EXTERNAL VISUAL INSPECTION OF

CAPACITORS

ESCC Basic Specification No. 2053000

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ESA/SCC Basic Specification No. 2053000

space components
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1. SCOPE

This specification, to be read in conjunction with ESA/SCC Basic Specification No. 20500, 'External Visual Inspection', contains additional specific requirements for Capacitors.

They shall apply to each component inspected.

2. GENERAL REQUIREMENTS

2.1 APPLICABILITY

The following criteria may not be varied or modified after commencing any inspection stage. Any ambiguity or proposed minor deviation shall be referred to the Qualifying Space Agency for resolution and approval.

2.2 PROCEDURE

All items shall be examined in such a manner that a minimum of handling and movement of the component is involved. During handling of components, lint free gloves/finger cots shall be used.

2.3 MAGNIFICATION

All items shall be examined with a binocular or stereoscopic microscope under a magnification of ×1 to ×10.

2.4 MOUNTING FIXTURES

Suitable fixtures may be used to assist in the inspection process. They must not themselves cause damage to the device.

3. DETAILED REQUIREMENTS

3.1 GENERAL

A component shall be rejected if it exhibits one or more of the defects listed in any of the following paragraphs of this specification. Where applicable, drawings are included to provide additional explanatory material, but these shall be considered as examples only.

The lot inspected shall be homogeneous. A component shall therefore also be rejected if it exhibits a significant deviation within the limits of this specification, from the rest of the lot. However, such components shall not be counted as a failure in any other lot definition.

The external visual inspection includes the verification of:

- Dimensions.
- Marking.
- Materials.
- Mechanical defects.

3.2 DIMENSIONS AND MARKING

Dimensions and marking shall be inspected in accordance with the requirements of ESA/SCC Basic Specification No. 20500, Paras. 4.6 and 4.7.

All letters and numbers shall be clearly legible without the use of optical resources.

Dimensional tolerances, including those of pin diameter and pin spacing, shall be as specified in the relevant ESA/SCC Detail Specification.

3.3 MATERIALS

The materials used shall be verified for conformance to the requirements of the applicable ESA/SCC Detail Specification. The production records shall be checked to ensure that the specific material requirements are met.

3.4 CAPACITORS ENCAPSULATED IN HERMETIC TUBULAR CASES

Such as:

- Solid electrolyte tantalum and aluminium capacitors.
- Plastic-dielectric capacitors.
- Filters and feed-through capacitors.

3.4.1 Lead Condition

(a) Corrosion is evident.

(b) Exposed base material, in excess of the lead diameter or thickness, caused by chipped glass meniscus.

(c) Exposed base material anywhere on the lead within a distance of 20mm of the case, other than that caused by (b).

(d) Exposed base material in excess of 5% of the surface area anywhere on the lead, beyond a distance of 1.5mm from the case.

(e) Non-conductive material on the lead beyond a distance of 1.5mm from the case.

(f) Reduction of lead diameter, width or thickness by more than 10%, within 20mm of the case.

(g) Nicks, fractures, non-uniformity or discolouration of coating or abrasions exposing base material.

3.4.2 Lead Configuration (See Figures II to V)

(a) Straight round leads twisted more than 1 revolution per 30mm of length.

(b) Flat leads twisted more than 10° per any 10mm.

(c) Leads kinked or bent and re-bent within 20mm of the case, other than for design, so that distance "A" as in Figure II is more than 2.0mm.

(d) Leads deviating from the specified direction, by a straight line or by a soft bend, by more than 1.0mm per any 5.0mm of length.

(e) Eccentricity of lead passing through header greater than 10% of the hole diameter, see ratio a/A in Figure IV.

(f) Lead tilted by more than 5°.

(g) Weld cathode terminal-to-case must be visible around the entire lead diameter. (When applicable.)

(h) Defective cathode terminal-to-case weld. Burnt weld, weld flash, excessive deformation of lead or can is not accepted. (When applicable).

