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Pages 1 to 16

**CAPACITORS, CHIP, TANTALUM,**

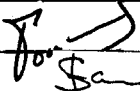
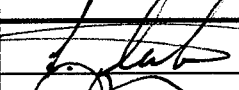
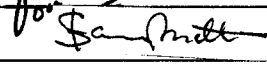
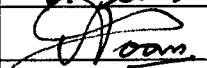
**SOLID ELECTROLYTE,**

**BASED ON TYPE 2213**

**ESA/SCC Detail Specification No. 3011/006**

**SCC**

**space components  
coordination group**

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Rev. 'A'

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ISSUE 1

**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
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**APPENDICES (Applicable to specific Manufacturers only)**

None.

**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Chip, Tantalum, Solid Electrolyte, based on Type 2213. It shall be read in conjunction with ESA/SCC Generic Specification No. 3011, the requirements of which are supplemented herein.

**1.2 RANGE OF COMPONENTS**

The range of capacitors covered by this specification is scheduled in Table 1(a).

**1.3 MAXIMUM RATINGS**

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the capacitors specified herein, are as scheduled in Table 1(b).

**1.4 PARAMETER DERATING INFORMATION**

The parameter derating information applicable to the capacitors specified herein, is shown in Figure 1.

**1.5 PHYSICAL DIMENSIONS**

The physical dimensions of the capacitors specified herein, are shown in Figure 2.

**1.6 FUNCTIONAL DIAGRAM**

The functional diagram of the capacitors specified herein, is shown in Figure 3.

**2. APPLICABLE DOCUMENTS**

The following document forms part of this specification and shall be read in conjunction with it:-

(a) ESA/SCC Generic Specification No. 3011 for Capacitors, Chip, Tantalum, Solid Electrolyte.

**3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS**

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply



**TABLE 1(a) - RANGE OF COMPONENTS**

Capacitance Value (μF)	Tolerance (±%)	Rated Voltage (U <sub>R</sub> ) (V)
1.5	10	50
2.2		50
3.3		40
4.7		25
6.8		20
10	20	16
15		10
22		6.3
33		4.0

