



**CAPACITORS, FIXED,
CERAMIC DIELECTRIC, TYPE I,
HIGH VOLTAGE, 1.0 to 5.0 kV
RADIAL LEADED DEVICE
ESCC Detail Specification No. 3001/035**

**ISSUE 1
October 2002**



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**CAPACITORS, FIXED,
CERAMIC DIELECTRIC, TYPE I,
HIGH VOLTAGE, 1.0 to 5.0 kV
RADIAL LEADED DEVICE**

ESA/SCC Detail Specification No. 3001/035



**space components
coordination group**

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**SCC**ESA/SCC Detail Specification
No. 3001/035

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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.	
'A'	Feb. '02	P1. Cover Page	:	None	
		P2. DCN	:	None	
		P6. Table 1(a)	:	Unit of Capacitance amended	
			:	Variant 02, Weight amended	
		P7. Table 1(a)	:	Unit of Capacitance amended	
			:	Variant 04, 2.0kV values amended	
			:	Variant 05, 1.0kV values amended	
		P9. Figure 2(a)	:	Dimension H, redrawn on diagram	
		P10. Figure 2(b)	:	Dimension H, redrawn on diagram	
		P11. Para. 4.2.1	:	(a) 3, Force amended to 10 Newtons	
			:	Deviation (a) added	
		P13. Para. 4.5.3	:	Capacitance Value changed to "pF"	
			:	Table amended	
			:	Table amended	
		P18. Table 6	:	No. 01 "Test Method and Conditions" 2nd paragraph reference changed	
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**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Capacitor, Fixed, Ceramic Dielectric, Type I, High Voltage, 1.0 to 5.0kV, Radial Leaded Devices. It shall be read in conjunction with ESA/SCC Generic Specification No. 3001, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS AND RANGE OF COMPONENTS

The variants and range of components covered by this specification are given 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 scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION (FIGURE 1)

Not applicable.

1.5 PHYSICAL DIMENSIONS

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

1.6 FUNCTIONAL DIAGRAM

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

2. APPLICABLE DOCUMENTS

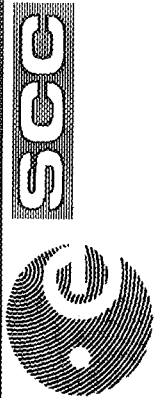
The following documents form part of this specification and shall be read in conjunction with it:-

- (a) ESA/SCC Generic Specification No. 3001 for Capacitors, Fixed, Ceramic Dielectric, Types I and II.

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. In addition the following symbol is used:-

V_T = Test Voltage.



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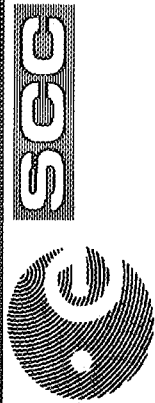
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TABLE 1(a) - TYPE VARIANTS AND RANGE OF COMPONENTS

Variant	Case Size	Figure	Capacitance Range (pF)				Weight (g)
			1.0kV	2.0kV	3.0kV	4.0kV	
01	1515	2(a)	470	270	220	100	1.0
			560	330	270	120	
			680	390	-	150	
			820	470	-	180	
			1 000	560	-	-	
02	2020	2(b)	680	470	330	100	2.0
			820	560	390	120	
			1 000	680	470	150	
			1 200	820	560	180	
			1 500	1 000	-	220	
			1 800	1 200	-	270	
			-	-	-	300	
-	-	-	330				

NOTES: See Page 7.



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TABLE 1(a) - TYPE VARIANTS AND RANGE OF COMPONENTS

Variant	Case Size	Figure	Capacitance Range (pF)					Weight (g)
			1.0kV	2.0kV	3.0kV	4.0kV	5.0kV	
03	2520	2(a)	1 200	680	330	270	120	3.0
			1 500	820	390	330	150	
			1 800	1 000	470	-	180	
			2 200	1 200	560	-	220	
04	3333	2(a)	-	1 500	680	-	270	4.0
			3 300	2 200	1 200	820	560	
			3 900	2 700	1 500	1 000	680	
			4 700	3 300	1 800	1 200	820	
			5 600	3 900	2 200	-	-	
			6 800	4 700	-	-	-	
05	5440	2(b)	8 200	6 800	2 200	1 500	1 000	7.0
			10 000	8 200	2 700	1 800	1 200	
			12 000	10 000	3 300	2 200	1 500	
			15 000	-	3 900	2 700	1 800	

