



europaean space agency
agence spatiale européenne

Pages 1 to 11

**INTERNAL VISUAL INSPECTION OF
CAPACITORS**

ESA/SCC Basic Specification No. 2043000



**space components
coordination group**

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 1	September 1994	<i>Pommes</i>	<i>[Signature]</i>
Revision 'A'	May 1996	<i>Pommes</i>	<i>[Signature]</i>

**SCC**ESA/SCC Basic Specification
No. 2043000

Rev. 'A'

PAGE 2

ISSUE 1

DOCUMENTATION CHANGE NOTICE


Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
'A'	May '96	P1. Cover page P2. DCN P9. Para. 3.6.1(b)	: Text rewritten	None None 221301

**TABLE OF CONTENTS**

	<u>Page</u>
1. <u>SCOPE</u>	4
2. <u>GENERAL REQUIREMENTS</u>	4
2.1 Applicability	4
2.2 Procedure	4
2.3 Magnification	4
2.4 Mounting Fixtures	4
3. <u>DETAILED REQUIREMENTS</u>	4
3.1 General	4
3.2 Tantalum Capacitors	4
3.2.1 Tantalum Pellet	4
3.2.2 Termination	5
3.3 Plastic-dielectric Capacitors	5
3.3.1 Termination Clearance	5
3.3.2 Terminal Leads	5
3.3.3 Insulation	6
3.3.4 Winding	6
3.4 Mica-dielectric Capacitors	6
3.4.1 Lead Conditions	6
3.4.2 Lead Welding	6
3.4.3 Contact Area between Mica Plates	6
3.4.4 Mica Plates	7
3.5 Filter/Feed-through Capacitors	7
3.5.1 Discoidal Capacitors	7
3.5.2 Tubular Capacitors	8
3.5.3 Ferrite Sleeve	9
3.5.4 Coils	9
3.5.5 Metal-plated Parts	9
3.5.6 Sub-assembly or Pre-encapsulation Inspection	9
3.6 Ceramic-dielectric Non-feed-through Capacitors	9
3.6.1 Ceramic Surface Defects	9
3.6.2 End Metallisation Defects	10
3.6.3 Terminal Lead Defects	10

FIGURES

I	Tantalum Pellet	5
II	Termination	5
III	Termination Clearance	6
IV	Insulation Tape	6
V	Mica-dielectric Capacitors	7
VI	Discoidal Capacitors	8
VII	Tubular Capacitors	8
VIII	Electrode Plates Visible	9
IX	Holes, Chips and Cracks	9
X	End Metallisation Defects	10
XI	End Metallisation Defects	10
XII	Gaps Between Lead and Ceramic Slug	10
XIII	Gaps Between Lead Nail and Ceramic Slug	10
XIV	Solder Spike	11
XV	Solder Spike and Short Terminal Length	11
XVI	Cracks or Notches in the Bending Area	11

	<p style="text-align: center;">ESA/SCC Basic Specification No. 2043000</p>		<p>PAGE 4 ISSUE 1</p>
---	--	--	---------------------------

1. SCOPE

This specification, to be read in conjunction with ESA/SCC Basic Specification No. 20400, "Internal 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 components shall be submitted to examination immediately prior to sealing or encapsulation, or immediately after decapping, in an area where the standard of cleanliness is not less than that of the assembly area.

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 $\times 1$ to $\times 10$.

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.

3.2 TANTALUM CAPACITORS (SOLID/WET/CHIP)

3.2.1 Tantalum Pellet (See Figure I)

- (a) No silver coat. (Solid electrolyte capacitors).
- (b) Silver coat over top of pellet shoulder or less than H/2. (Solid electrolyte capacitors).
- (c) Non-uniform colour of dielectric, which proves uneven thickness of that layer. (Wet electrolyte capacitors).

3.2.2 Termination (See Figure II)

- (a) Inadequate weld of tantalum wire to terminal. There must be evidence of good mechanical bonding between the terminal and the tantalum lead. The decrease or increase in diameter due to the weld must not exceed $D/4$.
- (b) Bent tantalum wire on pellet - maximum deviation 5° .
- (c) The anode terminal shall be positioned and joined to the tantalum pellet such that there is evidence of good mechanical bonding and the dimensions of the unit will permit correct alignment of element in its mould/case.