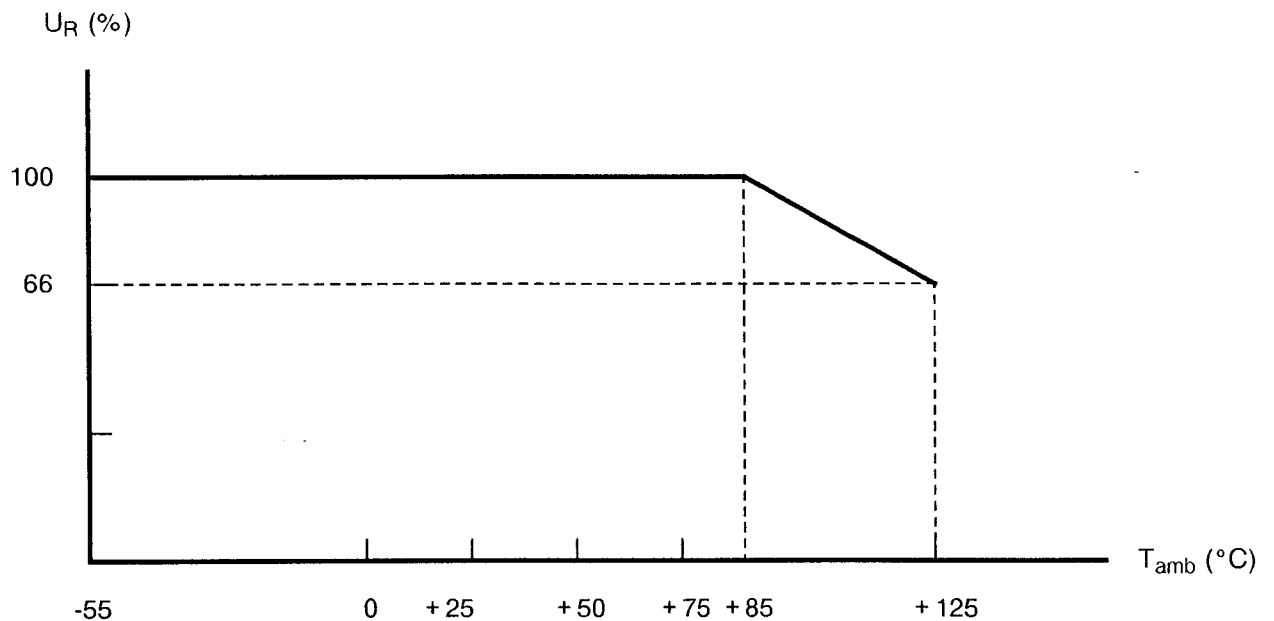
**TABLE 1(b) - MAXIMUM RATINGS**

No.	Characteristics	Symbol	Maximum Ratings	Units	Remarks
1	Rated d.c. Voltage	U <sub>R</sub>	See Table 1(a)	V	Note 1
2	Surge Voltage (d.c.)	U <sub>S</sub>	1.30 U <sub>R</sub>	V	
3	Operating Temperature Range	T <sub>op</sub>	-55 to +125	°C	T <sub>amb</sub>
4	Storage Temperature Range	T <sub>stg</sub>	-55 to +125	°C	
5	Soldering Temperature	T <sub>sol</sub>	+260	°C	Soldering time: ≤ 10 seconds

**NOTES**

- At T<sub>amb</sub> ≤ +85°C. For derating at T<sub>amb</sub> > +85°C, see Figure 1.

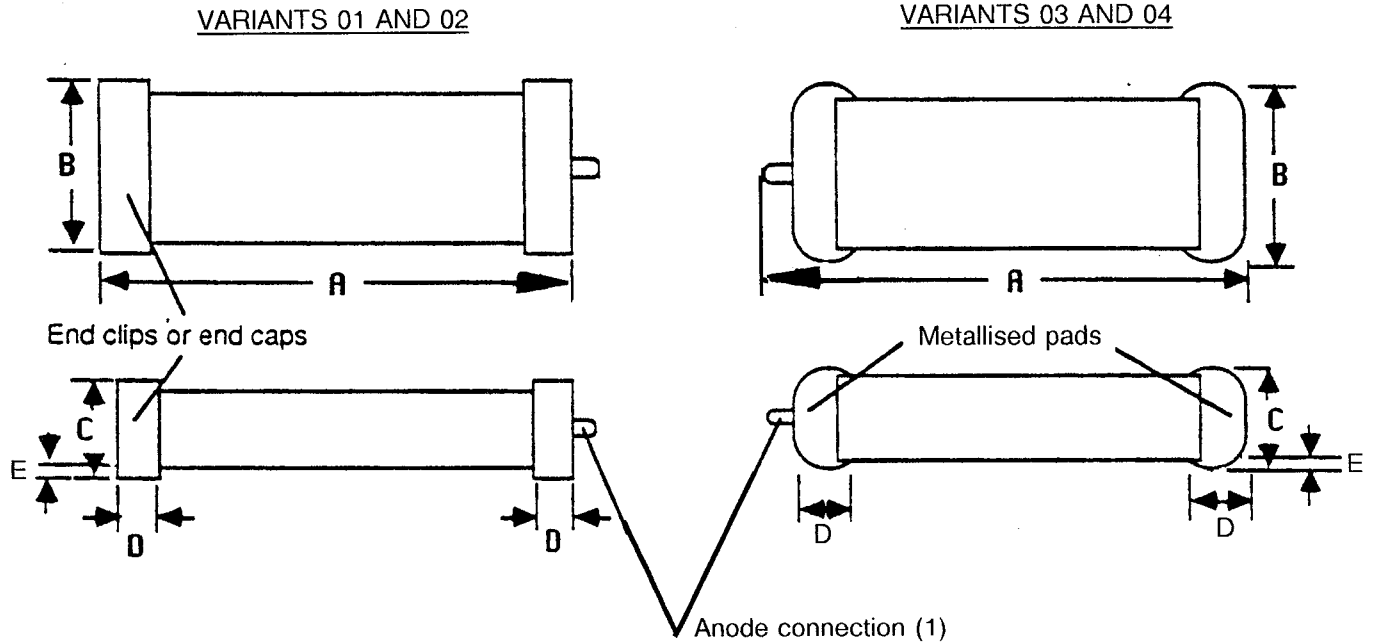
**FIGURE 1 - PARAMETER DERATING INFORMATION**



