double plug, ~~transparent body~~ (tungsten or molybdenum plug, square end-cap, hard glass) design.
- Appendix E: Glass body (transparent), axial lead, ~~transparent body~~, point contact design.
- Appendix F: Glass body (opaque), axial lead, double plug, ~~opaque body~~, (power rectifier and regulator).
- Appendix G: Metal body, axial lead, solder contact design.
- Appendix H: Metal body, stud mounted, solder contact design.
- Appendix I: Metal body, diamond base regulators, solder contact design.

6. 4. Summary. The following conditions shall be specified in the applicable performance specification sheet or acquisition document:

- a. Detailed requirements for materials, design, construction, and workmanship.
- b. Magnification requirements, if other than specified herein.

APPENDIX A

GLASS BODY (TRANSPARENT), AXIAL LEAD, ~~TRANSPARENT BODY~~, PRESSURE CONTACT DESIGN

A.1 General. This appendix contains the acceptance criteria for devices of the transparent glass body, axial lead, pressure contact connection (C and S bend whisker) design (see figure 2074-A1). The following examinations shall be made after encapsulation (~~C and S bend whisker~~). This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

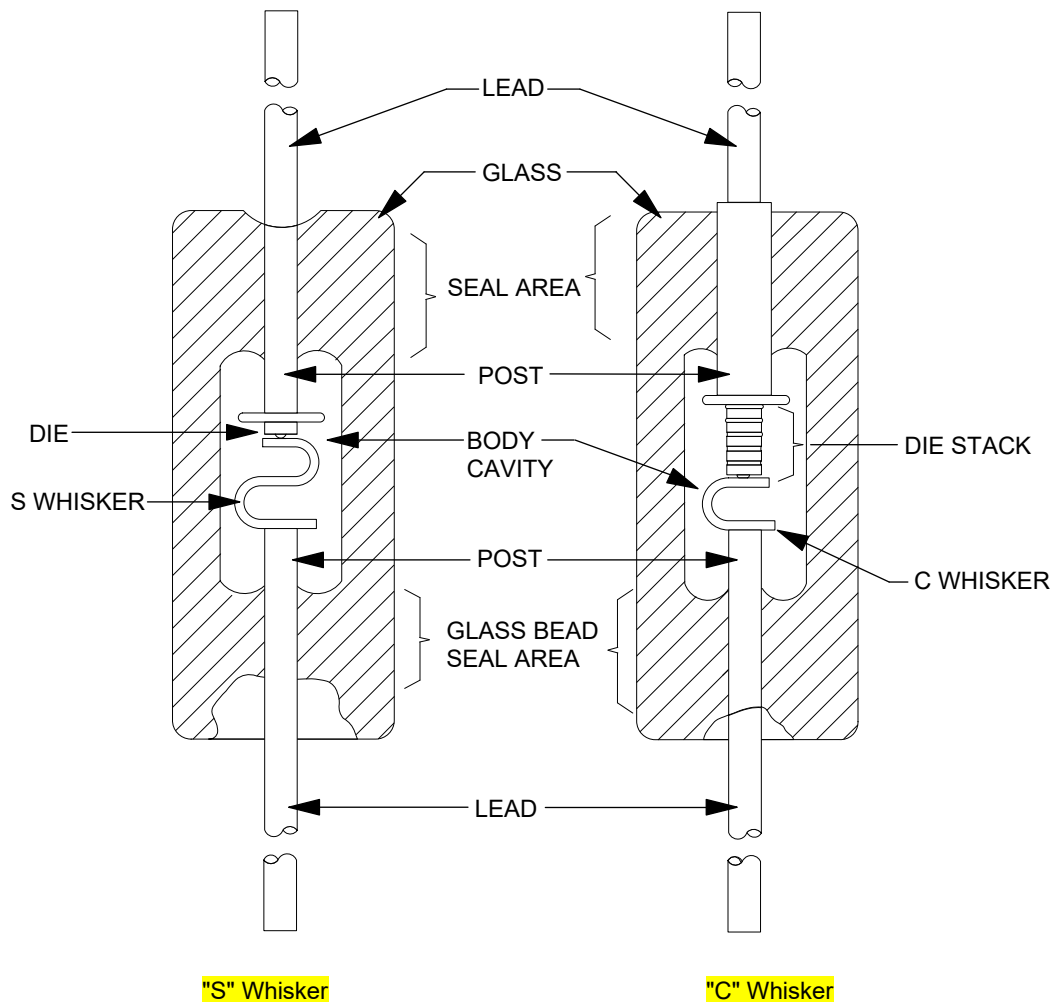


FIGURE 2074-A1. Transparent glass body, axial lead, pressure contact internal construction.

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APPENDIX A

A.1.1 Glass cracks and chips (see figure ~~2074-A1~~ 2074-A2). No cracks shall be allowed in the vicinity of the cavity. Any crack originating at either end of the package or crack that extends into the body of the glass toward the **die** cavity more than 25 percent of the glass-to-glass or glass-to-metal seal length shall be cause for rejection. Any glass chip deep enough to expose the plug or lead surface and extending longitudinally into the glass-to-metal seal toward the **body** cavity to reduce the effective seal length to less than one external lead diameter shall be cause for rejection.

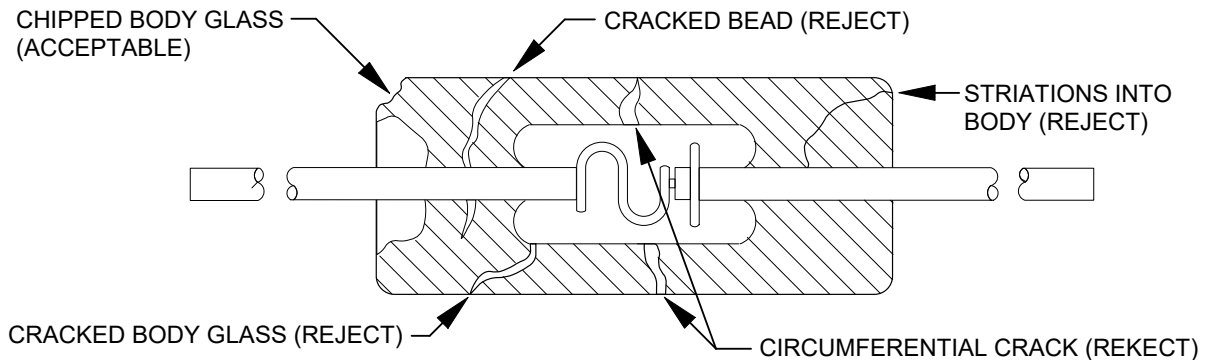


FIGURE ~~2074-A1~~ 2074-A2. Glass cracks and chips.

A.1.2 Incomplete seal. All devices shall be inspected for glass-to-metal seal or glass-to-glass seal. Both seals shall be a minimum of one external lead diameter over the entire ~~sealed portion~~ **area** (sealed interface).

A.1.3 Bubbles in seal. All devices shall be inspected for bubbles in the glass-to-metal or glass-to-glass seal. A series of bubbles that reduce the effective seal length to less than one external lead diameter shall be cause for rejection. Bubbles in the glass, but not affecting the glass-to-glass or glass-to-metal seal area, ~~are~~ **shall not be** cause for rejection.

A.1.4 Glass package deformities (see figure ~~2074-A2~~ 2074-A3). Any glass envelope deformity equal to or greater than 75 percent of the external lead diameter shall be cause for rejection.

A.1.5 Extraneous matter **Foreign material**. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas.

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APPENDIX A

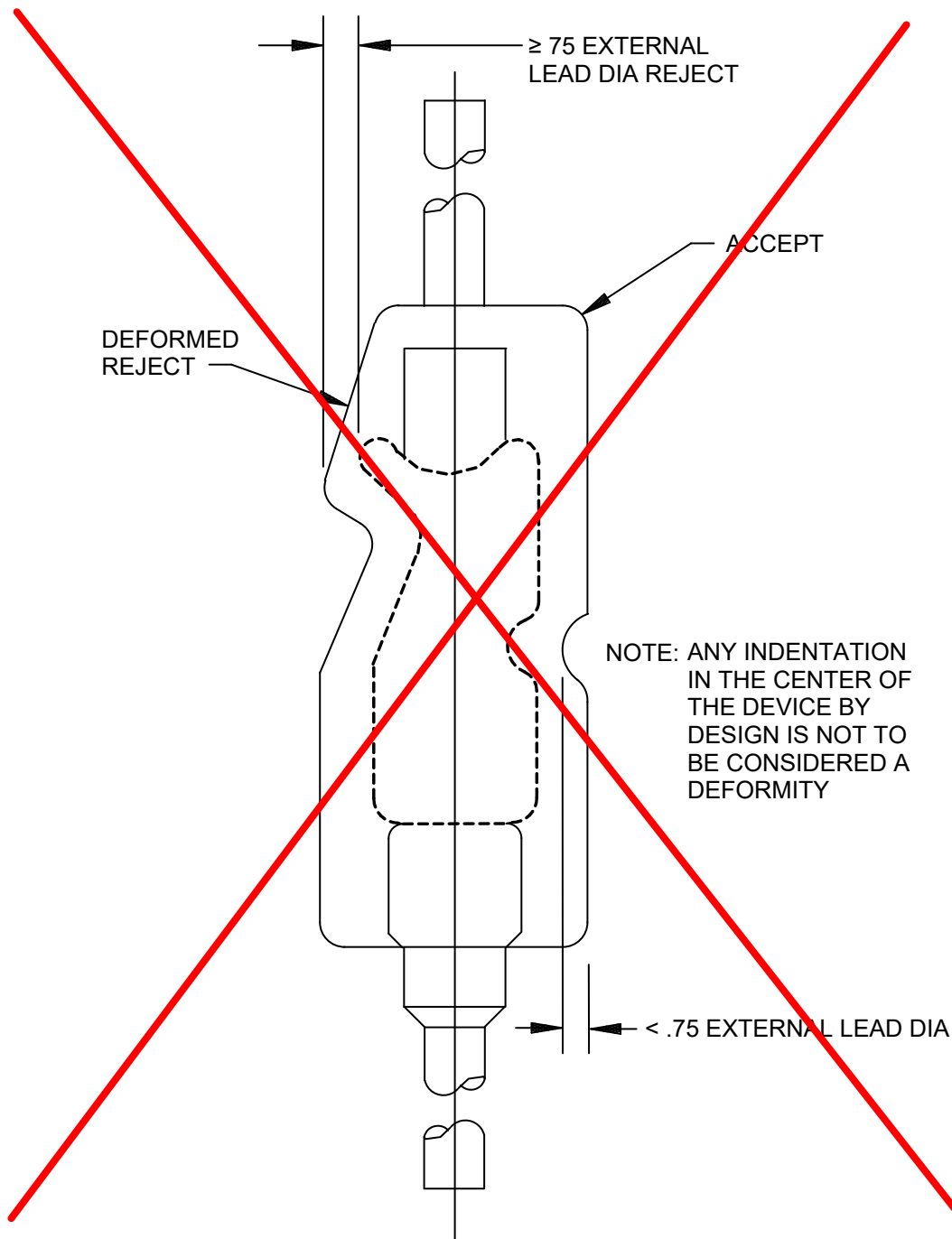
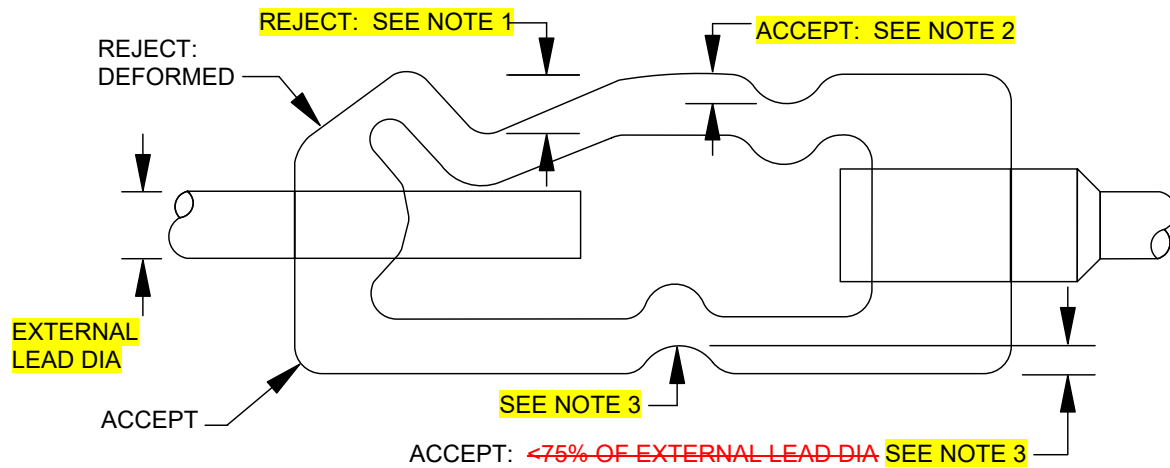


FIGURE 2074-A2 2074-A3. Package deformities.

MIL-STD-750-2

APPENDIX A



NOTES:

1. Reject if deformity is greater than or equal to 75 percent of external lead diameter.
2. Accept when deformity/indentation is less than 75 percent of external lead diameter.
3. Any indentation in the center of the device by design is not to be considered a deformity.

FIGURE 2074-A3. Package deformities.

A.1.6 Solder protrusions (see figure 2074-A3 2074-A4). All devices shall be inspected for solder protrusions. Any device with a solder protrusion that extends more than twice the smallest protrusion width of the protrusion shall be rejected.

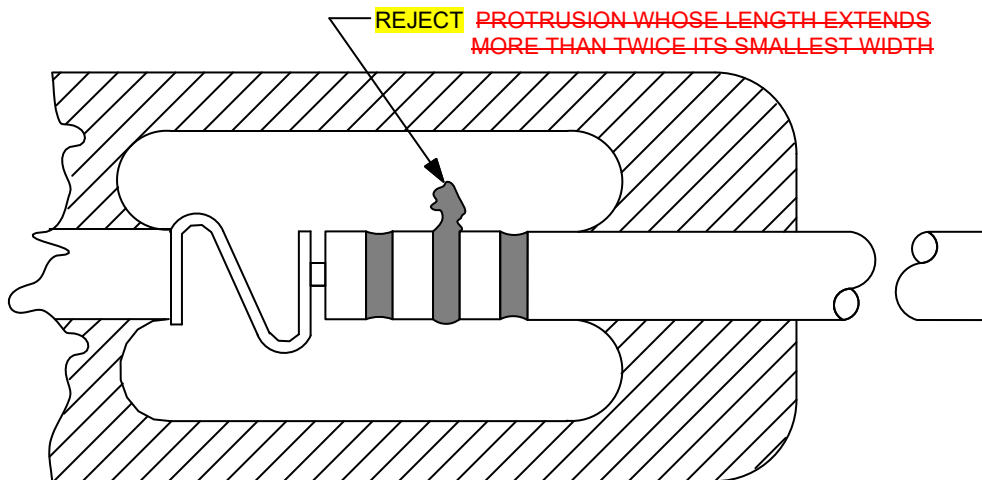


FIGURE 2074-A3 2074-A4. Solder protrusions.

MIL-STD-750-2

APPENDIX A

A.1.7 Die-to-die solder connection (for stacked die construction only).