FIGURE I - TANTALUM PELLET (3.2.1)

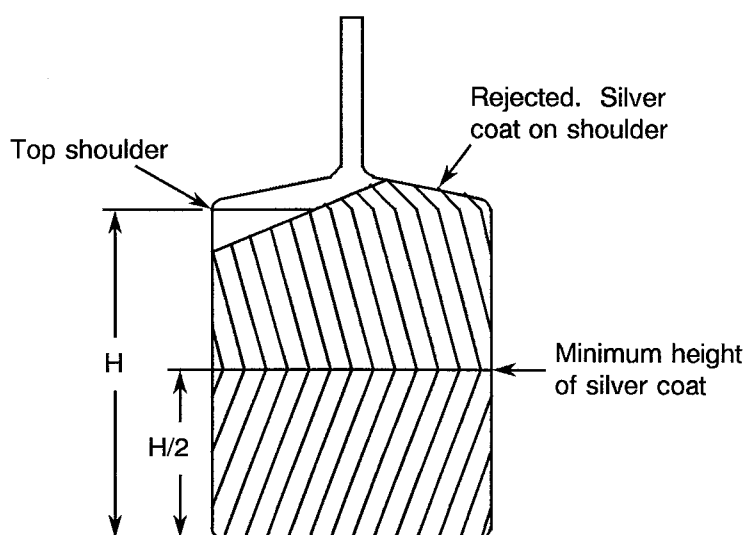
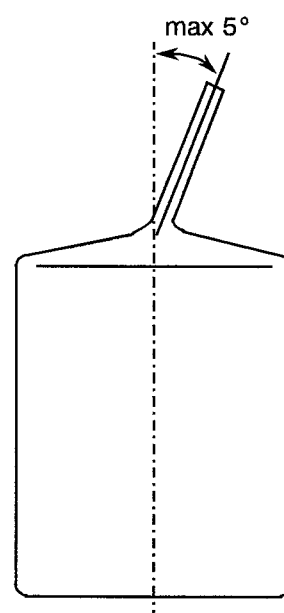


FIGURE II - TERMINATION (3.2.2)



3.3 PLASTIC-DIELECTRIC CAPACITORS

3.3.1 Termination Clearance (See Figure III)

- (a) Contact metallisation does not cover 90% of the capacitor winding contact area (metallised turns of the winding only considered).
- (b) Sharp edges or overlapping on the contact metallisation that reduces termination clearance to less than 75% of original.
- (c) Top points of the contact metallisation higher than 0.5mm.

3.3.2 Terminal Leads

- (a) Corrosion evident.
- (b) Holes greater than 20% of the area covered by the terminal lead soldering.
- (c) Location of the terminal lead soldering not allowing for correct alignment of element in its mould/case.
- (d) Unattached solder globules.

3.3.3 Insulation (See Figure IV)

- (a) Edges of the contact area of the winding less than 100% covered by the insulation tape.
- (b) Insulation with cracks or holes.

3.3.4 Winding

- (a) Sheets overflowing beyond edge of winding.
- (b) Warped winding ("telescoping").

FIGURE III - TERMINATION CLEARANCE (3.3.1)

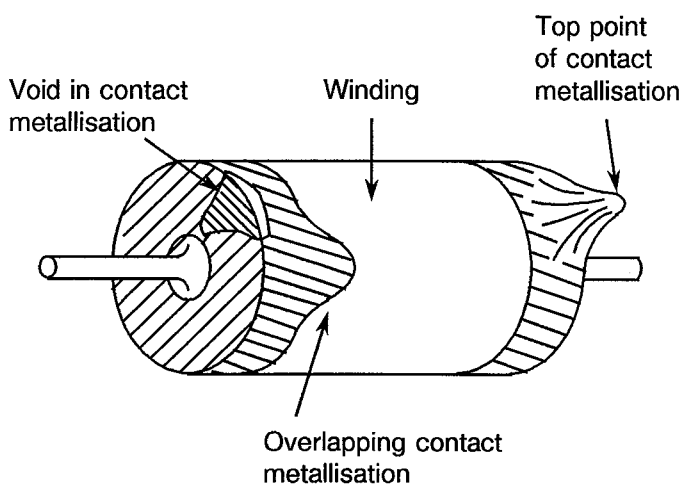
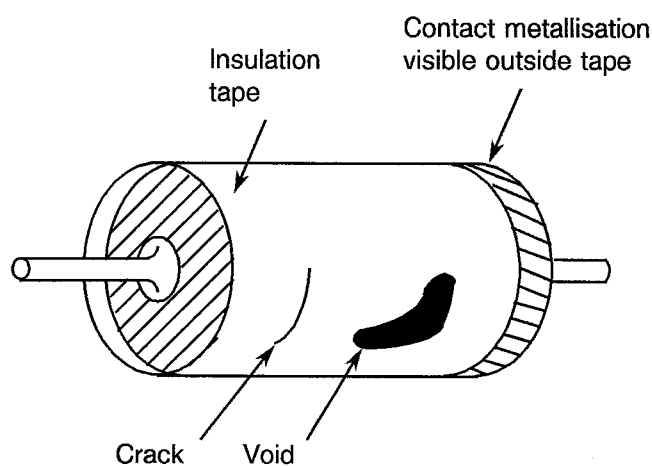