FIGURE I - TWISTED LEAD (3.4.2(a))

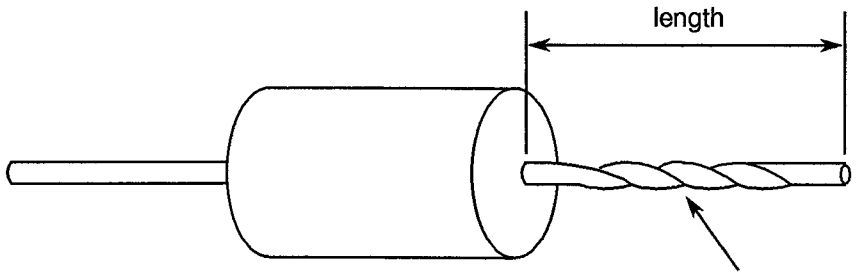
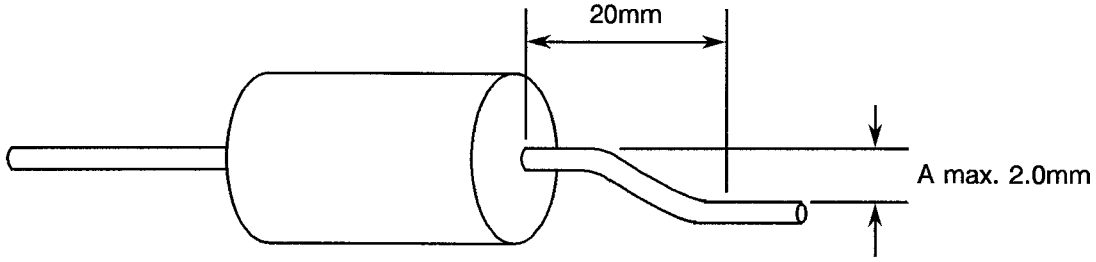
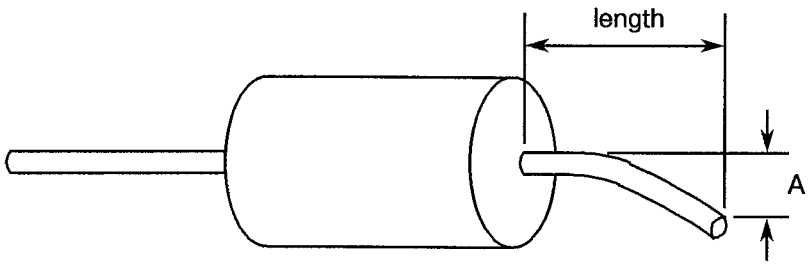


FIGURE II - KINKED LEAD (3.4.2(c))



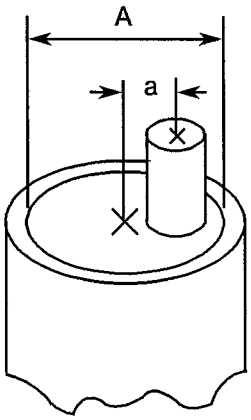
NOTES
1. Bent and re-bent lead. Rejected if A is more than 2.0mm within 20mm of case.

FIGURE III - LEAD DEVIATING FROM SPECIFIED DIRECTION (3.4.2(d))



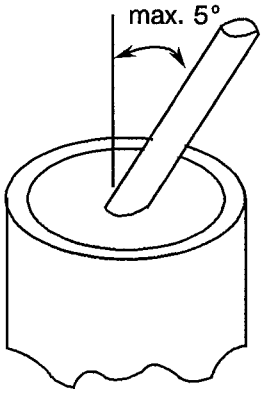
NOTES
1. Rejected if A is more than 1.0mm per 5.0mm of length.

FIGURE IV - ECCENTRICITY OF LEAD (3.4.2(e))



NOTES
1. Rejected if a is more than 10% of A.

FIGURE V - TILTED LEAD (3.4.2(f))



3.4.3 Case Sealing and Eyelet Solder Condition (See Figures VI and VII) (When Applicable)

(a) Holes or lack of uniformity or continuity of solder around the complete perimeter of the case.

(b) Solder protruding beyond the edge of the case.

(c) Weld spatters, lack of uniformity or continuity of weld.

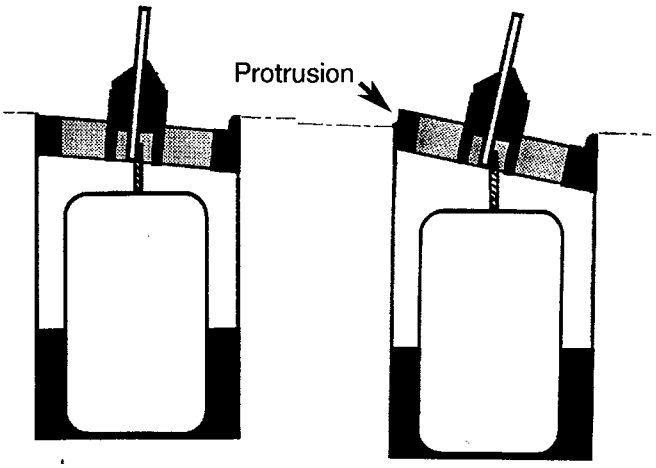
(d) Reduction of design sealing area by more than 30% due to undercutting of sealing material or misalignment of case parts.