Rated Voltage versus Temperature



**FIGURE 2 - PHYSICAL DIMENSIONS**

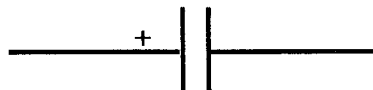


	A		B		C		D		E	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Variants 01 & 02	5.2	6.0	3.0	3.8	1.4	2.2	0.6	1.2	-	0.15
Variants 03 & 04	5.2	6.4	3.0	4.2	1.4	2.6	0.6	1.2	-	0.35

**NOTES**

1. All dimensions in millimetres.
2. The anode terminal shall be identified by the riser wire connection, which extends from the case by 0.4mm max.
3. For type variants 03 and 04, the measurement of the length will be performed including the riser wire.

**FIGURE 3 - FUNCTIONAL DIAGRAM**





#### 4. REQUIREMENTS

##### 4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein are stated in this specification and ESA/SCC Generic Specification No. 3011 for Capacitors, Chip, Tantalum, Solid Electrolyte. Deviations from the Generic Specification, applicable to this specification only, are detailed in Para 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

##### 4.2 DEVIATIONS FROM GENERIC SPECIFICATION

###### 4.2.1 Deviations from Special In-process Controls

None.

###### 4.2.2 Deviations from Final Production Tests (Chart II)

None.

###### 4.2.3 Deviations from Burn-in Tests (Chart III)

None.

###### 4.2.4 Deviations from Qualification Tests (Chart IV)

None.

###### 4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

##### 4.3 MECHANICAL REQUIREMENTS

###### 4.3.1 Dimension Check

The dimensions of the capacitors specified herein shall be verified in accordance with the requirements set out in Para 9.3 of ESA/SCC Generic Specification No. 3011 and shall conform to those shown in Figure 2 of this specification.

###### 4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.25 grammes.

###### 4.3.3 Adhesion

The requirements for adhesion are specified in Para 9.5 of ESA/SCC Generic Specification No. 3011.

###### 4.3.4 Damp Heat (Steady State)

The requirements for damp heat (steady state) testing are specified in Section 9 of ESA/SCC Generic Specification No. 3011. The duration of the test shall be 56 days.





#### 4.4 Materials and Finishes

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the capacitors specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

##### 4.4.1 Case

Not applicable.

##### 4.4.2 Terminations

The capacitors shall be terminated in accordance with the requirements of ESA/SCC Basic Specification No. 23500, as follows:-

(a) **Variant 01:**

With clips or end caps Type 'E' with Type '2' finish.

(b) **Variant 02:**

With clips or end caps Type 'E' with Type '3' finish.

(c) **Variant 03:**

With pads of Silver Loaded Epoxy Resin with Type '2' finish.

(d) **Variant 04:**

With pads of Silver Loaded Epoxy Resin with Type '3' finish.

#### 4.5 MARKING

##### 4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. These components being too small to accommodate the marking as specified hereafter, the marking information in full shall accompany each component in its primary package. The information to be marked and the order of precedence shall be as follows:-

- (a) The SCC Component Number.
- (b) Electrical Characteristics and Ratings.
- (c) Traceability Information.