- a. Solder voids. Any solder flow is less than 50 percent of the perimeter of the minimum available contact area of the die shall be cause for rejection.
- b. Solder overflow. ~~A.1.9 Die-to-post or die-to-die contact area.~~ Any solder overflow that touches the top (opposite) surface of the die or dice shall be cause for rejection.

A.1.8 ~~A.1.9~~ Die-to-post solder connection or die-to-die contact area.

- a. Solder voids. Solder shall not be rough in appearance and ~~shall be fused to a minimum of one-half~~ if solder flow is less than 50 percent of the perimeter of the minimum available ~~bonding perimeter~~ contact area of the die shall be cause for rejection.
- b. Solder overflow. Any solder overflow that touches the opposite surface of the die or dice shall be cause for rejection.

A.1.9 ~~A.1.7~~ Pressure contact ~~defects~~ connections. The following misalignments or deformations shall be cause for rejection:

- a. Whisker embedded within glass body wall (see figure ~~2074-A4~~ 2074-A5).

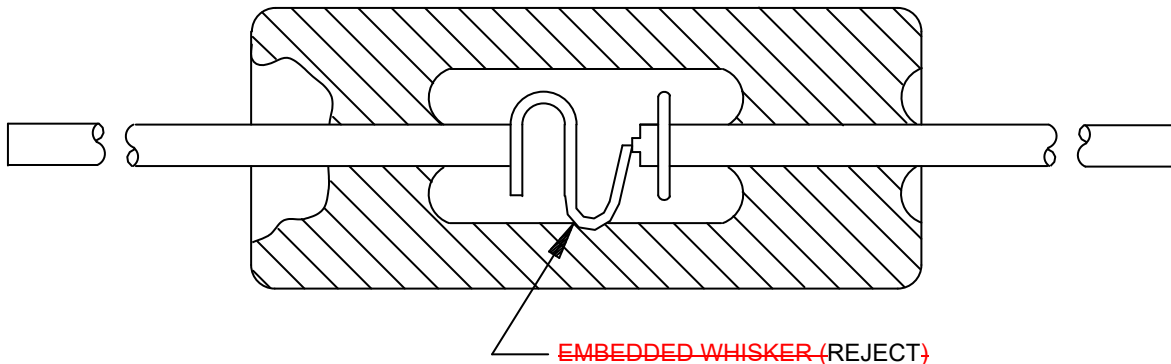


FIGURE ~~2074-A4~~ 2074-A5. Embedded whisker.

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APPENDIX A

- b. Toe contact **angle greater than 15 degrees** between base of C or S bend whisker and **top surface** of die caused by insufficient loading (see figure ~~2074-A5~~ **2074-A6**).

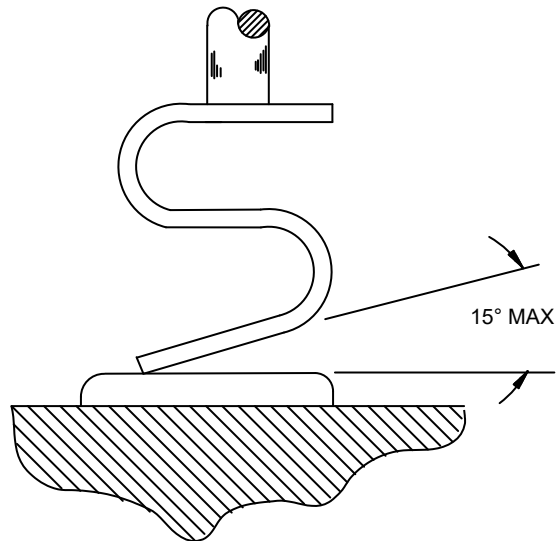


FIGURE ~~2074-A5~~ **2074-A6**. Whisker toe contact **angle**.

- c. Toe contact on **top surface** of die (see figure ~~2074-A6~~ **2074-A7**).

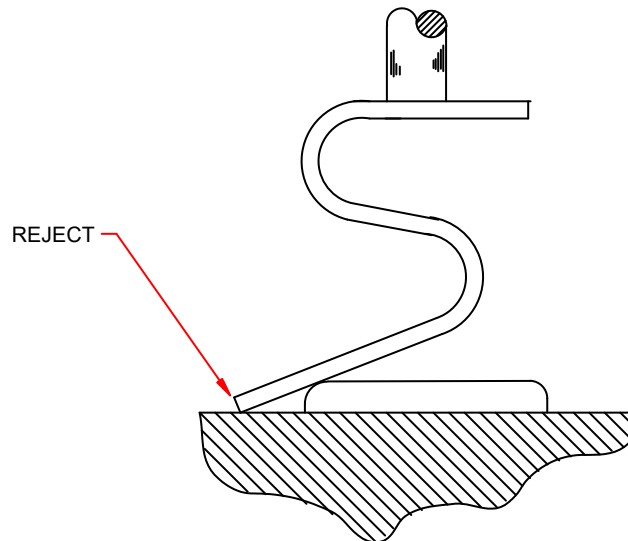


FIGURE ~~2074-A6~~ **2074-A7**. Whisker toe contact on top surface of die.

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APPENDIX A

- d. Heel contact between base of C or S bend whisker and top surface of die (see figure ~~2074-A7~~ 2074-A8).

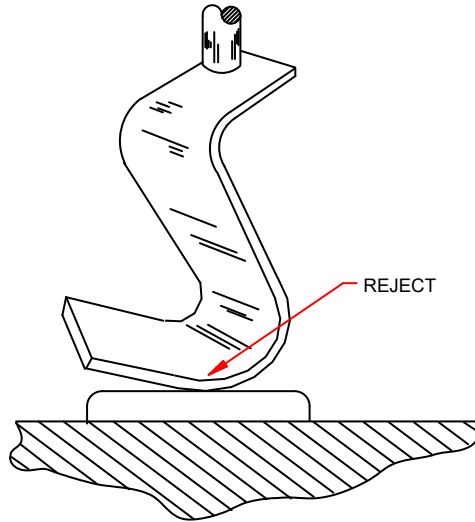


FIGURE ~~2074-A7~~ 2074-A8. Whisker heel contact.

- e. Point contact between base of C or S bend whisker and top surface of die except by design (deformed or twisted whisker) (see figure ~~2074-A8~~ 2074-A9).

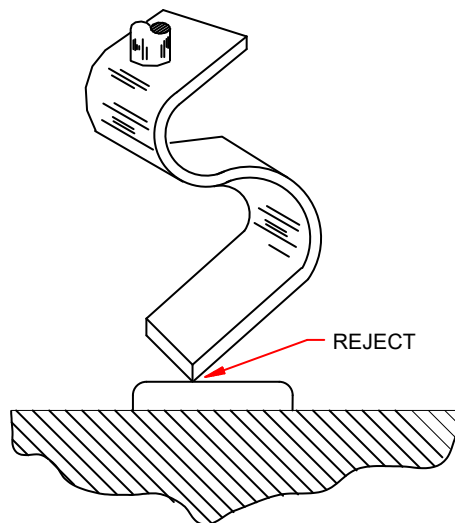
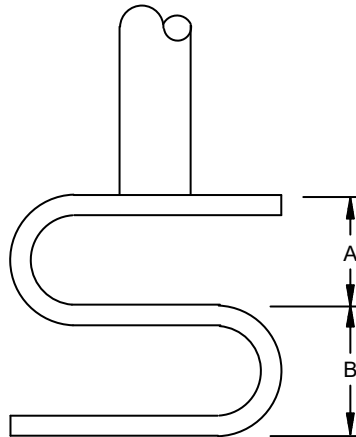


FIGURE ~~2074-A8~~ 2074-A9. Whisker point contact.

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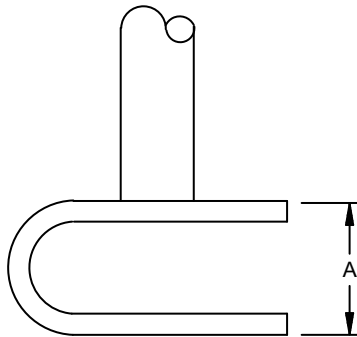
APPENDIX A

- f. Design compressed height (see figures ~~2074-A9~~ 2074-A10 and ~~2074-10~~ 2074-A11). Either half of an S or a C bend whisker that is compressed so that any dimension is reduced to less than 50 percent of its design shall be rejected.



REJECT IF EITHER "A" OR "B" IS LESS THAN
50% OF ITS DESIGN COMPRESSED HEIGHT

FIGURE ~~2074-A9~~ 2074-A10. S bend whisker compressed height.



REJECT IF EITHER "A" IS LESS THAN 50%
OF ITS DESIGN COMPRESSED HEIGHT

FIGURE ~~2074-A10~~ 2074-A11. C bend whisker compressed height.

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APPENDIX A

A.1.10 A-1.8 Whisker-to-post connection weld-to-post. Any device that exhibits weld splash or splatter (teardrop or balled) between whisker and post shall be rejected when it exceeds 25 percent of nominal lead diameter. The profile of the whisker weld to post shall not allow light penetration by more than 50 percent of lead diameter when using back lighting techniques.

A.1.11 A-1.10 Die alignment.

- a. **Single die attachment defects** (see figure ~~2074-A11~~ 2074-A12). A device shall be rejected if the die ~~surface is not within~~ tilts more than 15 degrees ~~of being normal to the centerline of the mounting post from~~ the principle axis of the device.

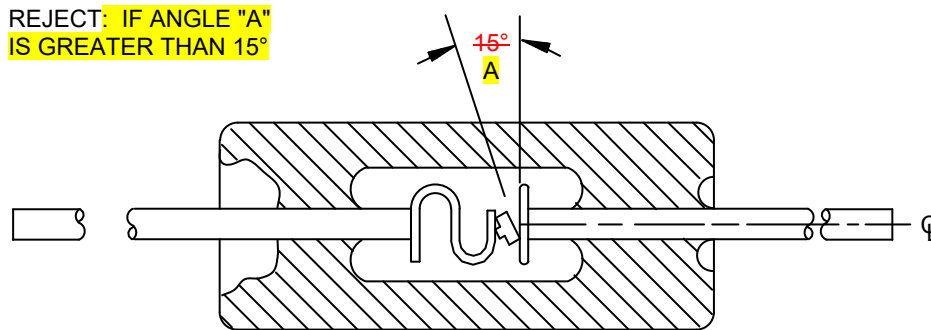


FIGURE ~~2074-A11~~ 2074-A12. Die to bond surface alignment.

- b. **A-1.12 Multiple chip die stack attachment defects.** A device shall be rejected if the multiple chip die stack ~~that~~ tilts more than 10 degrees from the principle axis of the device ~~shall be cause for rejection~~.

A.1.12 A-1.14 Lead alignment defects (see figure 2074-A13). This requirement is ~~(applicable only~~ to that portion of each lead within the ~~glass envelope)~~. A device lead which is either misaligned or bent so that it makes an angle with the principle device axis greater than 10 degrees shall be rejected.

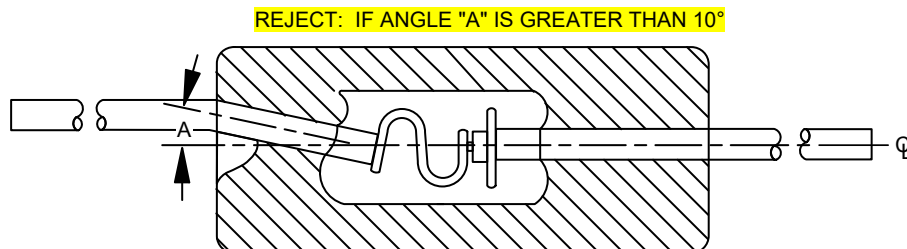


FIGURE 2074-A13. Lead misalignment.

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APPENDIX B

GLASS BODY (TRANSPARENT), AXIAL LEAD, ~~TRANSPARENT BODY~~, STRAIGHT THROUGH LEAD TO DIE CONTACT DESIGN

B.1 General. This appendix contains the acceptance criteria for devices of the transparent glass body, axial lead, straight through lead to die contact design (see figure 2074-B1). The following ~~criteria~~ examinations shall be ~~specified for the straight through construction (see figure 2074-B1)~~ performed after encapsulation but before body coating or painting. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

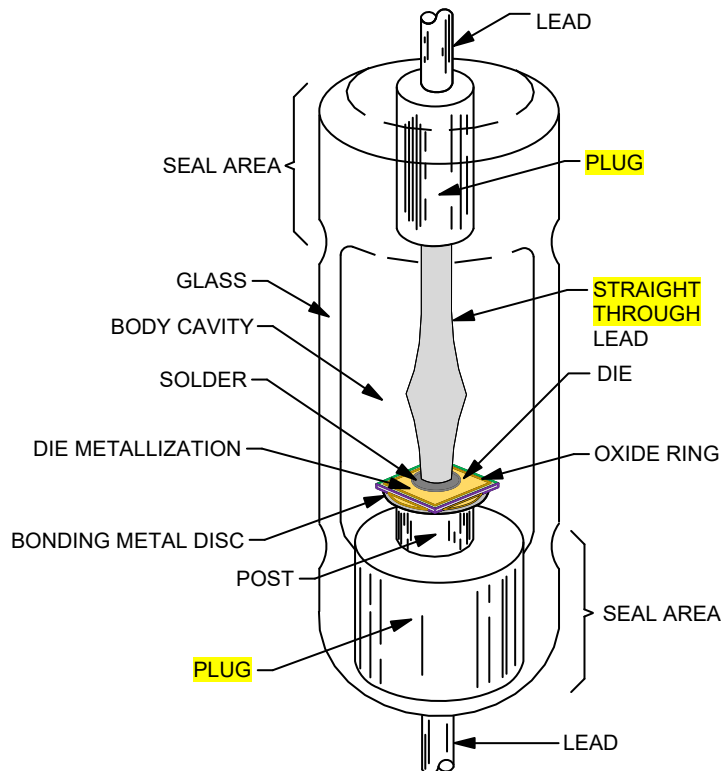


FIGURE 2074-B1. **Transparent glass body, axial lead, straight through lead to die contact** internal construction.

B.1.1 Glass cracks and chips (see ~~figure 2074-A1~~ **figure 2074-A2**). No cracks shall be allowed in the vicinity of the cavity. Any crack originating at either end of the package or crack that extends into the body of the glass toward the cavity more than 25 percent of the glass-to-glass or glass-to-metal seal length shall be cause for rejection. Any glass chip deep enough to expose the plug or lead surface and extending longitudinally into the glass-to-metal seal toward the cavity to reduce the **effective seal length** to less than one external lead diameter shall be cause for rejection.

B.1.2 Incomplete seal. All devices shall be inspected for glass-to-metal seal or glass-to-glass seal. Both seals shall be a minimum of one external lead diameter over the entire **sealed portion (sealed interface)**.