(e) Glass cover tilted more than acceptable.

(f) Holes or cracks in the eyelet soldering.

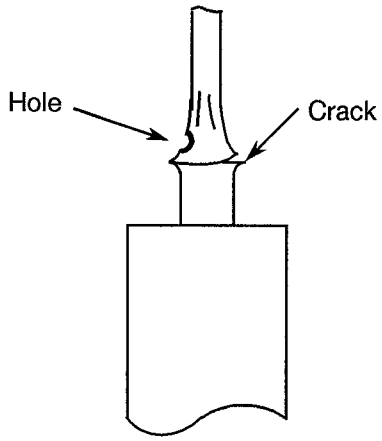
(g) Solder protruding beyond the edge of the eyelet or longer than 0.5mm.

FIGURE VI - COCKED SEALING AREA (3.4.3(e))



NOTES
1. The glass cover shall not protrude beyond the end of the case.

FIGURE VII - DEFECTS IN EYELET SOLDERING (3.4.3(f))



NOTES
1. Rejected if holes or cracks are visible.

3.4.4 Glass Seals

(a) Filling protruding above the level of the case flange.

(b) Bubbles in the seal whose diameter exceeds 12.5% of the seal diameter, or a collection of smaller bubbles which cannot be separated from each other or whose spatial distribution cannot be determined.

(c) Foreign material embedded in the glass.

(d) Chips or cracks of any length, shape or position except meniscus crazing.

3.4.5 Can

(a) Drops of solder on the can.

(b) Any deformation of the can.

(c) Corrosion or discolouration of the can.

3.5 SURFACE MOUNTED CAPACITORS

Such as:

- Solid electrolytic tantalum and aluminium chip capacitors.
  (For Ceramic-dielectric Chip Capacitors, see ESA/SCC Basic Specification No. 20430 "Internal Visual Inspection of Fixed Capacitors", Para. 3.6).

3.5.1 Terminal Condition (See Figure VIII)

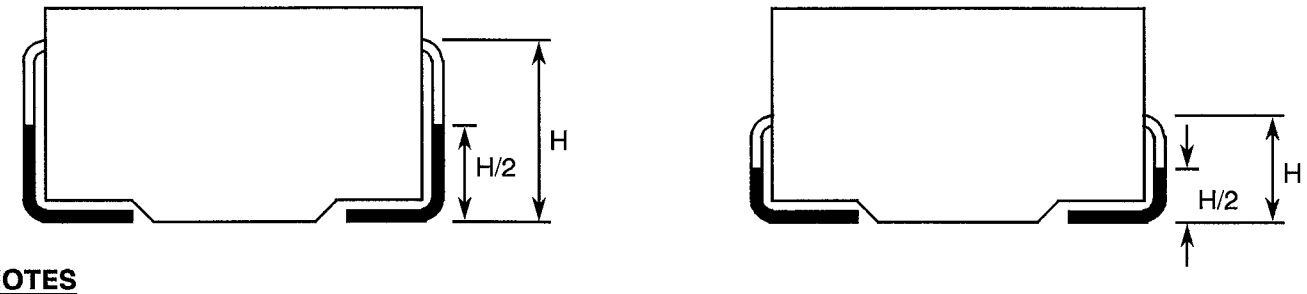
(a) Corrosion is evident.

(b) Exposed base material.

(c) Non-conductive material on the terminals beyond H/2 of tab from the body moulding/termination interface.

(d) Reduction of tab width or thickness by more than 10%.