##### 4.5.2 The SCC Component Number

The SCC Component Number shall be constituted and marked as follows:-

3011006 01B

Detail Specification Number \_\_\_\_\_

Type Variant, (see Para. 4.4.2) \_\_\_\_\_

Testing Level (B or C, as applicable) \_\_\_\_\_

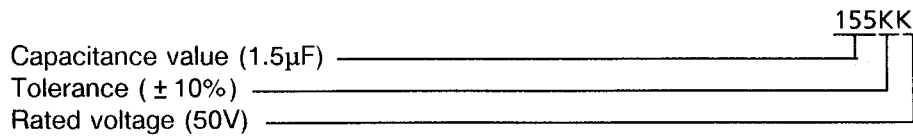


4.5.3 Electrical Characteristics and Ratings

The electrical characteristics and ratings to be marked in the following order of precedence are:-

- (a) Capacitance value.
- (b) Tolerance.
- (c) Rated voltage.

The information shall be constituted and marked as follows:



4.5.3.1 Capacitance

The capacitance values shall be expressed by means of the following codes. The unit quantity for marking shall be picofarads.

Capacitance Value	Code
XX10 <sup>4</sup>	XX4
XX10 <sup>5</sup>	XX5
XX10 <sup>6</sup>	XX6

4.5.3.2 Tolerance



The tolerance on capacitance values shall be indicated by the code letters specified hereafter.

Tolerance (%)	Code letter
± 10	K
± 20	M

4.5.3.3 Rated Voltage

The rated voltage shall be indicated by the code letters specified hereafter.

Rated Voltage (V)	Code Letter
50	K
40	J
25	G
20	F
16	E
10	D
6.3	A
4.0	M

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#### 4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESA/SCC Basic Specification No. 21700. The information to be marked shall be as follows:-

- (a) Manufacturing date code.
- (b) Serial number.
- (c) Manufacturer's name.

#### 4.5.5 Polarity

Polarity shall be indicated as given in Note 2 to Figure 2.

### 4.6 ELECTRICAL MEASUREMENTS

#### 4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C.

#### 4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3.

#### 4.6.3 Circuits for Electrical Measurements

Not applicable.

### 4.7 BURN-IN TESTS

#### 4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C. The parameter drift values ( $\Delta$ ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit values specified in Table 2 shall not be exceeded.

On completion of burn-in, a recovery period of  $24 \pm 2$  hours is necessary before the performance of the end measurements.

#### 4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 3011. The conditions for burn-in shall be as specified in Table 5(a) of this specification.

#### 4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable.



**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE**

No.	Characteristics	Symbol	ESA/SCC 3011 Test Method	Test Conditions	Limits		Unit	Remarks	
					Min.	Max.			
1	Capacitance	$C_n$	Para. 9.4.1.1	$V_T \leq 0.5V_{rms}$ $V_P = 2.1 \text{ to } 2.5V$ $f = 100 \pm 5Hz$ or $f = 120 \pm 5Hz$	$C_n$ -10 -20	$C_n$ +10 +20	$\mu F$ % %	See Table 1(a)	
2	D.C. Leakage Current	$I_L$	Para. 9.4.1.2	$V_T = U_R \pm 2\%$ Series Resistor = $1k\Omega$	-	(Note1)	$\mu A$		
3	Dissipation Factor	DF	Para. 9.4.1.3	$f = 100 \pm 5Hz$ or $f = 120 \pm 5Hz$	-	$C_n \leq 10\mu F$ 6	$C_n > 10\mu F$ 8	%	

**NOTES**

1.  $0.01C \times U_R$  or 1.0, whichever is the greater.

**TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES**

No.	Characteristics	Symbol	ESA/SCC 3011 Test Method	Test Conditions (Note 1)	Limits			Unit	Remarks	
					Min.	Max.				
1	Capacitance	$C_n$	Para. 9.4.1.1	$V_T \leq 0.5V_{rms}$ $V_P = 2.1 \text{ to } 2.5V$ $f = 100 \pm 5Hz$ or $f = 120 \pm 5Hz$ - $55^\circ C$ , + $85^\circ C$ + $125^\circ C$	$C_n$ -10 -15	$C_n$ +10 +15		$\mu F$ % %	See Table 1(a)	
2	D.C. Leakage Current	$I_L$	Para. 9.4.1.2	$V_T = U_R \pm 2\%$ Series Resistor = $1k\Omega$ + $85^\circ C$ + $125^\circ C$	- -	(Note 2) (Note 3)		$\mu A$		
3	Dissipation Factor	DF	Para. 9.4.1.3	$f = 100 \pm 5Hz$ or $f = 120 \pm 5Hz$ - $55^\circ C$ + $85^\circ C$ , + $125^\circ C$	-	$C_n \leq 10\mu F$ 8 8	$C_n > 10\mu F$ $C < 22\mu F$ 10 8	$C \geq 22\mu F$ 12 10	%	