FIGURE IV - INSULATION TAPE (3.3.3)



3.4 MICA-DIELECTRIC CAPACITORS

3.4.1 Lead Conditions

- (a) Corrosion evident.
- (b) Cracks or notches in the bending area of the terminal leads.

3.4.2 Lead Welding

- (a) Width of the weld spot less than 70% of wire diameter.
- (b) Wire thickness reduced by welding by more than 10% of its original thickness.
- (c) Weld spot out of centre by more than 20% of the wire diameter or width.

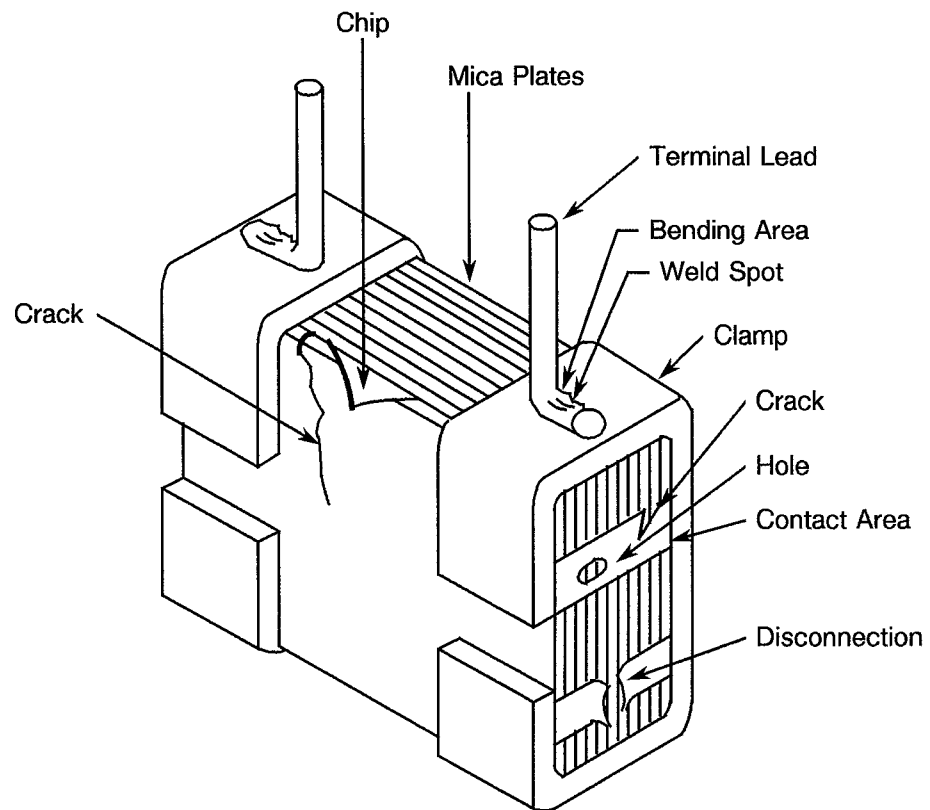
3.4.3 Contact Area between Mica Plates (See Figure V)

- (a) Cracks.
- (b) Disconnections.
- (c) Holes.

3.4.4 Mica Plates

- (a) Cracked or broken glass.
- (b) Chips in the plates that exceed 0.2mm in major dimension.
- (c) Misalignment of plates.