NOTES

1. The capacitors are available in $\pm 5\%$ and $\pm 10\%$ tolerances.

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

No.	Characteristics	Symbol	Limits		Unit	Remarks
			Min.	Max.		
1	Rated Voltage	U_R	See Table 1(a)		V	
2	Operating Temperature Range	T_{op}	-55	+125	°C	Without derating. T_{amb}
3	Storage Temperature Range	T_{stg}	-55	+125	°C	
4	Soldering Temperature	T_{sol}	-	+260	°C	Note 1

NOTES

1. Duration 5 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

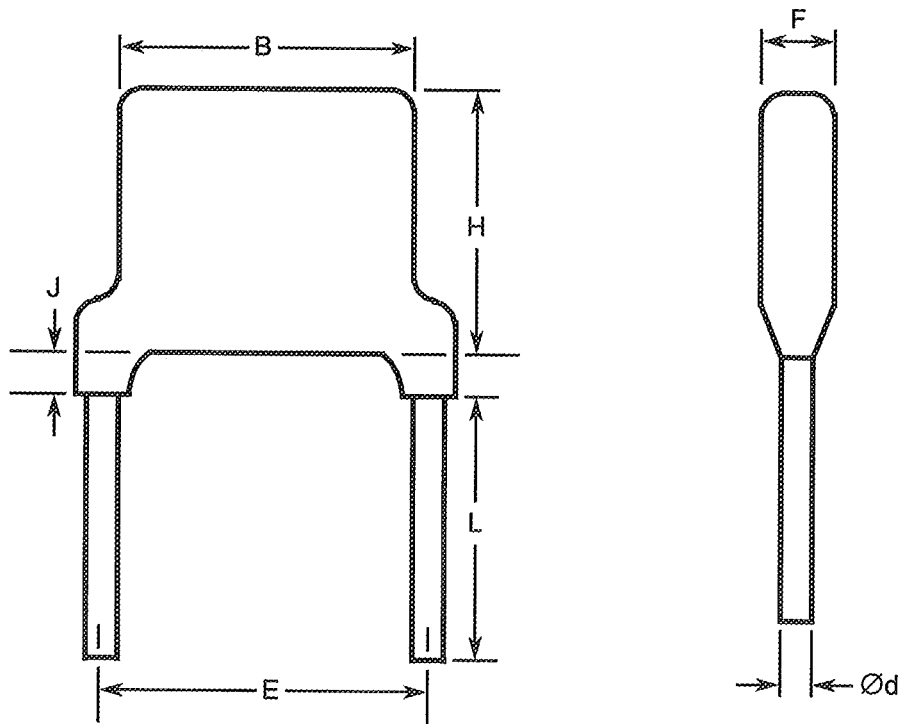
FIGURE 1 - PARAMETER DERATING INFORMATION

Not applicable.



FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a)