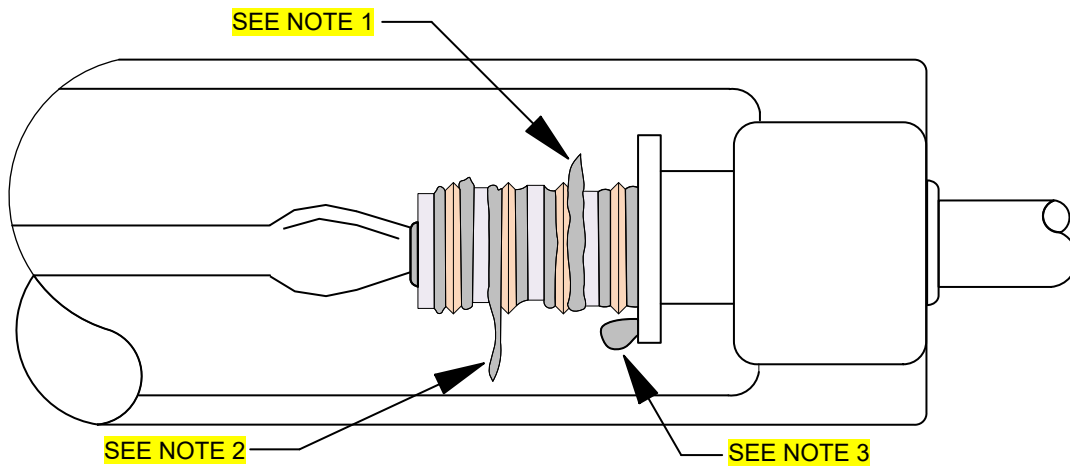
B.1.3 Bubbles in seal. All devices shall be inspected for bubbles in the glass-to-metal or glass-to-glass seal. A series of bubbles that reduce the **effective seal length** to less than one external lead diameter shall be cause for rejection. Bubbles in the glass, but not affecting the glass-to-glass or glass-to-metal **seal area**, ~~are~~ **shall not be** cause for rejection.

APPENDIX B

B.1.4 ~~Glass package deformities~~ (see ~~figure 2074-A2~~ ~~figure 2074-A3~~). Any glass envelope deformity equal to or greater than 75 percent of the external lead diameter shall be cause for rejection.

B.1.5 ~~Extraneous matter~~ **Foreign material**. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas.

B.1.6 B.1.7.b Solder protrusion, slivers, and spikes (see ~~figure 2074-B6~~ **2074-B2**). A device shall be rejected if ~~solder slivers and spikes are not securely attached to the main body. A securely attached sliver or spike is one having a cross sectional area greater at the area of attachment than anywhere else on the solder protrusion and having no necked down areas~~ a solder protrusion extends more than twice the smallest width of the protrusion.



NOTES:

1. Accept cross sectional area greater at the area of attachment than anywhere else on the sliver or spike.
2. Reject because the length exceeds twice the smallest width of attachment area.
3. Reject because the area of attachment is less than anywhere else on the sliver or spike.

FIGURE ~~2074-B6~~ **2074-B2**. Solder slivers and spikes.

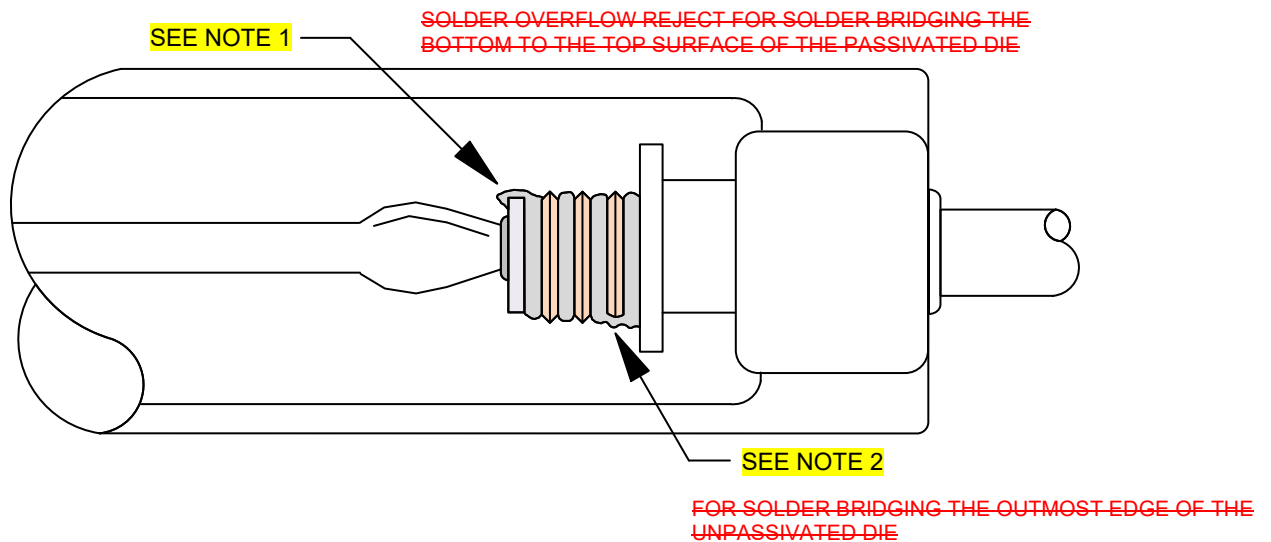
APPENDIX B

B.1.7 ~~B.1.8~~ Die-to-die solder connection (~~see figure 2074-B7~~) for stacked die construction only).

- a. Solder voids (see figure 2074-B3). A device shall be rejected if more than 50 percent of the perimeter of the available contact area of the die is void of solder.

FIGURE 2074-B3. Die-to-die solder voids

- b. Solder overflow (see figure 2074-B4). A device shall be rejected if any solder flow bridges the bottom to the top surface of the passivated die. A device shall be rejected if any solder flow bridges the outer most edge of un-passivated die.



NOTES:

1. Reject for solder overflow bridging the bottom to top surface of the passivated die.
2. Reject for solder bridging the outermost edge of the unpassivated die.

FIGURE ~~2074-B7~~ 2074-B4. Die-to-die solder ~~connection~~ bridging and overflow.

APPENDIX B

B.1.9 ~~B.1.6~~ Die-to-post solder connection.

- a. Solder voids (see figure ~~2074-B2~~ **2074-B5**). A device shall be rejected if solder flow is less than 50 percent of the perimeter of the minimum available contact area of the ~~post~~ **die**.

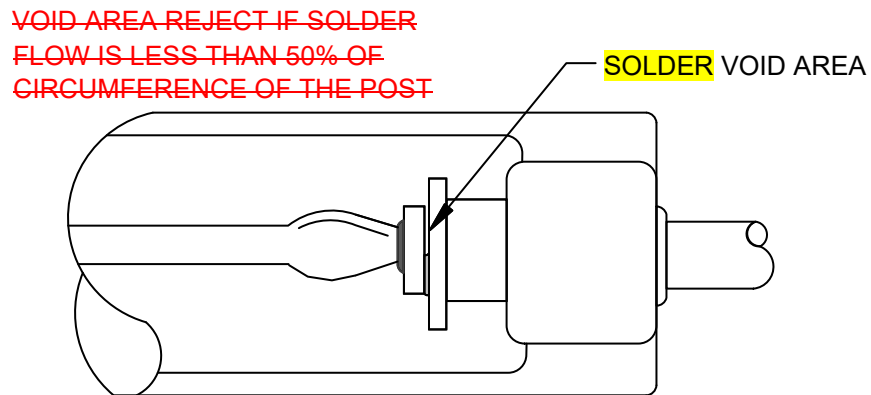


FIGURE ~~2074-B2~~ **2074-B5**. Solder voids.

- b. Solder overflow (see figure ~~2074-B3~~ **2074-B6**). A device shall be rejected if any solder flow touches the **top** (opposite) surface of the die.

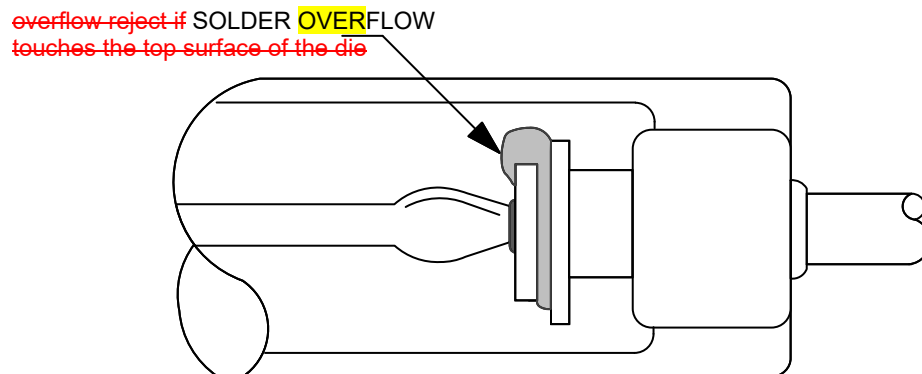


FIGURE ~~2074-B3~~ **2074-B6**. Solder ~~bridge~~ overflow to top side of die.

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APPENDIX B

B.1.10 B.1.7 Lead-to-die solder connection.

- a. Lead to die solder voids (see figure 2074-B4 2074-B7). A device shall be rejected if more than 50 percent of the perimeter of the available contact area of the lead is void of solder.

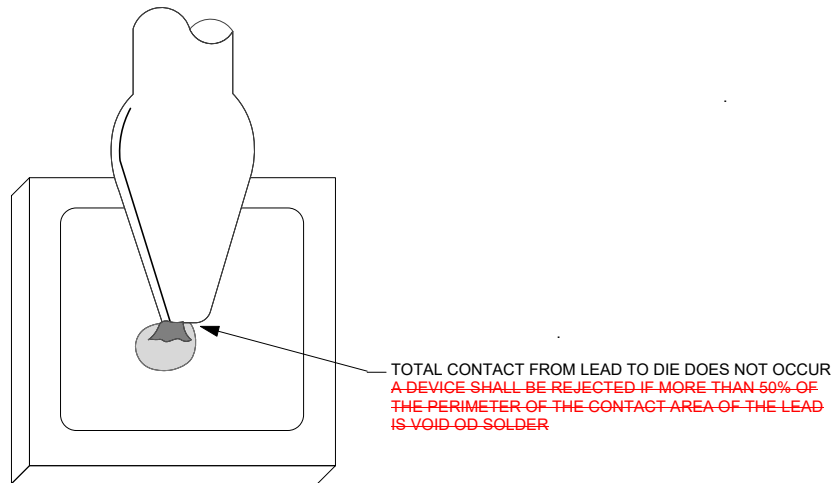


FIGURE 2074-B4 2074-B7. Lead to die solder voids.

- b a. Solder overflow (see figure 2074-B5 2074-B8). A device shall be rejected if solder flow extends beyond 50 percent of the distance from the metal area to the outer edge of the oxide area.

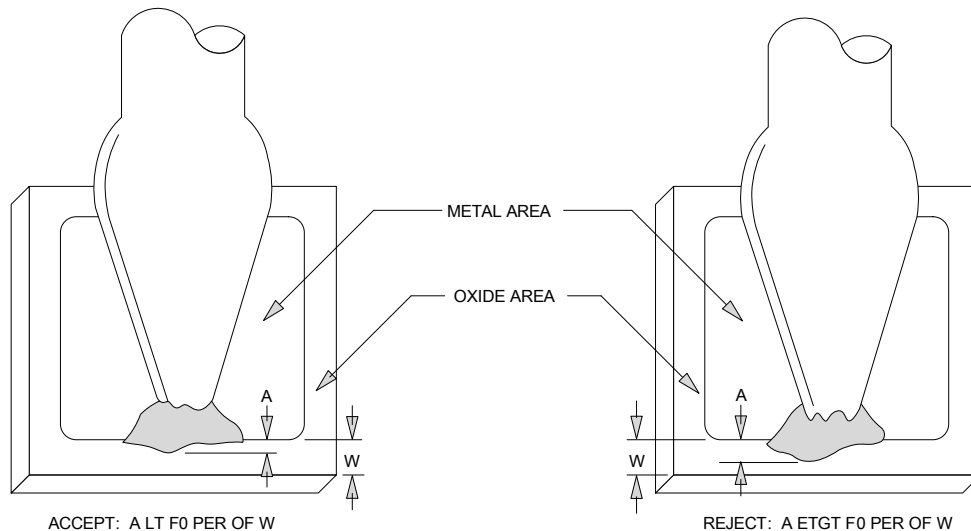
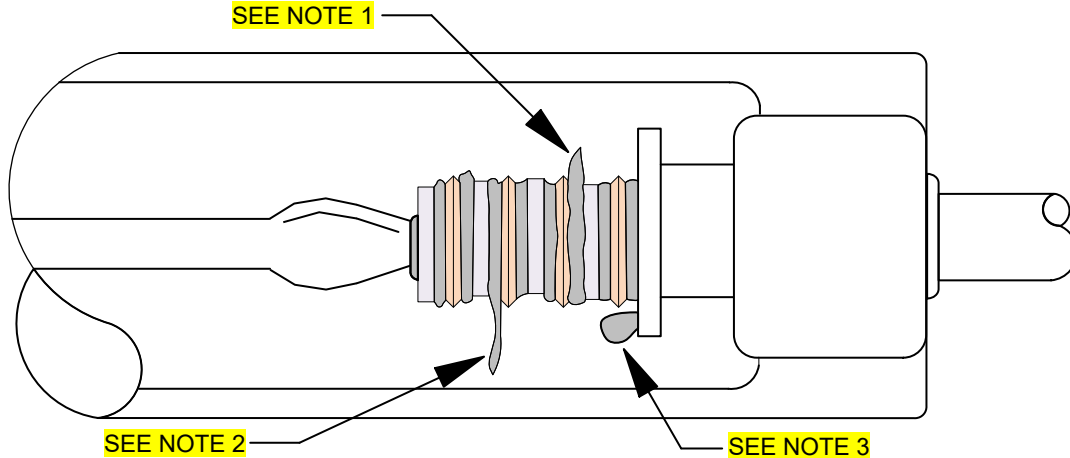


FIGURE 2074-B5 2074-B8. Solder overflow onto oxide area.

APPENDIX B

- c b. Solder ~~protrusion~~, slivers, and spikes (see figure 2074-B6 2074-B9). A device shall be rejected if solder slivers and spikes are not securely attached to the main body. A securely attached sliver ~~of or~~ spike is one having a cross sectional area greater at the area of attachment than anywhere else on the ~~solder protrusion and having no necked down areas~~ sliver of or spike. Solder ~~protrusions~~, slivers, and spikes whose length exceeds twice the smallest width of attachment shall be rejected.



NOTES:

1. Accept cross sectional area greater at the area of attachment than anywhere else on the sliver or spike.
2. Reject because the length exceeds twice the smallest width of attachment area.
3. Reject because the area of attachment is less than anywhere else on the sliver or spike.

FIGURE 2074-B6 2074-B9. Solder slivers and spikes.

- d e. Solder balls. A device shall be rejected if there are any insecurely attached solder balls. An insecurely attached solder ball is one whose major cross sectional area is more than twice the cross sectional area of the attachment.