**NOTES**

1. Inspection Level II, Single Sampling, AQL 2.5% for each capacitance value. Each capacitance value shall be considered as constituting a complete lot.
2.  $0.1C \times U_R$  or 10, whichever is the greater.
3.  $0.12C \times U_R$  or 12, whichever is the greater.

**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

Not applicable

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	Characteristic	Symbol	Spec. and/or Test Method	Test Conditions	Change Limits ( $\Delta$ )	Unit	Remarks
1	Capacitance	$\Delta C/C$	As per Table 2	As per Table 2	$\pm 5$	%	
2	D.C. Leakage Current	$\Delta I_L/I_L$	As per Table 2	As per Table 2	(Note 1)	%	Note 2

**NOTES**

1. Whichever is smaller from +200% of initial value or (+25% [ +0.05 $\mu$ A]) of limit value given in Table 2.
2. Leakage currents less than 0.1 $\mu$ A are considered as 0.1 $\mu$ A value.

**TABLE 5(a) - CONDITIONS FOR BURN-IN**

No.	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	$T_{amb}$	+125	$^{\circ}$ C
2	Test Voltage	$V_T$	0.66 $U_R$	V

**TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTS**

No.	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	$T_{amb}$	+85 $^{\circ}$ C +125 $^{\circ}$ C	$^{\circ}$ C
2	Test Voltage	$V_T$	Rated Voltage (1) Derated Voltage	V

**NOTES**

1. The test voltage shall be the rated voltage (see Table 1(a)) for  $T_{amb} = +85^{\circ}$ C and the derated voltage (see Figure 1) for  $T_{amb} = +125^{\circ}$ C.

**FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TESTS**

Not applicable



- 4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3011)
- 4.8.1 Measurements and Inspections on Completion of Environmental Tests  
The parameters to be measured and inspections to be performed on completion of environmental testing are scheduled in Table 6. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C.
- 4.8.2 Measurements and Inspections at Intermediate Points during Endurance Tests  
The parameters to be measured and inspections to be performed at intermediate points during endurance tests are scheduled in Table 6. The measurements shall be performed at the temperatures specified for the test.
- 4.8.3 Measurements and Inspections on Completion of Endurance Tests  
The parameters to be measured and inspections to be performed on completion of endurance tests are scheduled in Table 6. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C.
- 4.8.4 Conditions for Operating Life Tests (Part of Endurance Testing)  
The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 3011. The conditions for operating life testing shall be as specified in Table 5(b) of this specification.
- 4.8.5 Electrical Circuit for Operating Life Tests (Figure 5)  
Not applicable.



**TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING**

No.	ESA/SCC GENERIC SPEC. No. 3011		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Visual Inspection	Para. 9.1	Visual Inspection	ESA/SCC No. 20400	-	-	-	-
02	Mounting on Substrates	Para. 9.2	<b>Final Measurements</b> Capacitance D.C. Leakage Current Dissipation Factor Visual Examination	Table 2 Item 1 Table 2 Item 2 Table 3 Item 3 Good Tinning	C I <sub>L</sub> DF -	Table 2 Item 1 (2) Table 2 Item 2 Table 2 Item 3 - -	-	-
03	Adhesion	Para. 9.5	<b>Final Examination</b> Visual Examination  Capacitance	No damage or loosening from substrate  Table 2 Item 1	-  C	-  Table 2 Item 1	-	-
04	Solderability	Para. 9.6	Visual Examination	No damage	-	-	-	-
05	Rapid Change of Temperature	Para. 9.7	<b>Initial Measurements</b> Capacitance  <b>Final Measurements</b>  Visual Examination  Capacitance Change D.C. Leakage Current Dissipation Factor	Table 2 Item 1 or value recorded in 02 After 4 hours minimum recovery No corrosion, mechanical damage or obliteration of marking Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C  -  ΔC/C I <sub>L</sub> DF	Table 2 Item 1  -  -5.0 +5.0 Table 2 Item 2 Table 2 Item 3	-	%
06	Vibration	Para. 9.8	<b>Intermediate Measurements</b> Electrical Measurements  <b>Final Examination</b> Visual Examination	During last cycle Intermittent operation, intermittent contact, arcing, open or shorts  No damage	-  -	-  -	-	-
07	Shock or Bump	Para. 9.9	<b>Final Examination</b> Visual Examination	No damage	-	-	-	-
08	Climatic Sequence  Dry Heat  Cold Test  Damp Heat	Para. 9.10  Para. 9.10.2  Para. 9.10.4  Para. 9.10.6	<b>Initial Measurements</b> Capacitance  <b>Intermediate Measurements</b> Capacitance Change D.C. Leakage Current  <b>Intermediate Measurements</b> Capacitance Change  <b>Final Measurements</b>  Visual Inspection Capacitance Change D.C. Leakage Current Dissipation Factor	Value recorded in 02 At High Temperature Table 3 Item 1 Table 3 Item 2 At Low Temperature Table 3 Item 1 Recovery Period 1 to 24 hours Gen. 3011, Para. 9.10.7 Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C  ΔC/C I <sub>L</sub>  ΔC/C  - ΔC/C I <sub>L</sub> DF	Table 2 Item 1  Table 3 Item 1 Table 3 Item 2  Table 3 Item 1  - - -10 +10 Table 2 Item 2 - Note 3	-	%

**NOTES:** See Page 16.



**TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONTINUED)**

No.	ESA/SCC GENERIC SPEC. No. 3011		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
09	Damp Heat (Steady-State)	Para. 9.11 and Para. 4.3.4 of this specification	<b>Initial Measurements</b> Capacitance <b>Final Measurements</b> Visual Examination Capacitance Change D.C. Leakage Current Dissipation Factor	Value recorded in 02 Recovery Period 6 to 24 ± 2 hours No damage Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C - ΔC/C I <sub>L</sub> DF	Table 2 Item 1 - -10 Table 2 Item 2 -	- - +10 Note 3	- %
10	High and Low Temperature Stability	Para. 9.12	Capacitance Change D.C. Leakage Current at all but Step 2 Dissipation Factor	Table 3 Item 1 Table 3 Item 2 Table 3 Item 3	ΔC/C I <sub>L</sub> DF	Table 3 Item 1 Table 3 Item 2 Table 3 Item 3		
11	Surge Voltage	Para. 9.13	<b>Final Measurements</b> Capacitance D.C. Leakage Current Dissipation Factor	After temperature stabilisation Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C I <sub>L</sub> DF	Table 2 Item 1 Table 2 Item 2 Table 2 Item 3		
12	Operating Life	Para. 9.15	<b>Initial Measurements</b> Capacitance D.C. Leakage Current Dissipation Factor <b>Intermediate Measurements</b> D.C. Leakage Current <b>Final Measurements</b> Capacitance Change D.C. Leakage Current Dissipation Factor Visual Examination	Value recorded in 02 Table 2 Item 2 Table 2 Item 3 At 250 and 1000 hours At High Temperature Table 3 Item 2 At 1000 and 2000 hours and after 24 hours recovery Table 2 Item 1 Table 2 Item 2 Table 2 Item 3 No damage	C I <sub>L</sub> DF I <sub>L</sub> ΔC/C I <sub>L</sub> DF -	Table 2 Item 1 Table 2 Item 2 Table 2 Item 3 Table 3 Item 2 Table 2 Item 2 Table 2 Item 3	-5.0 +5.0 -	% -
13	Permanence of Marking	Para. 9.17	<b>Final Examination</b> Visual Examination	ESA/SCC No. 24800	-	-	-	-

**NOTES**

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Value to be recorded.
3. 1.2 x value specified in Table 2 Item 3.