FIGURE VIII - NON-CONDUCTIVE MATERIAL ON TERMINALS (3.5.1(c))



NOTES

1. Rejected if non-conductive material on marked parts of terminals (H/2).

3.5.2 Terminal Configuration (See Figures IX and X)

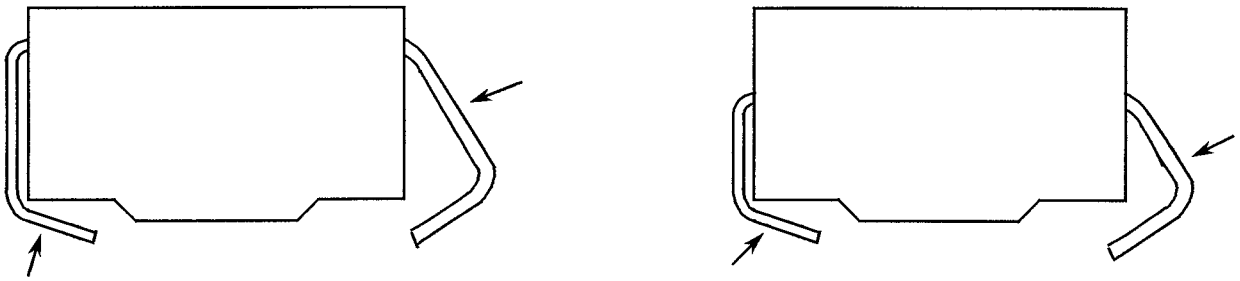
(a) Terminals twisted more than 5°.

(b) Terminal bends around the body moulding are not the nominal 90°.

(c) Terminals projecting from body.

(d) Terminals kinked or bent and re-bent, other than for design, so that distance "A" in Figure X is more than 1.0mm.

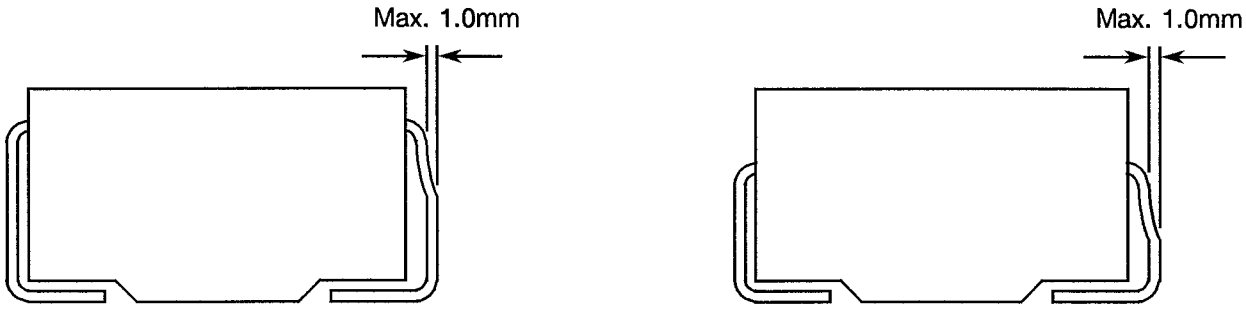
FIGURE IX - TERMINALS PROJECTING FROM BODY (3.5.2(c))



NOTES

1. Rejected if terminals projecting from body.

FIGURE X- KINKED TERMINAL (3.5.2(d))



NOTES

1. Rejected if marked distance is more than 1.0mm.

3.5.3 Body Coating or Moulding

(a) Any holes, voids or cracks visible at a magnification of maximum 10×.

(b) Device body or body lead connections not covered by coating or moulding.

(c) Chipping of coating or moulding when the chipped area exceeds 5% of the affected case side.

(d) Embedded foreign material.

(e) Discolouration of coating or moulding.

3.6 LEADED EPOXY-MOULDED OR COATED CAPACITORS

Such as:

- Ceramic-dielectric capacitors.
- Mica-dielectric capacitors.
- Plastic-dielectric capacitors.

3.6.1 Lead Condition

(a) Corrosion is evident.

(b) Exposed base material, in excess of the lead diameter or thickness, caused by chipped body moulding.

(c) Exposed base material anywhere on the lead within a distance of 20mm of the moulding/ termination interface, other than that caused by (b).

(d) Exposed base material in excess of 5% of the surface area anywhere on the lead, beyond a distance of 20mm from the moulding/termination interface.

(e) Non-conductive material on the lead beyond a distance of 1.5mm from the case.

(f) Reduction of lead diameter, width or thickness by more than 10%, within 20mm of the case.

(g) Nicks, fractures, non-uniformity or discolouration of coating or abrasions exposing base material.

3.6.2 Lead Configuration (See Figures XI to XIV)

(a) Straight round leads twisted more than 1 revolution per 30mm of length.

(b) Flat leads twisted more than 10° per any 10mm.

(c) Leads kinked or bent and re-bent within 20mm of the case, other than for design, so that distance "A" as in Figure XII is more than 2.0mm.