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APPENDIX C

GLASS BODY (TRANSPARENT), AXIAL LEAD AND SURFACE MOUNT, DOUBLE PLUG, ~~TRANSPARENT BODY~~
(DUMET PLUG, ROUND END-CAP, SOFT GLASS)

C.1 General. This appendix contains the acceptance criteria for devices of the transparent glass body, axial lead and surface mount, double plug, soft glass design (see figure 2074-C1). The following inspections shall be performed after encapsulation and before body coating or painting. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

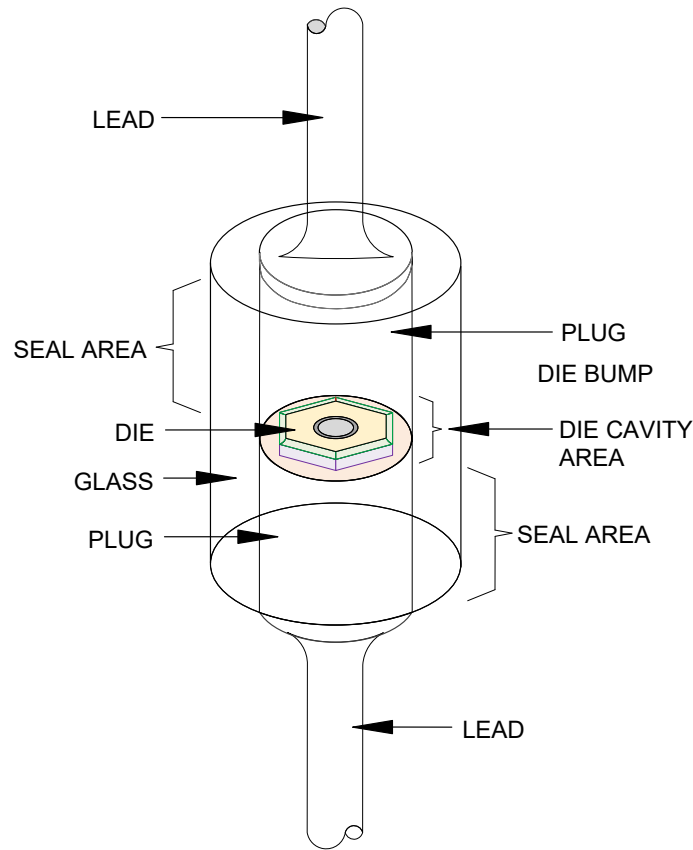


FIGURE 2074-C1. Transparent glass body, double plug, soft glass internal construction.

C.1.1 ~~C.1.7~~ Die defects. The following die defects shall be cause for rejection.

C.1.1.1 ~~C.1.7.2~~ Chipout or cracks. Die chipouts or die cracks shall use the criteria detailed in ~~3.4~~ 5.1 of this test method and figures 2074-1 and 2074-2.

C.1.1.2 Solder overflow. Solder or preform that makes contact to chip die on die bump side.

C.1.1.3 ~~C.1.7.4~~ Tilt. Die tilt greater than 5 degrees, ~~or slug~~.

APPENDIX C

C.1.2 C-1.5 Extraneous matter Foreign material. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas (die cavity area). Extraneous materials between the glass body seal and the ~~slug is~~ plug in the seal area are considered attached and shall not be cause for rejection.

C.2 Criteria for axial leaded devices. The following criteria shall apply for axial leaded mount devices.

C.2.1 C-1.4 Glass cracking (see figure 2074-C1 2074-C2). The glass body of the diode shall be evaluated for the following classification of glass cracks.

- a. Reject "A" cracks: Cracks that are not confined to the glass surface or the outer 25 percent of the seal length.
- b. Reject "B" cracks: ~~spiral or~~ Longitudinal cracks of any length originating at either end that propagate in the direction of the die ~~are cause for rejection. Reject for cracks that are not confined to the glass surface or the outer 25 percent of the seal length.~~
- c. Accept "C" cracks: Small surface impact marks, "c" cracks, and microcracks ~~are acceptable~~ if they are confined to the glass surface with no other cracks radiating from them.
- d. Reject "D" cracks: Spiral cracks originating at either end that propagate in the direction of the die.
- e. Accept "E" cracks: Cracks confined to the outer 25 percent of the designed seal length that propagate back toward the starting edge (away from the die area) ~~are acceptable~~.

~~REJECT: CRACKS NOT CONFINED TO SURFACE OR OUTER 25% OF SEAL LENGTH -- "A"~~
~~REJECT: CRACKS OF ANY LENGTH THAT PROPAGATE TOWARD DIE -- "B"~~
~~REJECT: SPIRAL CRACKS PROPAGATING TOWARD DIE -- "C"~~
~~ACCEPT: SMALL C CRACKS OR MICRO CRACKS IN GLASS SURFACE -- D~~
~~ACCEPT: CRACKS IN OUTER 25% OF SEAL LENGTH THAT PROPAGATE AWAY FROM DIE -- "E"~~

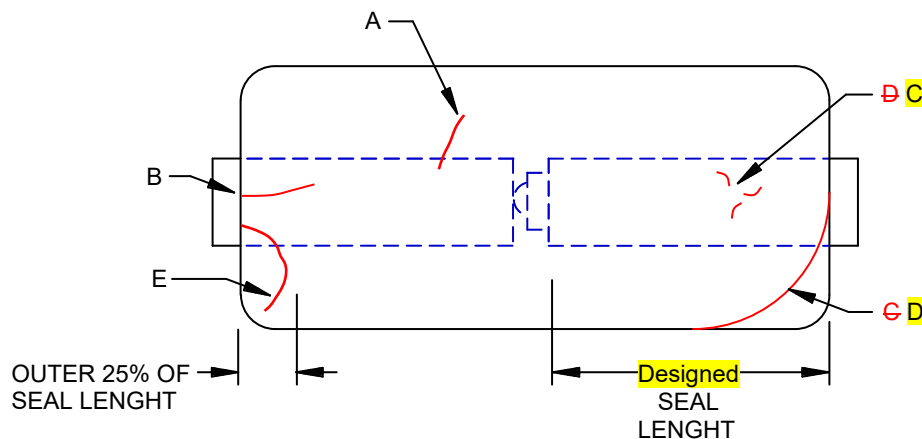


FIGURE 2074-C1 2074-C2. Glass cracks.

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APPENDIX C

C.2.2 C-1.2 High seal (see figure 2074-C2).

- a. Glass positioning (see figure 2074-C3). Any device which displays a glass case body off center condition reducing the seal band length of either plug by more than 25 percent of its designed seal length shall be cause for rejection.

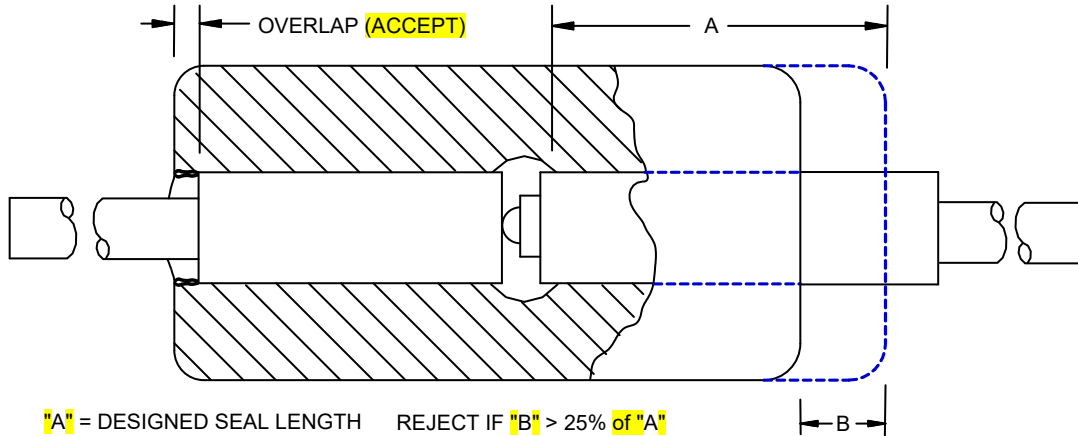
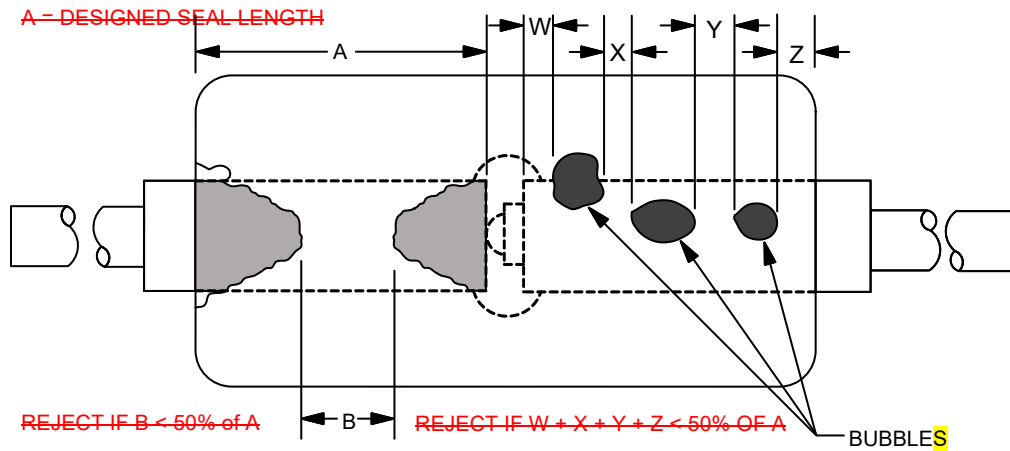


FIGURE 2074-C2 2074-C3. High seal Glass positioning.

- b. C-1.3 Insufficient seal (see 2074-C3 2074-C4). Any anomaly seal surface anomalies such as bubbles, plug blisters, separations, leaching, or undersealing that affects the which, when combined, reduce the seal length of either plug by reducing the a sealing band along any linear path to less than 50 percent of the designed seal length on any package type shall be cause for rejection.



NOTES:

1. Designed seal length is dimension "A".
2. Reject if dimension "B" is less than 50 percent of dimension "A".
3. Reject if the sum of dimensions "W", "X", "Y" and "Z" are less than 50 percent of dimension "A".

FIGURE 2074-C3 2074-C4. Insufficient seal.

APPENDIX C

C.2.3 C-1.4 Plug alignment and displacement (see figure 2074-C4 and 2074-C5). All devices shall be inspected for proper plug alignment.

- a. Plug displacement (see figure 2074-C5). A plug to plug displacement distance ~~more~~ greater than 25 percent of the diameter of the plug shall be cause for rejection.

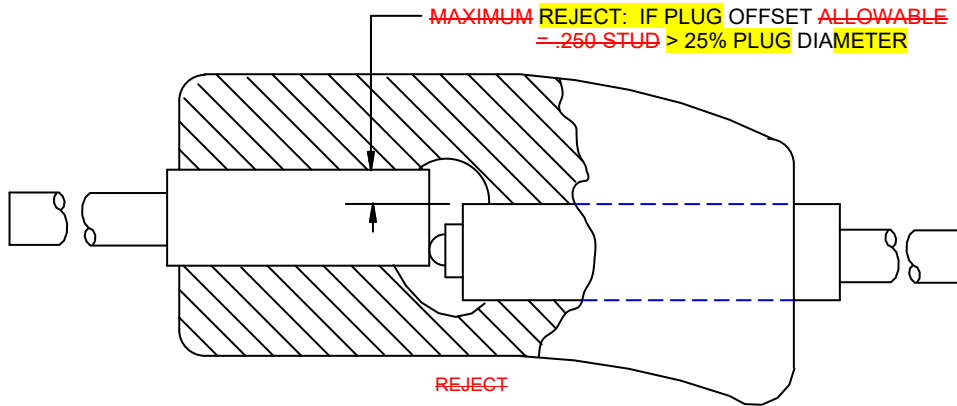


FIGURE 2074-C4 2074-C5. Plug alignment to plug displacement.

- b. Plug tilt (see figure 2074-C6). The plug shall not tilt to the degree that it touches the chip or is misaligned from the other plug axis more than 5 degrees. Any plug that tilts more than 5 degrees with respect to the other or that tilts sufficiently to make any unintended contact with the die shall be cause for rejection.

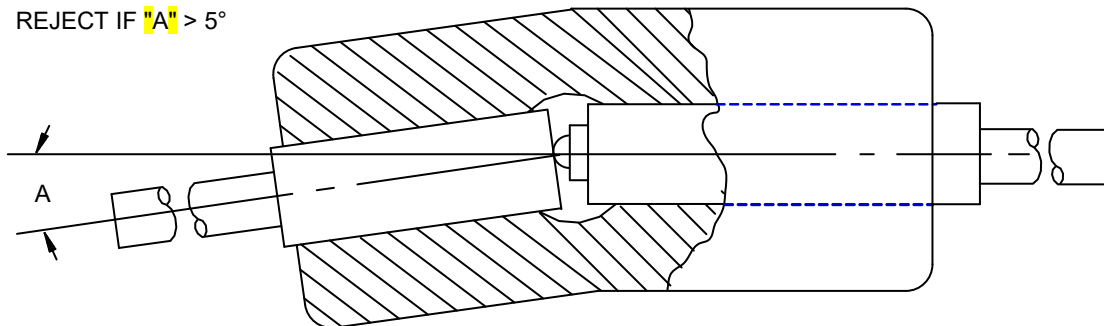


FIGURE 2074-C5 2074-C6. Plug displacement tilt.

APPENDIX C

C.2.4 ~~C.1.6~~ **Lead Terminal to plug** connections (see figure ~~2074-C6~~ **2074-C7**). **Lead Terminal** to plug connections shall be inspected for incomplete welds. Any partial welds less than 75 percent of total weld area shall be cause for rejection.

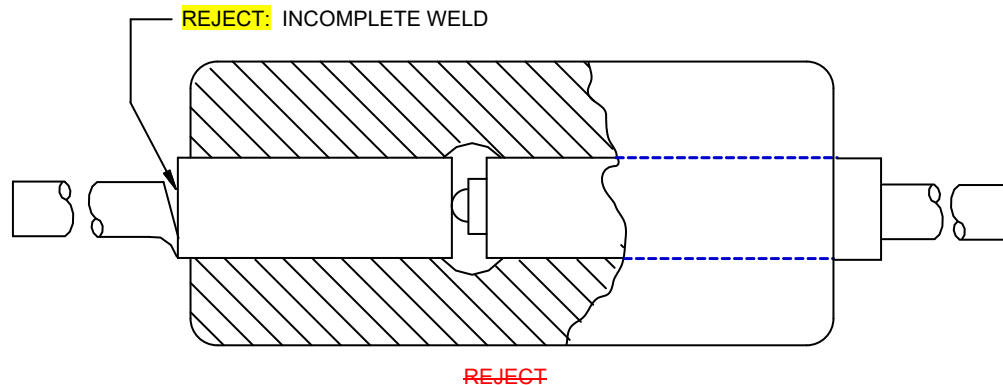


FIGURE ~~2074-C6~~ **2074-C7**. Incomplete **terminal-to-plug** weld.

C.3 ~~C.1.8~~ **Criteria for round end-cap surface mount devices.** The following criteria shall apply for **round** end-cap surface mount devices:

- Glass-to-metal seal shall be .015 inch (0.381 mm) **minimum** for DO-213AA and .020 inch (0.508 mm) **minimum** for DO-213AB, around the ~~diameter~~ **circumference** of each ~~slug~~ **plug**.
- Slug Plug** exposure shall not exceed 30 percent of the **slug plug** length .014 inch (0.3556 mm) **minimum** for DO-213AA and .022 inch (0.5588 mm) **minimum** for DO-213AB.
- There shall be no cracks in the ~~device~~ **glass** within .010 inch (0.254 mm) of the die.
- There shall be no cracks in the glass that are pointed towards the die.
- There shall be no conductive contaminants in the **die cavity area**.
- ~~For~~ Plug alignment, including end-caps, ~~see C.1.4~~ shall comply with the requirements of **C.2.3**.
- ~~For~~ End-cap **to plug** connections, ~~see C.1.6~~ shall comply with the requirements of **C.2.4**.