FIGURE V - MICA-DIELECTRIC CAPACITORS (3.4.3)



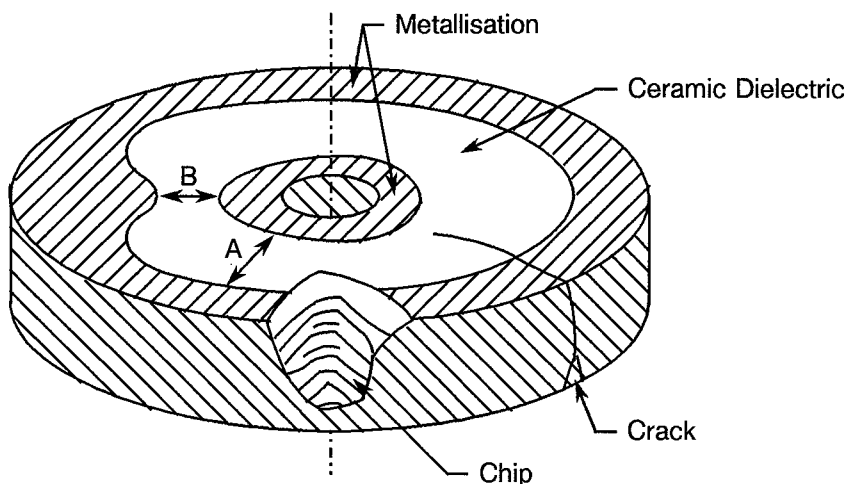
3.5 FILTER/FEED-THROUGH CAPACITORS (CERAMIC-DIELECTRIC)

3.5.1 Discoidal Capacitors (See Figure VI)

- (a) Cracks, buckling or delaminations in the ceramic dielectric.
- (b) Chips, voids or pin-holes in the ceramic dielectric that exceed 0.2mm in major dimension or penetrate to within 1 dielectric thickness of a buried electrode.
- (c) Discontinuity or lifting of metallisation.
- (d) Surface metallisation that reduces termination clearance to less than 75% of original radial distance between inner and outer termination.
- (e) Foreign matter or contamination.
- (f) Solder flux, balls, spikes, splashes or loose solder on pre-tinned components.



FIGURE VI - DISCOIDAL CAPACITORS (3.5.1)



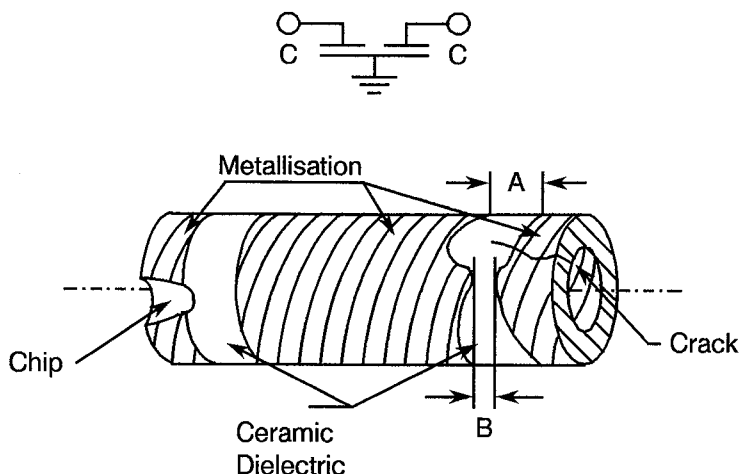
NOTES

1. Termination Clearance. Reject if B less than 75% of A.

3.5.2 Tubular Capacitors (See Figure VII)



- (a) Cracks or buckling of the ceramic dielectric.
- (b) Chips, voids or pin-holes in the ceramic dielectric that exceed 0.2mm in major dimension or penetrate to within 1 dielectric thickness of a buried electrode.
- (c) Discontinuity or lifting of metallisation.
- (d) Surface metallisation that reduces termination clearance to less than 75% of original radial distance between inner and outer termination.
- (e) Foreign matter or contamination.
- (f) Solder flux, balls, spikes, splashes or loose solder on pre-tinned components.

FIGURE VII - TUBULAR CAPACITORS (3.5.2)



NOTES

1. Termination Clearance. Reject if B less than 75% of A.

 	<p>ESA/SCC Basic Specification No. 2043000</p>	<p>Rev. 'A'</p>	<p>PAGE 9 ISSUE 1</p>
---	--	-----------------	---------------------------

3.5.3 Ferrite Sleeve (Inductive Element)

- (a) Cracked or broken ferrites.
- (b) Chips exceeding 10% of cross-sectional area.