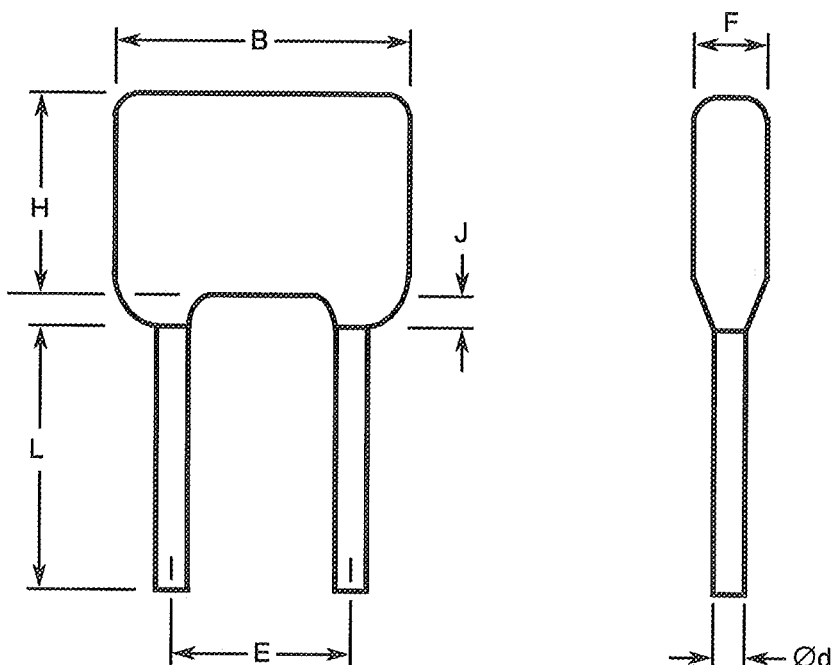


Variant	Case Size	Dimensions (mm)									Voltage
		B (max)	Ød		E		F (max)	H (max)	J (max)	L (min)	
			min	max	min	max					
01	1515	6.3	0.54	0.66	4.58	5.58	5.2	5.8	2.5	25	1 to 4kV
03	2520	8.9	0.54	0.66	7.12	8.12	5.2	7.1	2.5	25	1 to 2kV
03	2520	8.9	0.54	0.66	7.12	8.12	5.8	7.1	2.5	25	3 to 5kV
04	3333	11.4	0.81	0.99	9.66	10.66	5.8	10.4	2.5	25	1 to 4kV
04	3333	11.4	0.81	0.99	9.66	10.66	7.2	10.4	2.5	25	5kV



FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b)



Variant	Case Size	Dimensions (mm)									Voltage
		B (max)	Ød		E		F (max)	H (max)	J (max)	L (min)	
02	2020	7.6	0.54	0.66	4.58	5.58	5.2	7.1	2.5	25	1.0 to 4.0kV
05	5440	16.7	0.81	0.99	14.74	15.74	5.8	12.2	2.5	25	1.0kV
05	5440	16.7	0.81	0.99	14.74	15.74	6.4	12.2	2.5	25	2.0 to 4.0kV
05	5440	16.7	0.81	0.99	14.74	15.74	7.7	12.2	2.5	25	5.0kV

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. 3001 for Capacitors, Fixed, Ceramic Dielectric, Types I and II. Deviations from the Generic Specification, applicable to this specification only, are listed 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

(a) Para. 5.2.3, "Robustness of Terminations": Shall be replaced with a "Lead Peel" test as follows:-

1. Where necessary, bend the leads of the capacitor through 90° in the plane of the joint.
2. Apply a tensile force to the bend section of the lead until the joint peels.
3. The minimum peeling force shall be 10 Newtons.

4.2.2 Deviations from Final Production Tests (Chart II)

(a) Para. 9.2.2, "Pre-conditioning": Shall not be performed.

4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

None.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 5.2.3, "Robustness of Terminations": Shall be replaced with a "Lead Peel" test as described in Para. 4.2.1 of this specification.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 5.2.3, "Robustness of Terminations": Shall be replaced with a "Lead Peel" test as described in Para. 4.2.1 of this specification.

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. 9.4 of ESA/SCC Generic Specification No. 3001 and they 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 as scheduled in Table 1(a).



4.3.3 Robustness of Terminations

The terminations of these devices are defined as 'rigid'.

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 Encapsulation

Shall be coated in epoxy resin.

4.4.2 Leads

The lead material shall be Type 'A' with Type '3' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the 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:-

Detail Specification Number _____ 300103501B
Type Variant (see Table 1(a)) _____
Testing level (B or C, as applicable) _____