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APPENDIX D

GLASS BODY (TRANSPARENT), AXIAL LEAD AND SURFACE MOUNT, DOUBLE PLUG, ~~TRANSPARENT BODY~~
(TUNGSTEN OR MOLYBDENUM PLUG, SQUARE END-CAP, HARD GLASS)

D.1 General. This appendix contains the acceptance criteria for devices of the transparent glass body, axial lead and surface mount, double plug, hard glass design (see figure 2074-D1). The following inspections shall be performed after encapsulation and before body coating or painting. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

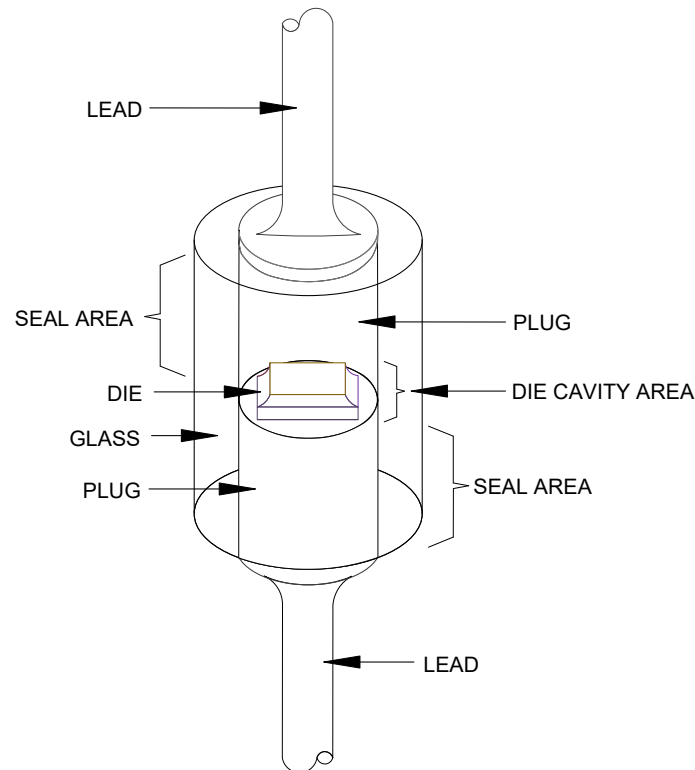


FIGURE 2074-D1. Transparent glass body, double plug, hard glass internal construction.

D.1.1 ~~D.1.5~~ Die effects defects. The following die defects shall be cause for rejection.

- Chipouts or cracks. Die chipouts or die cracks shall use the criteria detailed in paragraph ~~3-4~~ **5.1** of this test method and ~~figures 2074-1 and 2074-2.~~
- Conductive contaminants.** There shall be no conductive contaminants in the **die cavity area**.

D.1.2 ~~D.1.2.e~~ Foreign material. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas (**die cavity area**).

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D.2 Criteria for axial leaded and surface mount devices. The following criteria shall apply to axial leaded and surface mount devices.

D.2.1 ~~D.1.4~~ Glass anomalies.

D.2.1.1 ~~a. cracks~~ Glass cracking (see figure 2074-D2).

- ~~No cracks allowed except~~ Devices with "A", "B" and "D" cracks shall be rejected.
- Cracks confined to the outer 25 percent of the designed seal length ("E" cracks) that propagate back toward the starting edge (away from the die area) ~~are~~ shall be acceptable.
- Small surface impact marks ("C" cracks) and microcracks ~~are~~ shall be acceptable if they are confined to the glass surface with no other cracks radiating from them.

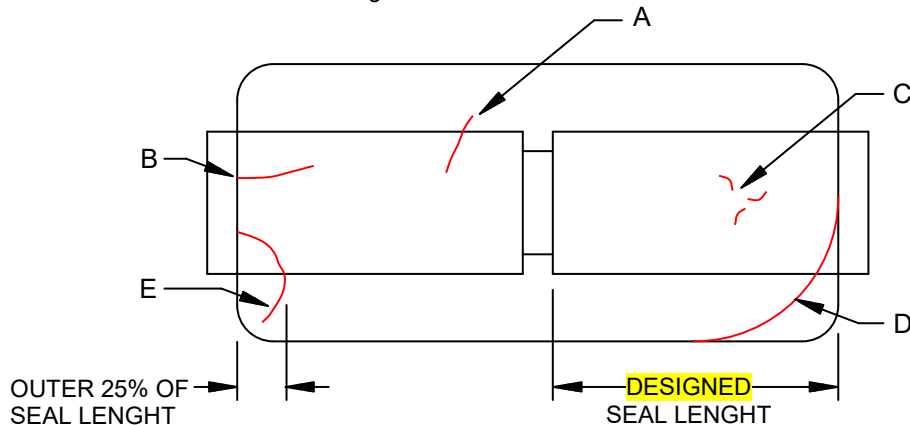


FIGURE 2074-D2. Glass cracks.

D.2.1.2 ~~b. Chipouts~~ (see figure ~~2074-D1~~ 2074-D3). Edge chipouts that expose a plug and are not confined to the outer 25 percent of the designed seal length (type "A") ~~are~~ shall be cause for rejection. Edge chip outs (regardless of size) that expose a plug and create a sharp angle or "V" shape that points toward the die area (type "B") ~~are rejects~~ shall be cause for rejection.

~~REJECT: CHIPOUTS NOT CONFINED TO OUTER 25% OF SEAL LENGTH - "A"~~
~~REJECT: CHIPOUTS OF ANY SIZE WITH SHARP POINT - "B"~~

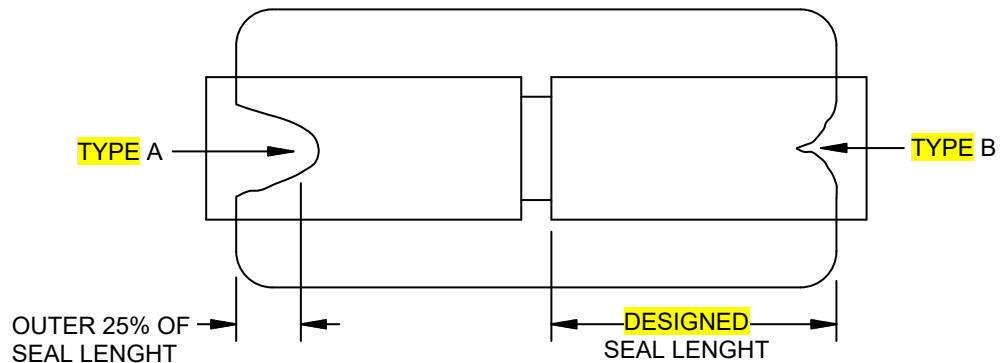


FIGURE ~~2074-D1~~ 2074-D3. Chip outs.

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APPENDIX D

D.2.1.3 ~~e~~. Holes. Any hole over the die or ~~slug plug~~ area greater than 50 percent of the glass thickness in depth ~~is~~ shall be cause for rejection. ~~except that~~ Holes of any depth are acceptable in the outer 25 percent of the designed seal length.

D.2.1.4 ~~d~~. Deformities (see figure ~~2074-D2~~ 2074-D4). Any glass surface deformity that causes the glass surface to be displaced by more than 10 percent of the designed glass diameter, or that results in the device not meeting a dimensional requirement, ~~is~~ shall be cause for rejection.

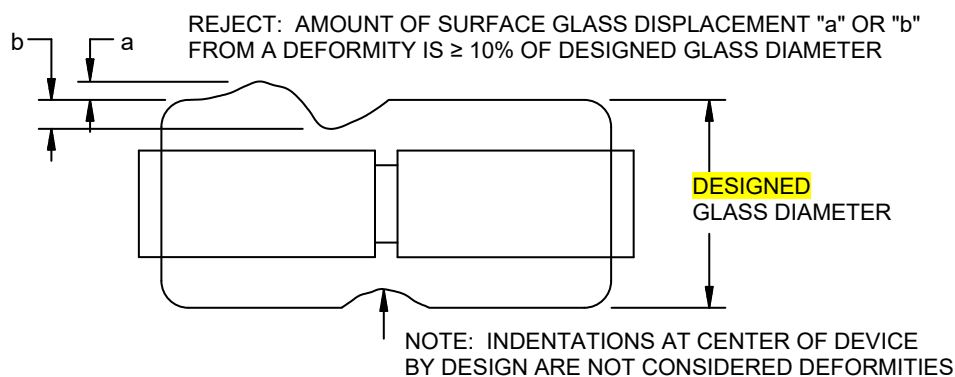


FIGURE ~~2074-D2~~ 2074-D4. Glass deformity.

D.2.1.5 ~~e~~. Surface damage and discoloration. Any device with surface abrasions, chips, scratches, rough or discolored (darkened) glass over the die area that result in the die not being clearly visible, ~~is a reject~~ shall be cause for rejection. Using liquid immersion to improve die visibility is acceptable.

D.2.2 ~~D.1.2~~ High seal.

- Glass positioning and missing glass (see figure ~~2074-D3~~ 2074-D5). Off center glass and portions of missing glass that reduce the seal length on either plug by more than 25 percent of the designed seal length ~~is~~ shall be cause for rejection.

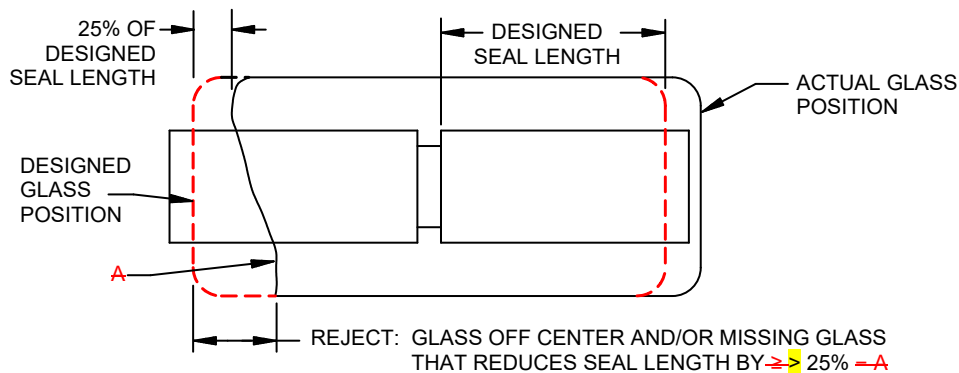


FIGURE ~~2074-D3~~ 2074-D5. Glass positioning and missing glass.

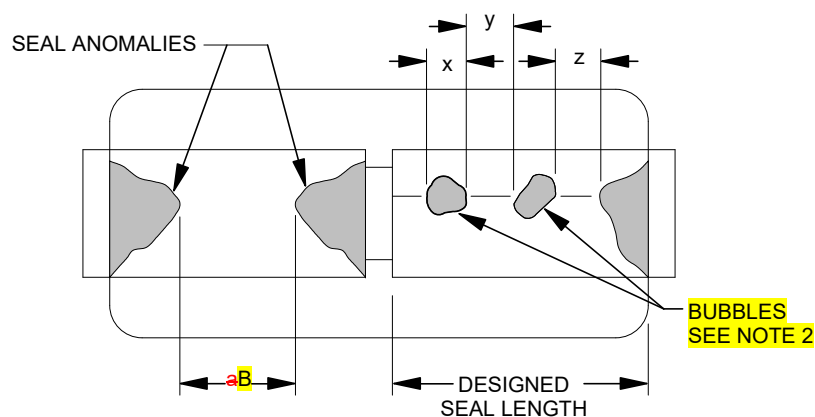
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- b. Insufficient seal (see figure 2074-D4 2074-D6). Any seal surface anomalies such as undercut, separations, plug blisters, scratches or cracks, bubbles, silicon chips, fibers, or missing plating which, when combined, reduce the sealing length along any linear path to less than 50 percent of the designed seal length are shall be cause for rejection.

NOTE: Lines or "strings" of small bubbles are considered to be seal anomalies for the entire length of the line.

REJECT SEAL LENGTH "a" REDUCED TO $\leq 50\%$ OF DESIGNED SEAL LENGTH
REJECT COMBINED SEAL LENGTHS "x" + "y" + "z" ALONG ANY LINE OF DESIGNED SEAL LENGTH



NOTES:

1. Reject: Seal length "B" reduced to less than or equal to 50 percent of designed seal length.
2. Reject: Combined seal lengths "x" + "y" + "z" along any line is less than or equal to 50 percent of designed seal length.

FIGURE 2074-D4 2074-D6. Insufficient seal.

- c. Extraneous materials. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas (die cavity area). Extraneous materials between the glass seal and the slug plug are considered attached and shall not be cause for rejection.

D.2.3 D.1.3 Alignment.

NOTE: Any die to plug non-contact that occurs as a result of die or plug misalignment is most accurately evaluated by thermal impedance testing. In cases where pass/fail status of a device is unclear based on the alignment requirements presented herein, thermal impedance testing may be used to determine the acceptability of the device.

- a. Die to plug offset (see figure 2074-D7). Any die that is out of axial alignment such that it extends beyond the slug plug more than 20 percent of its length or width is shall be cause for rejection (see figure 2074-D6).
- b a. Die alignment tilt (see figure 2074-D8). Any die that tilts more than 5 degrees with respect to the surface of either plug or that tilts sufficiently to make any unintended contact with the plug is shall be cause for rejection (see figure 2074-D5).

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REJECT: ~~LENGTH OF DIE NON-CONTACT~~ MAXIMUM DIE OFFSET "A" IS $\geq 20\%$ OF DIE LENGTH OR WIDTH

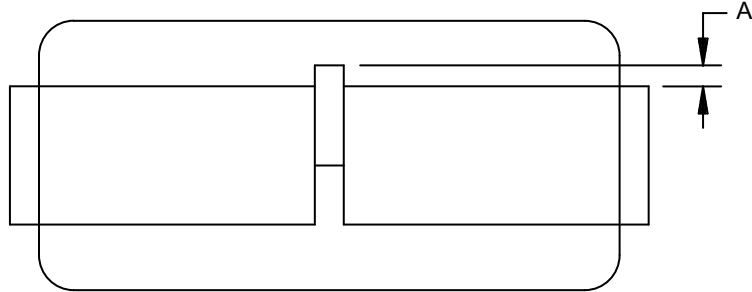
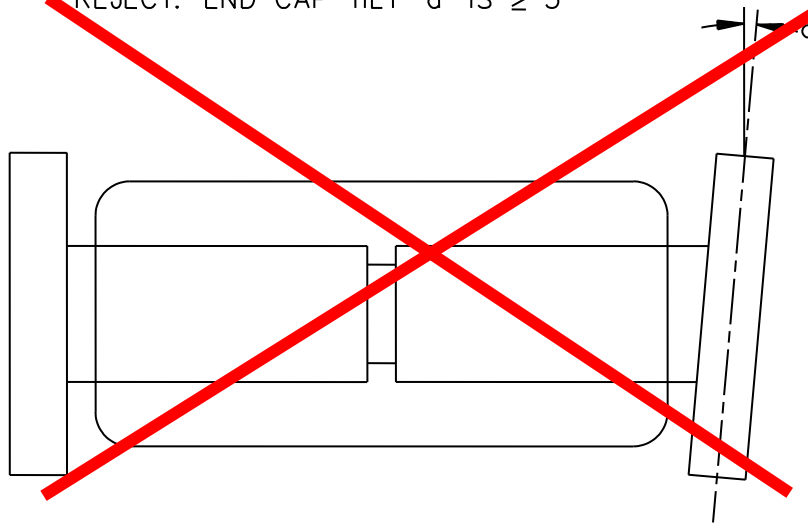


FIGURE ~~2074-D6~~ 2074-D7. Die non-contract (die to plug offset).