3.5.4 Coils (Inductive Element)

- (a) Cracked, broken or chipped cores.
- (b) Kinks, bends or nicks in wire that reduce diameter by more than 10%.

3.5.5 Metal-plated Parts

- (a) Burrs, damaged threads or dents.
- (b) Discontinuity, flaking or discolouration of plating.

3.5.6 Sub-assembly or Pre-encapsulation Inspection

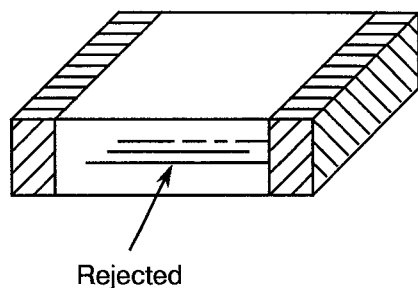
- (a) Excessive solder or metallic bridging between inner and outer capacitor electrode that reduces clearance to less than 75% of original radial distance between inner and outer termination.
- (b) Solder balls, spikes, splashes or loose solder.
- (c) Solder flux.
- (d) Defects in capacitor elements as defined in Paras. 3.5.1 and 3.5.2.
- (e) Defects in inductive elements as defined in Paras. 3.5.3 and 3.5.4.
- (f) Damage or defects in lead or body; damage or defects in plating of these elements.
- (g) Misalignment or eccentricity of sub-assembly elements.
- (h) Solder fillet of inner or outer capacitor terminations less than 75% complete.

3.6 CERAMIC-DIELECTRIC NON-FEED-THROUGH CAPACITORS

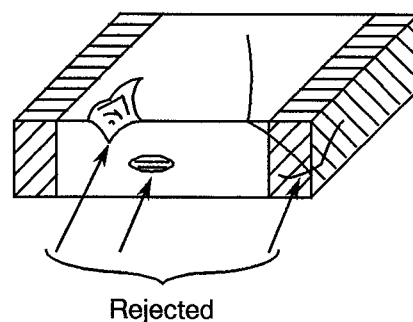
3.6.1 Ceramic Surface Defects (See Figures VIII and IX)

- (a) Electrode plates visible.
- (b) Voids, pin-holes or chips in the ceramic dielectric that exceed 5% of the major dimension or 0.2mm, whichever is greater, or penetrate to within 1 effective dielectric thickness of a buried electrode.
- (c) Cracks, buckling, or delaminations in the ceramic dielectric.
- (d) Solder spots, conducting smear, flux and/or foreign material.

**FIGURE VIII - ELECTRODE PLATES
VISIBLE (3.6.1 (a))**



**FIGURE IX - HOLES, CHIPS AND
CRACKS (3.6.1 (b), (c))**





3.6.2 End Metallisation Defects (See Figures X and XI)

- (a) End metallisation spikes: Distance A exceeds dimension E by more than 0.2mm.
- (b) Pad separation: Distance B exceeds dimension C so that the pad separation is reduced by more than 25%.
- (c) Voids in the end metallisation where distance D is larger than 25% of dimension C.
- (d) Holes and cracks in the end metallisation which fail the criterion of 3.6.2 (c), or are larger than 0.2mm in major dimension.
- (e) Evidence of poor bonding between the end metallisation and the plates.
- (f) Evidence of poor bonding between the end metallisation and the leads.
- (g) For tinned types, the end metallisation shall cover at least 75% of the total surface to be metallised. The remaining 25% of the surface may contain pinholes or rough spots smaller than 0.2mm in major dimension, but these shall not be concentrated in one area.

FIGURE X - END METALLISATION DEFECTS (3.6.2 (a), (b))

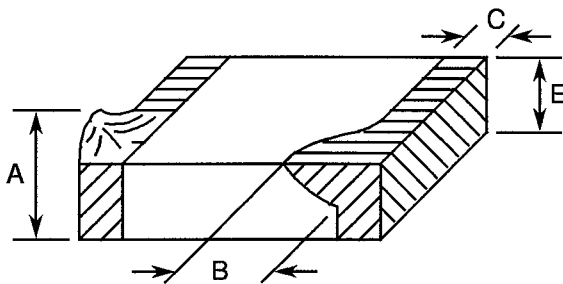
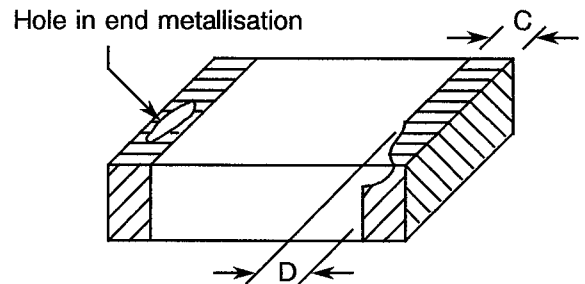