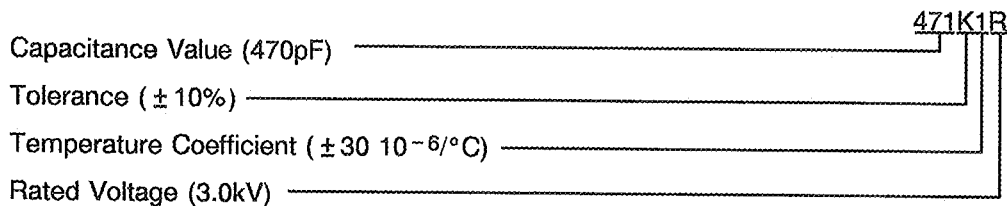


4.5.3 Electrical Characteristics and Ratings

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 Values

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

Capacitance Value	Code
XX10 ⁰	XX0
XX10 ¹	XX1
XX10 ²	XX2
XX10 ³	XX3

4.5.3.2 Tolerances

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

Tolerance (%)	Code Letter
± 5.0	J
± 10	K

4.5.3.3 Temperature Coefficient

The temperature coefficient shall be indicated by the code numbers specified hereafter.

10 ⁻⁶ /°C	Code Number
± 30	1



4.5.3.4 Rated Voltage

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

Rated Voltage (kV)	Code Letter
1.0	M
2.0	P
3.0	R
4.0	S
5.0	Z

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, 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. The measurements shall be performed at $T_{amb} = +125(+0 - 5)$ and $-55(+5 - 0)$ °C respectively.

4.6.3 Circuits for Electrical Measurements

A circuit for use in performing the electrical measurements listed in Table 2 of this specification is shown in ESA/SCC Generic Specification No. 3001.

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 stated, measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

The parameter drift values (Δ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 3001. The conditions for burn-in shall be as specified in Table 5 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 3001 Test Conditions	Limits		Unit
				Min	Max	
1	Capacitance	C	Para. 9.5.1.1	See Table 1(a)		pF
2	Tangent of Loss Angle	Tgδ	Para. 9.5.1.2	-	15	10 ⁻⁴
3	Insulation Resistance	Ri Ri × C	Para. 9.5.1.3 C ≤ 10 000pF C > 10 000pF	100 1000	- -	GΩ sec
4	Voltage Proof - Dielectric	VP	Para. 9.5.1.4 UR ≤ 1250V UR > 1250V	1.5UR 1.3UR	- -	V
5	Voltage Proof - Body Insulation	VP _B	Para. 9.5.1.4 UR ≤ 1250V UR > 1250V (Note 1)	1.5UR 1.3UR	- -	V

NOTES

- 5 samples only. If 1 failure occurs out of 5 parts, then test 100%. 1% rejects maximum allowed in case of 100% testing.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESA/SCC 3001 Test Conditions	Limits		Unit	Remarks
				Min	Max		
3	Insulation Resistance at T _{amb} = +125 ± 3 °C	Ri Ri × C	Para. 9.5.1.3 C ≤ 10 000pF C > 10 000pF	10 100	- -	GΩ sec	Notes 1 and 2
6(i)	Temperature Coefficient	TC	Para. 9.16 Between -55 and +20 ± 2 °C Between +20 ± 2 and +125 °C	-30 -30	+30 +30	10 ⁻⁶ /°C	5 parts for each capacitance value Notes 2 and 4
6(ii)	Temperature Coefficient	TC	Para. 9.16 Between +20 ± 2 and +125 °C	-30	+30	10 ⁻⁶ /°C	5 parts for each fired ceramic lot Notes 3 and 4

NOTES

- Single sample: Inspection Level S3, AQL = 2.5%.
- Applicable to Level 'B' only.
- Applicable to Level 'C' only.
- If 1 failure occurs out of 5 parts, then test 100%. 1% rejects maximum allowed in the case of 100% testing.



FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Change Limits (Δ)	Unit
1	Capacitance Change	$\frac{\Delta C}{C}$	As per Table 2	As per Table 2	± 1.0	%

TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	+ 125(+ 0 - 3)	$^{\circ}C$
2	Test Voltage	V_T	$U_R \leq 1250V: 1.3U_R$ $U_R > 1250V: 1.0U_R$	V

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. 3001)

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 tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.

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. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.

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 testing are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$.

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. 3001. The conditions for operating life testing shall be as specified in Table 5 for the burn-in test

4.8.5 Electrical Circuit for Operating Life Tests (Figure 5)

Not applicable.