REJECT: END CAP TILT "α" IS $\geq 5^\circ$



REJECT: DIE TILT "A" $> 5^\circ$

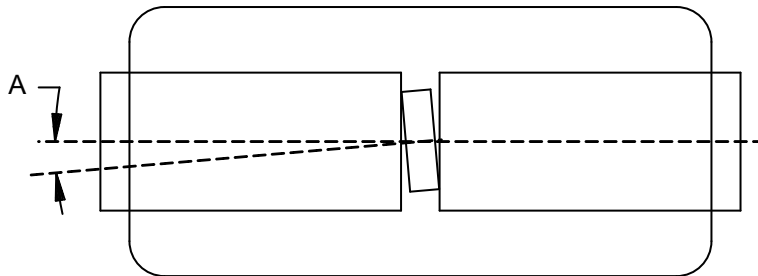


FIGURE ~~2074-D5~~ 2074-D8. Die tilt.

APPENDIX D

- c b. Plug alignment displacement (see figure 2074-D9). ~~Plugs that are not axially aligned other than in the die area to within 25~~ A plug to plug displacement distance (offset) greater than 25 percent of the diameter of the plug ~~are shall be~~ cause for rejection (~~see figure 2074-D7~~).

REJECT: PLUG OFFSET "A" IS $\geq 1/8$ (12.5%) $> 25\%$ OF PLUG DIAMETER

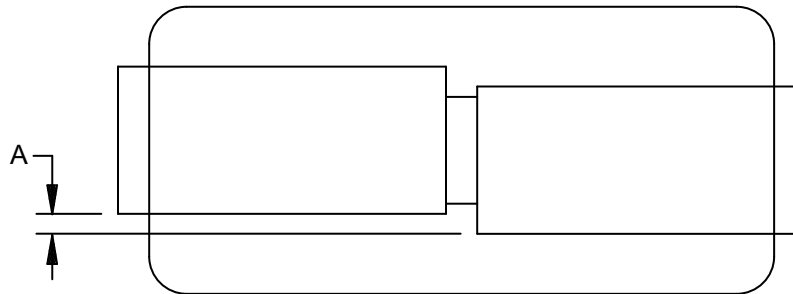


FIGURE ~~2074-D7~~ 2074-D9. Plug to plug offset.

- d. Plug tilt (see figure 2074-D10). Any plug that tilts ~~more~~ greater than 5 degrees with respect to the other plug or that tilts sufficiently to make any unintended contact with the die ~~is shall be~~ cause for rejection (~~see figure 2074-D8~~).

REJECT: PLUG TILT ANGLE "A" IS $\geq > 5^\circ$

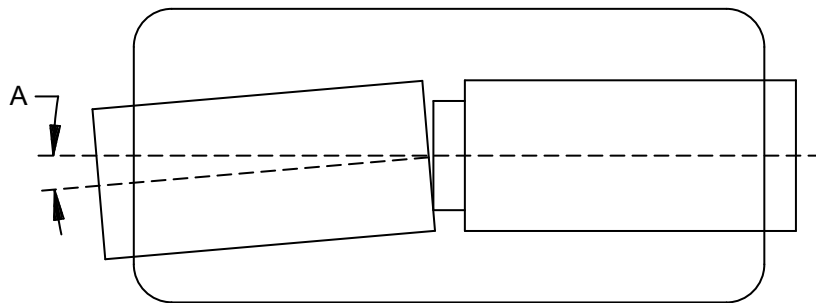


FIGURE ~~2074-D8~~ 2074-D10. Plug tilt angle.

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APPENDIX D

D.3 D.1.4 Lead and end cap attach Terminal to plug connection. The following criteria shall apply for axial lead (wire terminal) devices.

a. ~~b.~~ **Insufficient braze** (see figure 2074-D11). Terminals that are not brazed to the plug ~~around~~ at least 90 percent of the terminal perimeter ~~are shall be~~ cause for rejection. Any cracks or fissures in the braze ~~are shall be~~ cause for rejection. Pin holes in the braze ~~are shall be~~ acceptable.

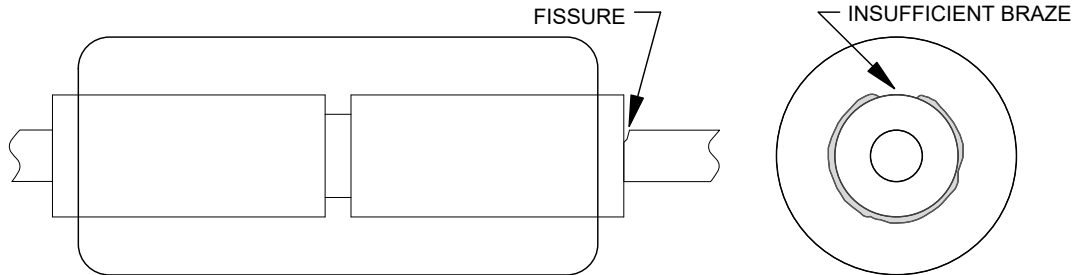
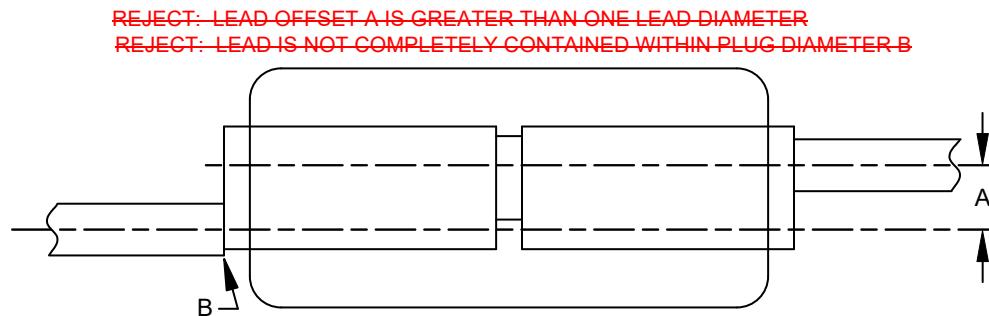


FIGURE 2074-D11. Fissure and insufficient braze of lead to plug.

b. ~~a.~~ **Lead alignment** (~~leaded devices~~) (see figure 2074-D12). Leads that are not axially aligned to within one lead diameter or leads that are not contained completely within the diameter of the plug, ~~are shall be~~ cause for rejection (see figure 2074-D9).



NOTES:

1. Reject if offset dimension "A" is greater than one lead diameter.
2. Reject at location "B" where lead is not completely contained within plug diameter.

FIGURE 2074-D9 2074-D12. Lead offset alignment.

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D.4 ~~e~~ End-caps (surface mount). The following criteria shall apply for end-cap surface mount devices.

- a. Clearance (see figure 2074-D13). Reject for end-caps that do not allow at least 3.0 mils .003 inch (0.076 mm) clearance from the glass body to the mounting surface on all four sides (~~see figure 2074-D10~~).

REJECT: ~~GLASS BODY TO END CAP CLEARANCE "A" IS ≤ 3 MILS~~
IF GLASS BODY DIAMETER EXCEEDS ENDCAP DIAMETER

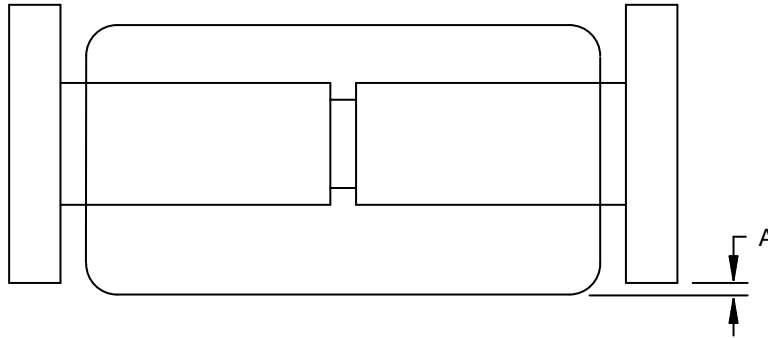


FIGURE ~~2074-D10~~ 2074-D13. End-cap clearance.

- b. Tilt (see figure 2074-D14). Reject for end-caps that are not perpendicular to the plugs to within 5 degrees (~~see figure 2074-D11~~).

REJECT: END CAP TILT "A" IS $\geq 5^\circ$

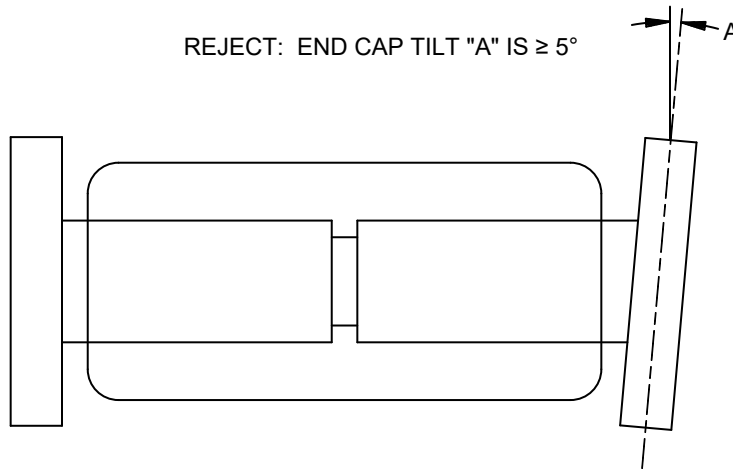


FIGURE ~~2074-D11~~ 2074-D14. End-cap tilt.

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- c. Deformation (see figure 2074-D15). Reject for end-caps that are bent sufficiently to cause the device to exceed any specified diode or end-cap dimension (~~see figure 2074-D12~~).

REJECT: DEVICE WITH END CAP DEFORMATION THAT EXCEEDS ANY SPECIFIED DIMENSION "A"

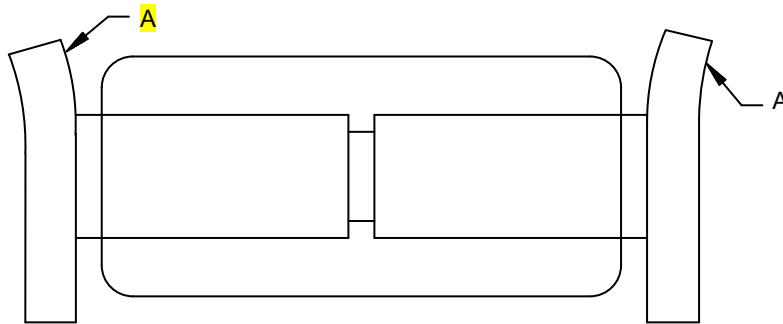


FIGURE ~~2074-D12~~ 2074-D15. End-cap deformation.

- d. Rotation (see figure 2074-D16). Reject for end-cap rotation where mounting surfaces are not co-planar to each other to within 5 degrees (~~see figure 2074-D13~~).

REJECT: END CAP ROTATION "A" $\geq 5^\circ$

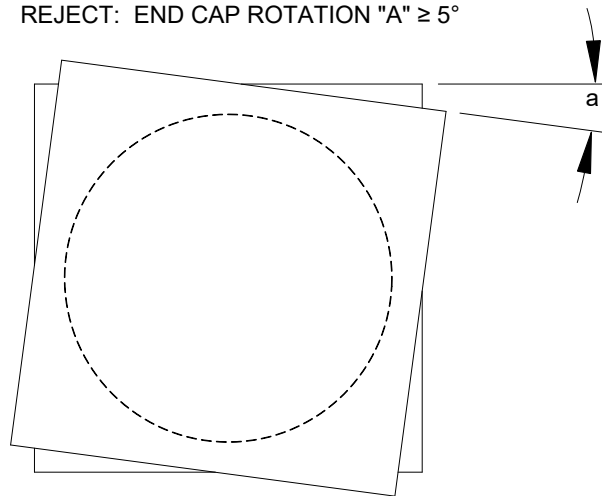


FIGURE ~~2074-D13~~ 2074-D16. End-cap rotation.

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- e. Mounting surface nicks and pits (see figure 2074-D17). Reject for ~~tabs~~ end-caps that have indentations, holes, nicks, pits, or other damage affecting more than 25 percent of any mounting surface (~~see figure 2074-D14~~).

~~REJECT: ANY MOUNTING SURFACE REDUCED TO $\leq 75\%$ OF ITS
DESIGNED AREA DUE TO NICKS (A), PITS (B), ETC.~~

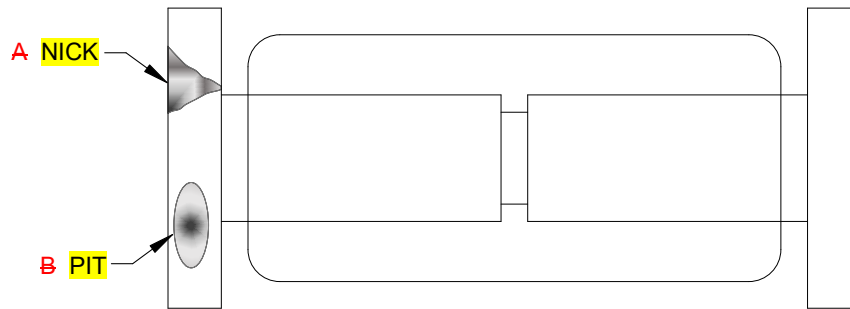


FIGURE ~~2074-D14~~ 2074-D17. Mounting surface nicks and pits.

- f. Finish defects. Reject for end-caps that exhibit flaking, blistering, or peeling.
- g. Braze. End-caps that are not brazed to the plug at least 90 percent of the terminal perimeter shall be cause for rejection. Any cracks or fissures in the braze shall be cause for rejection. Pin holes in the braze shall be acceptable.

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APPENDIX E

GLASS BODY (TRANSPARENT), AXIAL LEAD, ~~TRANSPARENT BODY~~, POINT CONTACT DESIGN

E.1 General. This appendix contains the acceptance criteria for devices of the transparent glass body, axial lead, point contact design (see figure 2074-E1). The following ~~additional criteria shall be specified for the point contact construction~~ examinations shall be made after encapsulation but before body coating or painting. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

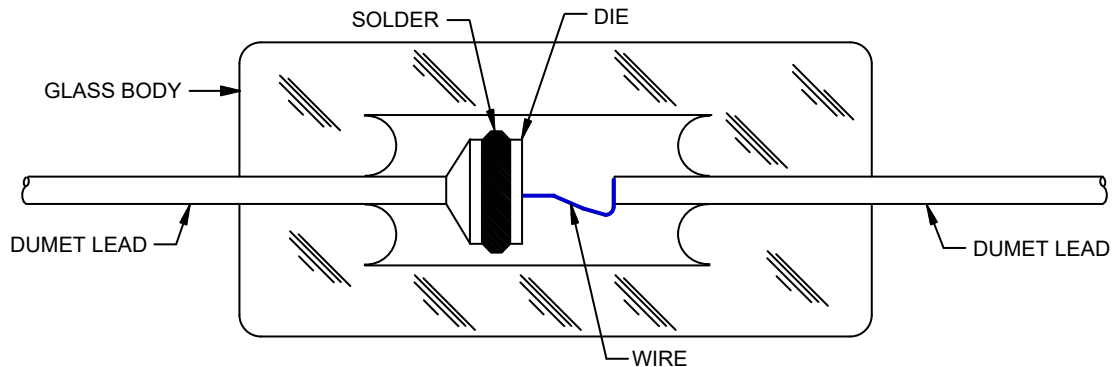


FIGURE 2074-E1. Transparent glass body, axial lead, point contact internal construction.