FIGURE XI - END METALLISATION DEFECTS (3.6.2 (c), (d))



3.6.3 Terminal Lead Defects (See Figures XII to XVI)

- (a) Gaps between lead and ceramic slug larger than 20% of soldering interface A.
- (b) Gaps larger than 20% of the lead nail head diameter B.
- (c) Solder spikes exceeding ceramic slug by more than 0.2mm.
- (d) Contact length K between terminal lead and ceramic slug less than 75% of the body length C.
- (e) Cracks or notches in the bending area of terminal leads.
- (f) Corrosion evident.

FIGURE XII - GAPS BETWEEN LEAD AND CERAMIC SLUG (3.6.3 (a))

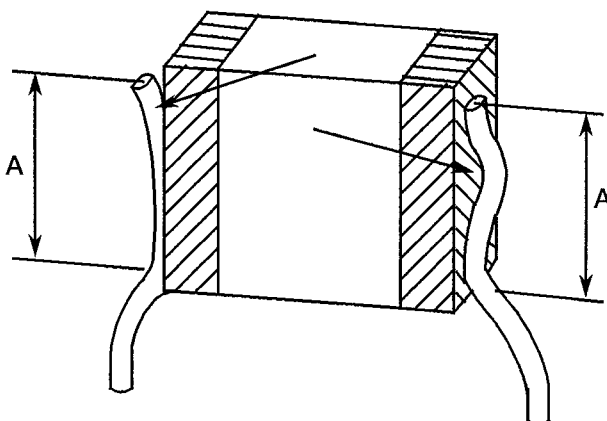


FIGURE XIII - GAPS BETWEEN LEAD NAIL AND CERAMIC SLUG (3.6.3 (b))

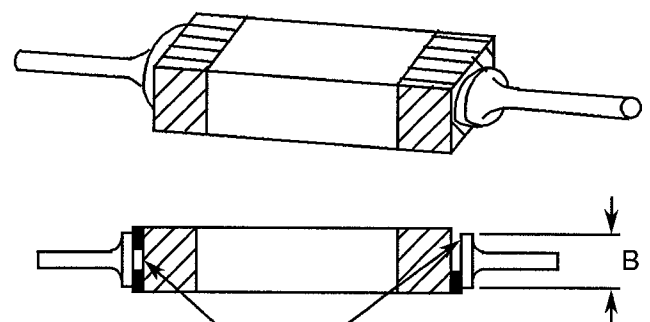


FIGURE XIV - SOLDER SPIKE (3.6.3 (c))

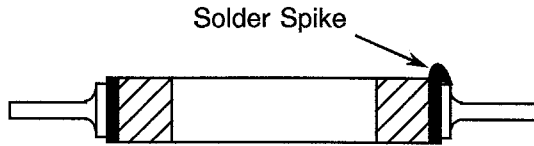


FIGURE XV - SOLDER SPIKE AND SHORT TERMINAL LENGTH (3.6.3 (c), (d))

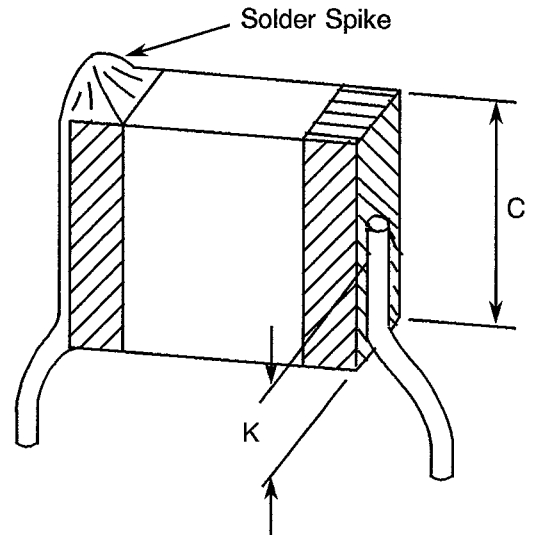


FIGURE XVI - CRACKS OR NOTCHES IN THE BENDING AREA (3.6.3 (e))