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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. 3001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT	
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.		
01	Robustness of Terminations	Para. 9.7 and Para. 4.2.1 of this specification	Visual Examination	-	-	-	-	-	
02	Resistance to Soldering Heat	Para. 9.8	Initial Measurements Capacitance	Table 2 Item 1	C	Table 2 Item 1			
			Final Measurements Capacitance Change Insulation Resistance	After a recovery period of 24 ± 2 hours Table 2 Item 1 Table 2 Item 3	ΔC/C Ri or Ri × C	-1.0	+1.0		%
03	Solderability	Para. 9.9	Visual Examination	-	-	-	-	-	
04	Rapid Change of Temperature	Para. 9.10	Initial Measurements Capacitance	Table 2 Item 1	C	Table 2 Item 1			
			Final Measurements Visual Examination Capacitance Change Tangent of Loss Angle	After a recovery period of 24 ± 2 hours - Table 2 Item 1 Table 2 Item 2	- ΔC/C Tgδ	-	-		-
05	Vibration	Para. 9.11	During Last Cycle Intermittent Contact	Para. 9.11.3 Open or Shorts	-	-	-	-	
			After Test Visual Examination	-	-	-	-	-	
06	Shock or Bump	Para. 9.12	Visual Examination	-	-	-	-	-	
07	Climatic Sequence	Para. 9.13	Initial Measurements Capacitance	Table 2 Item 1	C	Table 2 Item 1			
			Final Measurements	After a recovery period of 1 to 24 hours	-	-	-		-
			External Visual Inspection	Para. 9.3 of ESA/SCC 3001	-	-	-		-
			Capacitance Change	Table 2 Item 1	ΔC/C	-2.0	+2.0		%
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	2 × Table 2 Item 2			
Insulation Resistance	Table 2 Item 3	Ri or Ri × C	10	-	GΩ				
Voltage Proof - Body Insulation	Table 2 Item 5	VP _B	100	-	sec				
						Table 2 Item 5			

NOTES

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.



TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

NO.	ESA/SCC GENERIC SPEC.NO. 3001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
08	Damp Heat, Steady State	Para. 9.14	Initial Measurements Capacitance Final Measurements Visual Examination Capacitance Change Tangent of Loss Angle Insulation Resistance Voltage Proof - Body Insulation	Table 2 Item 1 After a recovery period of 6 to 24 ± 2 hours - Table 2 Item 1 Table 2 Item 2 Table 2 Item 3 Table 2 Item 5	C - ΔC/C Tgδ Ri or Ri × C VP _B	Table 2 Item 1 - -2.0 2 × Table 2 Item 2 10 100 Table 2 Item 5	- - +2.0 - - - Table 2 Item 5	% GΩ sec
09	Operating Life	Para. 9.15 Change limits relate to initial (0- hour) measurements	Initial Measurements Capacitance Intermediate Measurements Capacitance Change Insulation Resistance Final Measurements Capacitance Change Tangent of Loss Angle Insulation Resistance Voltage Proof - Dielectric Voltage Proof - Body Insulation Visual Examination	Table 2 Item 1 After a recovery period of 1 hour minimum Table 2 Item 1 Table 2 Item 3 After a recovery period of 24 ± 2 hours Table 2 Item 1 Table 2 Item 2 Table 2 Item 3 Table 2 Item 4 Table 2 Item 5 -	C ΔC/C Ri or Ri × C ΔC/C Tgδ Ri or Ri × C VP VP _B -	Table 2 Item 1 -3.0 10 100 -3.0 2 × Table 2 Item 2 10 100 Table 2 Item 4 Table 2 Item 5 -	- +3.0 - - +3.0 - - Table 2 Item 4 Table 2 Item 5 -	% GΩ sec % GΩ sec -
10	Temperature Coefficient	Para. 9.16	Temperature Coefficient	Table 3 Item 6(i) or 6(ii)	TC	Table 3 Item 6(i) or 6(ii)		

NOTES

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.



APPENDIX 'A'

AGREED DEVIATIONS FOR TEKELEK TEMEX (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS	
Para. 4.2.1	The selection of sample for micro-sectioning examination may be performed as follows.	
	Case Size	Number of Devices
	1515	10
	2020	10
	2520	8
	3333	8
	5440	6