E.1.1 Glass cracks and chips (see ~~figure 2074-A1~~ figure 2074-A2). No cracks shall be allowed in the vicinity of the cavity. Any crack originating at either end of the package or crack that extends into the body of the glass toward the die cavity more than 25 percent of the glass-to-glass or glass-to-metal seal length shall be cause for rejection. Any glass chip deep enough to expose the plug or lead surface and extending longitudinally into the glass-to-metal seal toward the cavity to reduce the effective seal length to less than one external lead diameter shall be cause for rejection.

E.1.2 Incomplete seal. All devices shall be inspected for glass-to-metal seal or glass-to-glass seal. Both seals shall be a minimum of one external lead diameter over the entire sealed portion (sealed interface).

E.1.3 Bubbles in seal. All devices shall be inspected for bubbles in the glass-to-metal or glass-to-glass seal. A series of bubbles that reduce the effective seal length to less than one external lead diameter shall be cause for rejection. Bubbles in the glass, ~~but~~ not effecting the glass-to-glass or glass-to-metal seal area, ~~are~~ shall not be cause for rejection.

E.1.4 Glass package deformities (see ~~figure 2074-A2~~ figure 2074-A3). Any glass envelope deformity equal to or greater than 75 percent of the external lead diameter shall be cause for rejection.

E.1.5 ~~Extraneous matter~~ Foreign material. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas.

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APPENDIX E

E.1.6 ~~E.1.9~~ Die-to-post solder connection ~~contact area~~.

- a. Solder voids. ~~Solder shall be smoothly formed from one element to another and shall be fused to a minimum of one half the available bonding area.~~ A device shall be rejected if solder flow is less than 50 percent of the perimeter of the minimum available contact area of the die.

~~E.1.8 Solder voids. A device shall be rejected if solder flow is less than 50 percent of the perimeter of the minimum available contact area of the die.~~ Solder shall be smoothly formed from one element to another and shall be fused to a minimum of 50 percent of the available bonding area.

- b. Solder overflow. Any solder overflow that touches the opposite surface of the die shall be cause for rejection.

E.1.7 Die-to-die solder connection (for stacked die construction only). When used, the die assemblies shall meet the requirements of B.1.7.

E.1.8 ~~E.1.6~~ Pressure contact ~~defects connections~~. The following misalignments or deformities shall be cause for rejection.

- a. Whisker touches glass body wall (see figure ~~2074-E1~~ 2074-E2).

AXIAL LEAD, TRANSPARENT BODY, POINT CONTACT

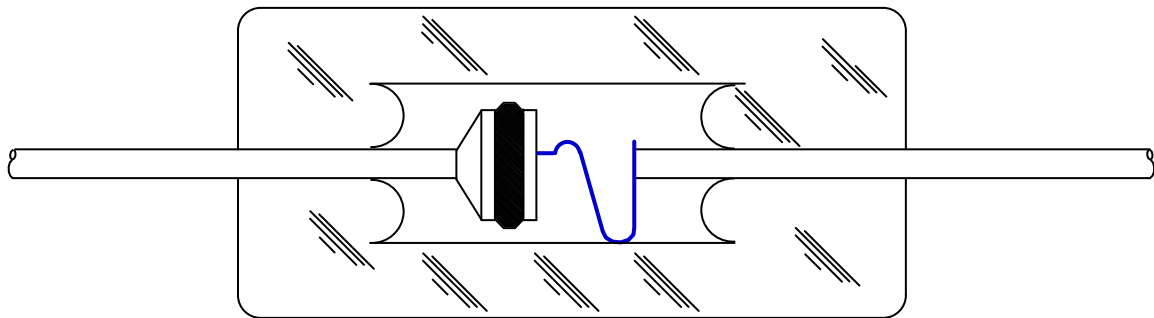


FIGURE ~~2074-E1~~ 2074-E2. Whisker touches glass body wall (reject).

- b. Whisker loops touch one another (see figure ~~2074-E2~~ 2074-E3).

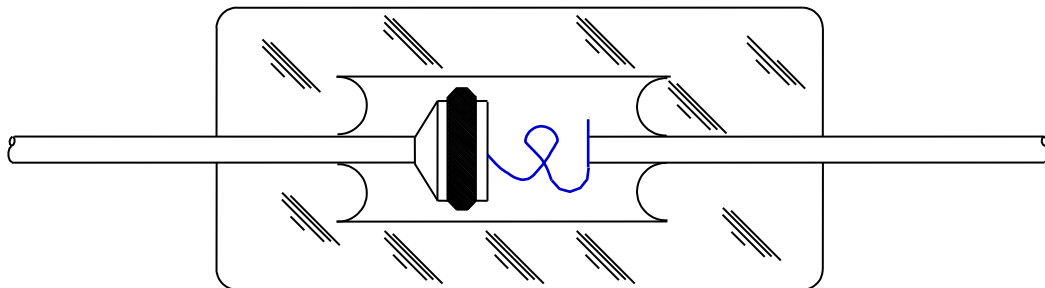


FIGURE ~~2074-E2~~ 2074-E3. Whisker loops touch one another (reject).

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- c. Whisker angle over 10 degrees from normal (see figure 2074-E3 2074-E4).

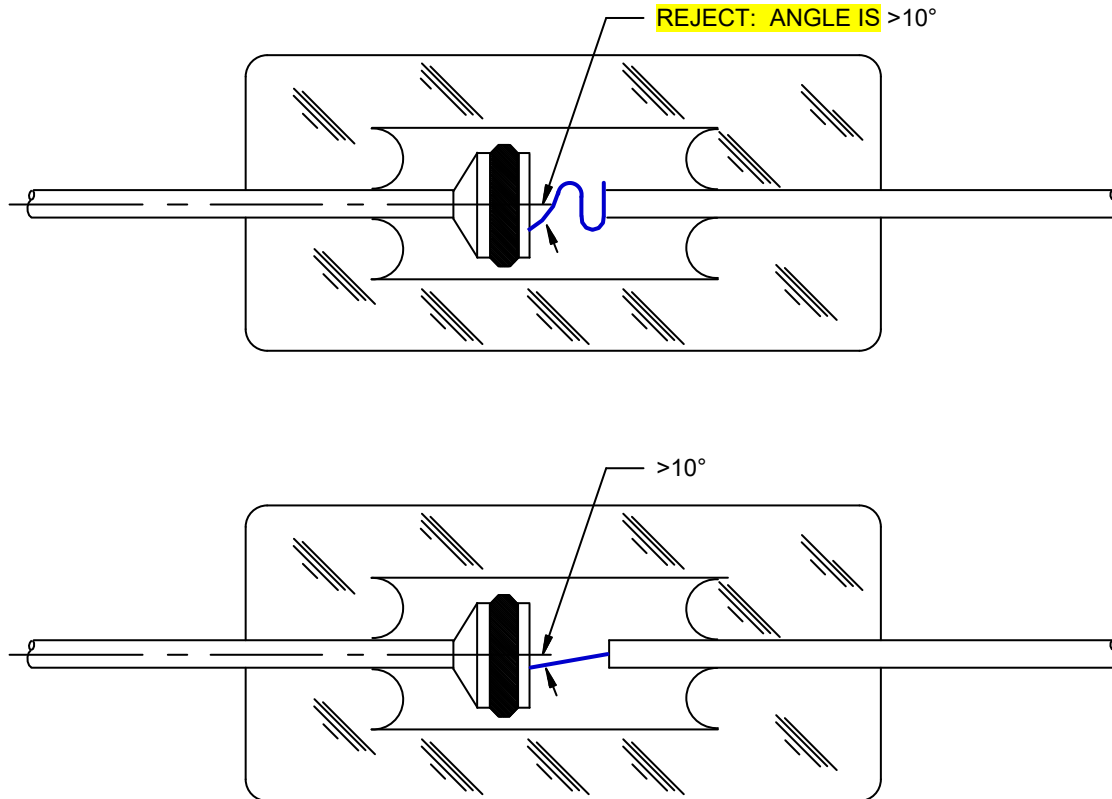


FIGURE 2074-E3 2074-E4. Whisker angle over 10 degrees from normal (reject).

E.1.9 E-1.7 Whisker-to-post connection weld-to-post. Any device that exhibits weld splash or splatter (tear dropped or balled) between whisker and post shall be rejected when it exceeds 25 percent of nominal lead diameter. The profile of whisker weld to the post shall not allow light penetration by more than 50 percent of lead diameter when using back lighting techniques.

E.1.10 Die alignment.

- a. Die-to-centerline surface.** A device shall be rejected if the die surface is not within 15 degrees of being normal to the centerline of the mounting post.

APPENDIX E

b. ~~E.12~~ Die touches glass package (see figure ~~2074-E4~~ 2074-E5). A device shall be rejected if the die touches the glass envelope.

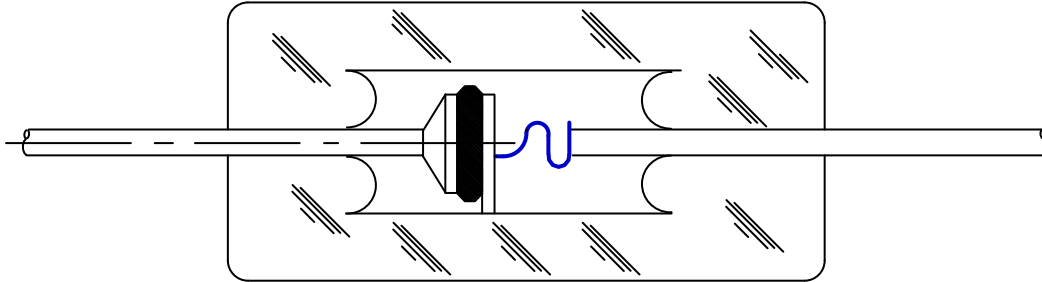


FIGURE ~~2074-E4~~ 2074-E5. Die touches glass package (reject).

E.1.11 Lead alignment defects (applicable to that portion of each lead within the glass envelope). A device whose lead which is either misaligned or bent so that it makes an angle with the principle device axis greater than 10 degrees shall be rejected.

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APPENDIX F

GLASS BODY (OPAQUE), AXIAL LEAD, DOUBLE PLUG, ~~OPAQUE BODY~~, POWER RECTIFIER AND REGULATOR

F.1 General. This appendix contains the acceptance criteria for the opaque glass body, axial lead, double plug design (see figure 2074-F1) used for power rectifier and regulator devices. The die related examinations shall be performed before encapsulation and remaining examinations shall be made after encapsulation but before body coating or painting. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

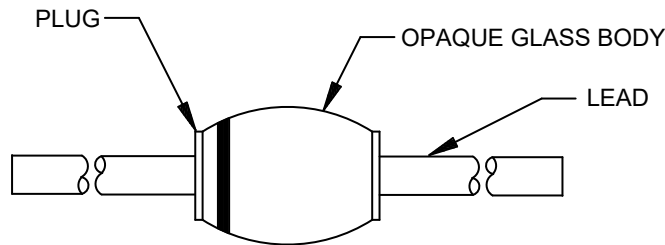


FIGURE 2074-F1. Opaque glass body, axial lead, double plug internal construction.

F.1.1 ~~F.1.2~~ Die ~~cracks~~ defects.

- a. Cracks. Any die exhibiting cracks that is broken, cracked, or chipped so as to reduce the total die area (or cracks extending into or across the junction area) to less than 75 percent of its original area shall be cause for rejection.

a. Chipouts or cracks. Die chipouts or die cracks shall use the criteria detailed in paragraph 3.1 5.1 of this test method and figures 2074-1 and 2074-2.

- b. F.1.1.a. Die geometry. ~~A die shall be rejected if it~~ Any die that is chipped or broken to the extent that 75 percent or less of the original surface remains shall be cause for rejection.

F.1.2 ~~F.1.4~~ Die mounting and alignment. After bonding die to the heat sink, plugs, or leads, the following shall be inspected for defects.

- a. ~~e.~~ Tilted die. A device shall be rejected if the die is tilted so that the die surface is greater than 5 degrees from being perpendicular to the ~~mounting-post~~ plug axis (see 2074-D8).

a. Die tilt (see figure 2074-D8). Any die that tilts more than 5 degrees with respect to the surface of either plug or that tilts sufficiently to make any unintended contact with the plug shall be cause for rejection.

- b. Axial alignment of plugs and die. A device shall be rejected if the plug-to-plug plugs shall be aligned axially within 25 percent of the diameter of either plug (see 2074-D9).

b. Plug displacement (see figure 2074-D9). A plug-to-plug displacement distance (offset) greater than 25 percent of the diameter of the plug shall be cause for rejection.

F.1.3 ~~F.1.5~~ Extraneous matter. A device shall be rejected if there is any extraneous, particulate matter between the terminal plugs or on the plug surface. No foreign stains shall be permitted on plug surfaces.

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F.1.4 ~~F.1.3~~ Braze (leaded devices). Leads that are not brazed to the plug around at least 90 percent of the lead perimeter ~~are~~ shall be cause for rejection (see 2074-D11). Any cracks or fissures in the braze ~~are~~ shall be cause for rejection. Pin holes in the braze ~~are~~ shall be acceptable.

F.1.5 ~~F.1.4~~ Flaking or loose material. ~~No~~ Unattached solder, braze, or other bonding material ~~shall~~ extending from the plugs shall be cause for rejection. Any blistering or peeling of plug surface shall be cause for rejection.