(d) Leads deviating from the specified direction, by a straight line or by a soft bend, by more than 1.0mm per any 5.0mm of length.

(e) Lead tilted by more than 5°.

FIGURE XI- TWISTED STRAIGHT ROUND LEAD (3.6.2(a))

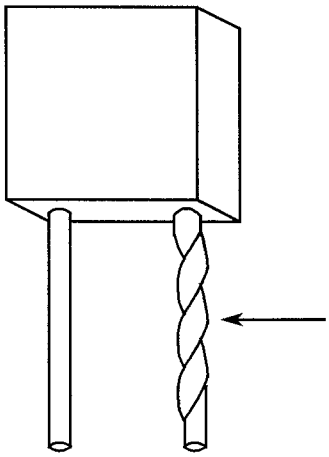
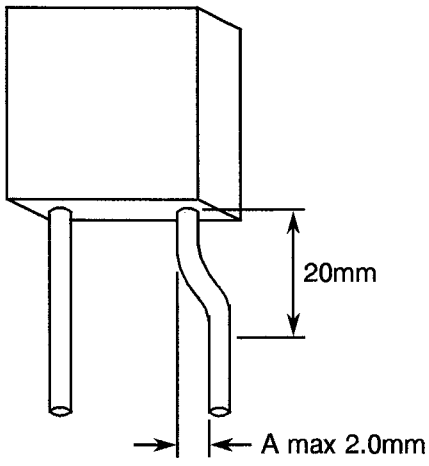


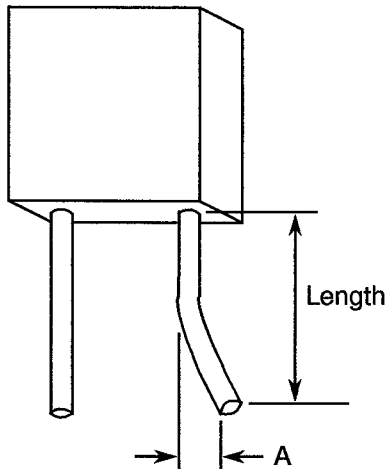
FIGURE XII- KINKED OR BENT LEAD (3.6.2(c))



NOTES

1. Bent and re-bent lead. Rejected if A is more than 2.0mm within 20mm of case.

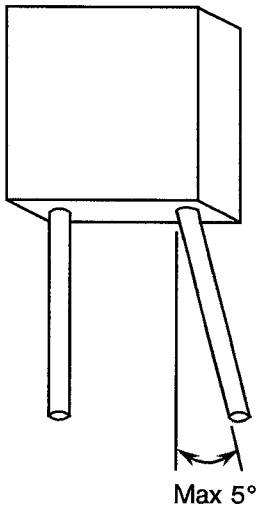
FIGURE XIII- LEAD DEVIATION FROM SPECIFIED DIRECTION (3.6.2(d))



NOTES

1. Rejected if A is more than 1.0mm per 5.0mm of length.

FIGURE XIV- TILTED LEAD (3.6.2(e))



3.6.3 Body Coating or Moulding

(a) Any holes, voids or cracks visible at a magnification of maximum 10×.

(b) Device body or body lead connections not covered by coating or moulding.

(c) Chipping of coating or moulding when the chipped area exceeds 5% of the affected case side.

(d) Embedded foreign material.

(e) Discolouration of coating or moulding.

3.6.4 Epoxy Seals (When Applicable)

(a) Unevenness in meniscus of epoxy.

(b) Spillage of epoxy on body.

(c) Cracks, chips or evidence of bubbles in the epoxy.

(d) Discolouration or foreign material in the epoxy.

3.7 GLASS-DIELECTRIC CAPACITORS

3.7.1 Lead Condition

(a) Corrosion evident.

3.7.2 Lead Welding

(a) Width of the weld spot less than 70% of wire diameter.

(b) Weld spot out of centre by more than 20% of the wire diameter or width.

(c) There must be evidence of good mechanical bonding between wire and capacitor plates.

3.7.3 Capacitor Plates

(a) Cracks or holes that exceed 0.2mm in major dimension.

(b) Disconnections.

(c) Corrosion

3.7.4 Glass Plates

(a) Capacitor plates extending beyond glass plates.

(b) Voids, pin-holes or chips in the glass that exceed 0.2mm in major dimension.

(c) Any crack that exceeds 0.2mm in length.