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APPENDIX G

METAL BODY, AXIAL LEAD, SOLDER CONTACT DESIGN

G.1. General. This appendix contains the acceptance criteria for devices of the metal body, axial lead, solder contact design (see figure 2074-G1). The following inspections shall be made prior to capping. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

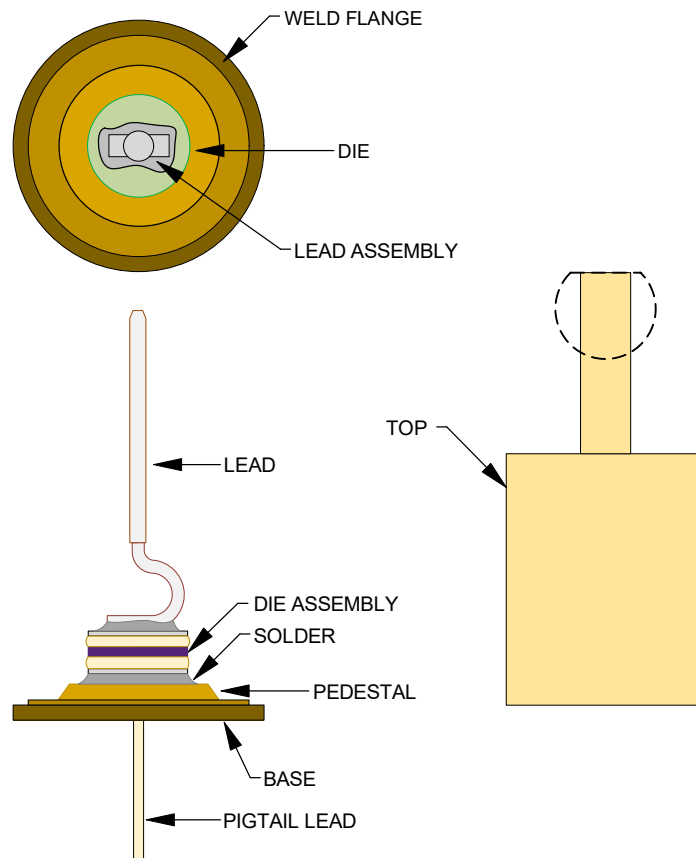


FIGURE 2074-G1. Metal body, axial lead, solder contact internal construction.

~~G.1.1 Examinations before capping.~~

G.1.1 ~~a. Solder defects (see figures 2074-G1 and 2074-G2).~~

- a. Solder protrusions.** Any device with a solder protrusion that extends more than twice the smallest protrusion width shall be rejected.

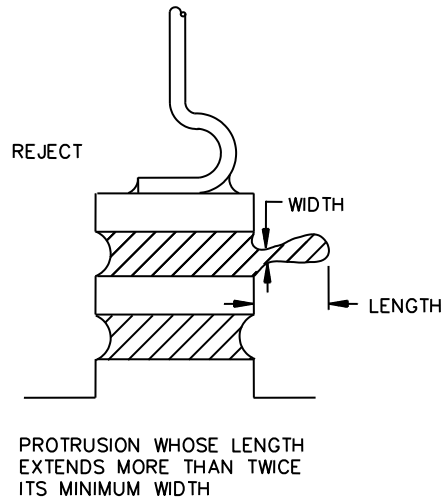


FIGURE ~~2074-G1~~ **2074-G2**. Solder protrusion.

- b. Solder flow (or voids)** (see figure 2074-G3). Solder shall be smoothly formed from one element to another and shall be fused to a minimum of 50 percent of the perimeter between adjacent elements.

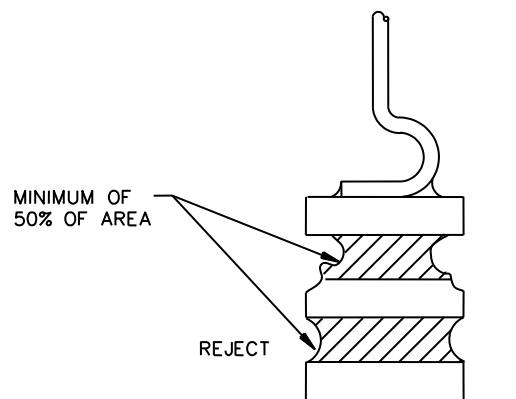


FIGURE ~~2074-G2~~ **2074-G3**. Solder flow.

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G.1.2 ~~b~~. Alignment (see figure ~~2074-G3~~ 2074-G4). Any device whose element has its geometric center displaced more than 33 percent of its width from the die, or die stack centerline, shall be rejected.

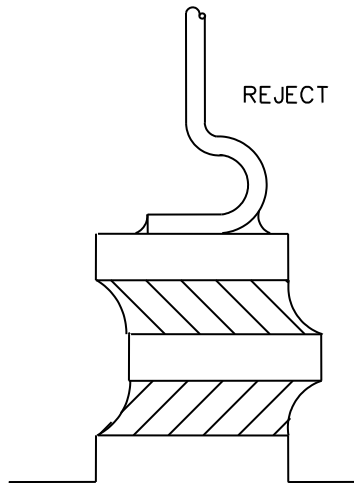


FIGURE ~~2074-G3~~ 2074-G4. Element alignment.

G.1.3 ~~c~~. Tilt (see figure ~~2074-G4~~ 2074-G5). Any element of a device that is tilted more than 10 degrees from the mounting plane shall be cause for rejection.

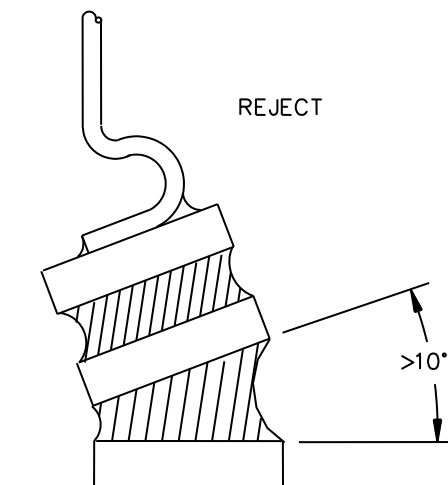


FIGURE ~~2074-G4~~ 2074-G5. Element tilt.

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APPENDIX G

G.1.4 ~~d~~. Die chip outs (see figure ~~2074-G5~~ **2074-G6**). Any device die that exhibits chip outs extending more than 25 percent of the die width or to within ~~2-0 mils~~ **.002 inch** (0.051 mm) of the junction area shall be cause for rejection.

G.1.5 ~~e~~. Die cracks (see figure ~~2074-G6~~ **2074-G7**). Any die exhibiting cracks that reduce the total die area (or cracks extending into or across the junction area) to less than 75 percent of its original area shall be cause for rejection.

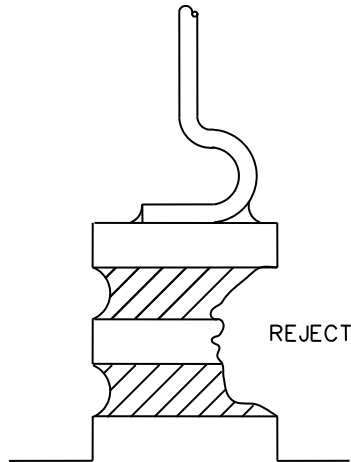


FIGURE ~~2074-G5~~ **2074-G6**. Die chip out.

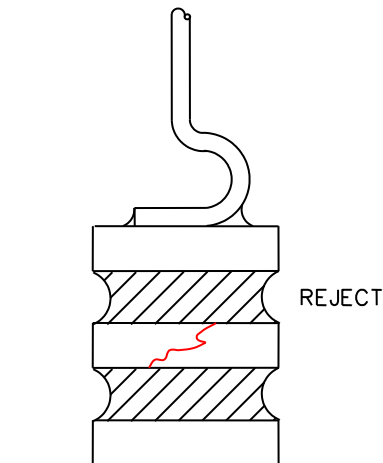


FIGURE ~~2074-G6~~ **2074-G7**. Die cracks.

G.1.6 ~~f~~. Extraneous matter. A device shall be rejected if there are unattached solder balls, semiconductor material, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas.

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APPENDIX H

METAL BODY, STUD MOUNTED, SOLDER CONTACT DESIGN

H.1 General. This appendix contains the acceptance criteria for devices of the metal body, stud mounted, solder contact design (see figure 2074-H1). The following inspections shall be made prior to capping. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

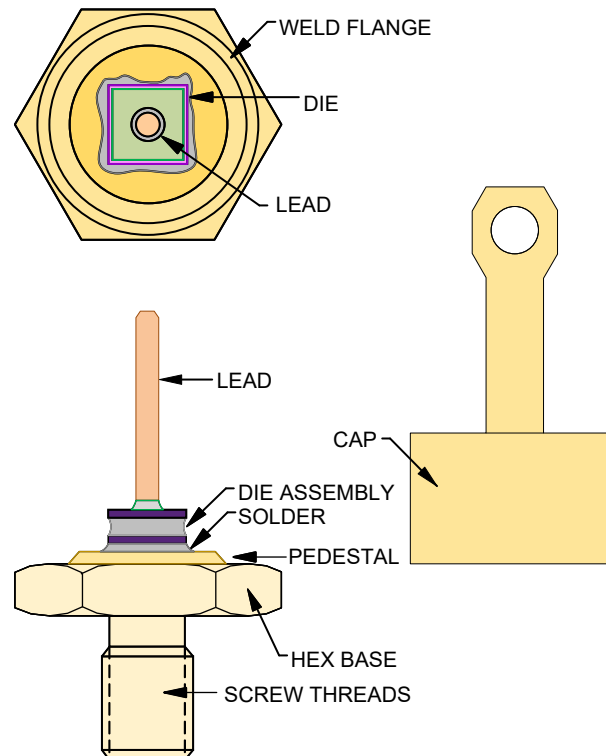


FIGURE 2074-H1. Metal body, stud mount, solder contact internal construction.

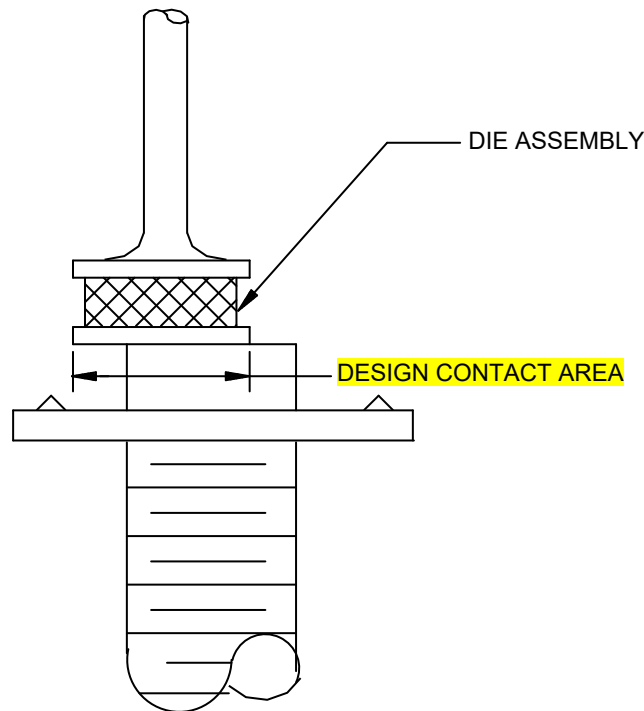
H.1.1 H.1.2.c. Multiple die attachments. A device shall be rejected if the attached portion of an adjacent die exceeds 25 percent of the die area.

H.1.2 Extraneous matter. ~~b. Foreign matter.~~ A device shall be rejected if there are unattached solder balls, semiconductor materials, chips, flaked plating, or opaque material that is larger than the smallest distance between exposed active areas.

APPENDIX H

H.1.3 ~~H.1.1~~ Die and lead assembly ~~(see figures 2074-H1 and 2074-H2).~~

- a. Die offset (see figure 2074-H2). The die and lead assembly shall be located on the ~~base~~ pedestal so that there is complete contact over the design contact area.



REJECT: DIE NOT CENTRALLY LOCATED

FIGURE ~~2074-H1~~ 2074-H2. ~~Offset~~ Die-to-pedestal offset.

- b. **Lead defects.** The lead shall be free of nicks and scrapes that reduce the lead diameter by more than 5 percent.
- c. ~~H.1.2—Extraneous matter.~~ ~~a.~~ Solder slivers and spikes. A device shall be rejected if solder slivers and spikes are not securely attached to the parent body of the solder. A securely attached sliver or spike is one having a cross sectional area greater at the area of attachment than anywhere else on the solder protrusion and having no necked-down areas.

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- d. Die and lead tilt (see figure 2074-H3). The die and lead assembly shall not be tilted ~~more~~ greater than 5 degrees with respect to the base.

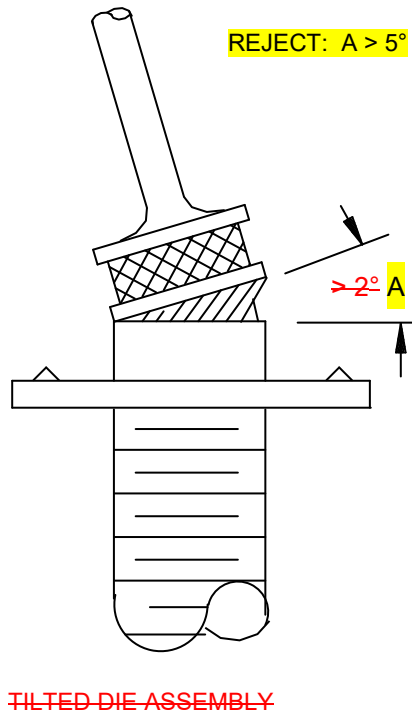


FIGURE 2074-H2 2074-H3. Tilted die and lead assembly.

H.1.4 H.1.3 Assembly defects.

- Tilted elements. A device shall be rejected if any element of the assembly is tilted in excess of 10 degrees from the normal mounting plane.
- Misaligned elements. A device shall be rejected if any element of the assembly is misaligned or displaced in excess of 33 percent of its width from the die or die stack centerline, bridges two active regions, or extends beyond the isolation region of the oxide.

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APPENDIX I

METAL BODY, DIAMOND BASE CASE MOUNT REGULATORS, SOLDER CONTACT DESIGN

I.1 General (see figure 2074-11). This appendix contains the acceptance criteria for devices of the metal body, diamond base case mount, solder contact design (see figure 2074-11). The following inspections shall be made prior to capping. This appendix is a mandatory part of this test method. The information contained herein is intended for compliance.

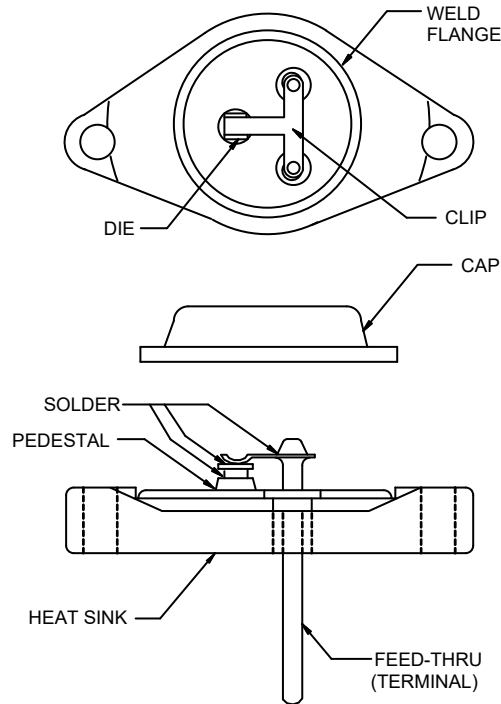


FIGURE 2074-11. Metal body, diamond base case mount, solder contact internal construction.

I.1.1 Die-to-pedestal and die-to-clip solder connections.

- Solder voids. A device shall be rejected if solder flow is less than 50 percent of the perimeter of the minimum available contact area.
- Solder overflow. A device shall be rejected if any solder flow bridges from the top to bottom surface of the die or reduces the normal separation of two active regions by 50 percent or more.

I.1.2 Clip-to-post and feed-through to heat sink solder connections.

- Solder voids. A device shall be rejected if the wetting action of the solder to each member element of the connection is not continuous.
- Solder overflow. A device shall be rejected if any solder flow extends on to any portion of the weld flange of the heat sink.

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