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Pages 1 to 17

**CAPACITORS, FIXED, CHIPS,
CERAMIC DIELECTRIC, TYPE I,
BASED ON TYPE 2220**

ESA/SCC Detail Specification No. 3009/006



**space components
coordination group**

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**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 5 and incorporates all modifications defined in Revision 'A' to Issue 5 and the following DCR's:- Cover page DCN Table 1(a) : Capacitance range increased Table 1(b) : No. 2, TC deleted and subsequent tests renumbered Para. 3 : Text added Para. 4.7 : Title amended Table 2 : No. 4, Symbol corrected Table 3 : Nos. 1, 2, 3, renumbered to "3", "5(i)", "5(ii)" respectively and Notes transferred from Characteristics column to Remarks column Table 5 : In new 5(i) and 5(ii), Para. reference changed to "9.11" Para. 4.8 : No. 2, Test Voltage increased to "2.0U _R " Paras 4.8.1/2/3 : Title amended Table 6 : First sentence amended Table 6 : Rewritten		None None 221132 221069 23680 221069 23680 221069 221124 221069 23680 23680 221069/ 221124/ 23680
'A'	Dec. '95	P1. Cover page P2. DCN P4. T of C P6. Table 1(a) P7. Figure 2 P15. Table 6 P16. Table 6 P16. Appendix 'A'	: Page count amended : Appendix 'A' page number amended : Component Ranges amended : In the Drawing, dimension 'M' amended : Contents amended : New page added : Page number amended to "17" : Vitramon document number amended	23795 None 23795 221292 221291 23795 23795 23795 23756
'B'	Apr. '97	P1. Cover page P2. DCN P6. Table 1(a)	: Range extended for 100V values	None None 221388
'C'	Oct. '97	P1. Cover page P2. DCN P6. Table 1(a) P7. Figure 2 P9. Para. 4.4.1	: In Note 1, "5" amended to "6" : In the Table, "06" added to "Variants 01, 03" heading : Variant 06 details added : "N.B." added	221431 221431 221431 221431 221431
'D'	May '98	P1. Cover page P2. DCN P8. Para. 4.2.2	: "None." deleted and Deviation added	None None 221446

**SCC**ESA/SCC Detail Specification
No. 3009/006

PAGE 3

ISSUE 6

TABLE OF CONTENTS

	<u>Page</u>
1. <u>GENERAL</u>	5
1.1 Scope	5
1.2 Range of Components	5
1.3 Maximum Ratings	5
1.4 Parameter Derating Information	5
1.5 Physical Dimensions	5
1.6 Functional Diagram	5
2. <u>APPLICABLE DOCUMENTS</u>	8
3. <u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u>	8
4. <u>REQUIREMENTS</u>	8
4.1 General	8
4.2 Deviations from Generic Specification	8
4.2.1 Deviations from Special In-process Controls	8
4.2.2 Deviations from Final Production Tests	8
4.2.3 Deviations from Burn-in and Electrical Measurements	8
4.2.4 Deviations from Qualification Tests	8
4.2.5 Deviations from Lot Acceptance Tests	8
4.3 Mechanical Requirements	8
4.3.1 Dimension Check	8
4.3.2 Weight	9
4.3.3 Adhesion	9
4.4 Materials and Finishes	9
4.4.1 Terminations	9
4.5 Marking	9
4.5.1 General	9
4.5.2 The SCC Component Number	9
4.5.3 Electrical Characteristics and Ratings	10
4.5.4 Traceability Information	11
4.6 Electrical Measurements	11
4.6.1 Electrical Measurements at Room Temperature	11
4.6.2 Electrical Measurements at High and Low Temperatures	11
4.6.3 Circuits for Electrical Measurements	11
4.7 Burn-in Tests	11
4.7.1 Parameter Drift Values	11
4.7.2 Conditions for Burn-in	11
4.7.3 Electrical Circuits for Burn-in	11
4.8 Environmental and Endurance Tests	14
4.8.1 Measurements and Inspections on Completion of Environmental Tests	14
4.8.2 Measurements and Inspections at Intermediate Points during Endurance Tests	14
4.8.3 Measurements and Inspections on Completion of Endurance Tests	14
4.8.4 Conditions for Operating Life Tests	14
4.8.5 Electrical Circuits for Operating Life Tests	14

**SCC**ESA/SCC Detail Specification
No. 3009/006

Rev. 'A'

PAGE 4

ISSUE 6

TABLESPage

1(a)	Range of Components	6
1(b)	Maximum Ratings	7
2	Electrical Measurements at Room Temperature	12
3	Electrical Measurements at High and Low Temperatures	12
4	Parameter Drift Values	13
5	Conditions for Burn-in and Operating Life Tests	13
6	Measurements and Inspections on Completion of Environmental Tests and at Intermediate Points and on Completion of Endurance Testing	15

FIGURES

1	Parameter Derating Information	7
2	Physical Dimensions	7
3	Functional Diagram	7
4	Test Circuits	13
5	Electrical Circuit for Burn-in and Operating Life Tests	13

APPENDICES (Applicable to specific Manufacturers only)

'A'	Agreed Deviations for Vitramon Ltd. (UK)	17
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**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Chips, Ceramic Dielectric, Type I, based on Type 2220. It shall be read in conjunction with ESA/SCC Generic Specification No. 3009, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of capacitors covered by this specification is 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 as 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.

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

CAPACITANCE RANGE (pF)	TOLERANCE (\pm) (%)	VALUES SERIES	RATED VOLTAGE (U_R) (V)
464 to 22600	1.0	E 96	100
464 to 22600	2.0	E 48	100
470 to 22000	5.0	E 24	100
470 to 22000	10	E 12	100
464 to 39200	1.0	E 96	50
464 to 40200	2.0	E 48	50
470 to 39000	5.0	E 24	50
470 to 39000	10	E 12	50
464 to 39200	1.0	E 96	25
464 to 40200	2.0	E 48	25
470 to 39000	5.0	E 24	25
470 to 39000	10	E 12	25

NOTES

1. As specified in Para. 4.4.1 and Figure 2, these ranges are available in 6 variants.



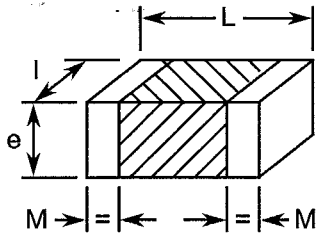
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	LIMITS		UNIT	REMARKS
			MIN.	MAX.		
1	Rated Voltage	U_R	See Table 1(a)		V	-
2	Operating Temperature Range	T_{amb}	-55	+125	°C	Without derating
3	Storage Temperature Range	T_{stg}	-55	+125	°C	-
4	Maximum Soldering Temperature	T_{sol}	-	+260	°C	Soldering time: t: <10 sec.

FIGURE 1 - PARAMETER DERATING INFORMATION

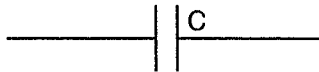
Not applicable.



FIGURE 2 - PHYSICAL DIMENSIONS



SYMBOL	DIMENSIONS (mm)			
	VARIANTS 01, 03, 06		VARIANTS 02, 04, 05	
	MIN.	MAX.	MIN.	MAX.
L	5.2	6.2	5.2	6.7
l	4.5	5.5	4.5	6.0
e	-	1.8	-	2.3
M	0.2	0.75	0.2	0.75

FIGURE 3 - FUNCTIONAL DIAGRAM



 	ESA/SCC Detail Specification No. 3009/006	Rev. 'D'	PAGE 8 ISSUE 6
---	--	----------	-------------------

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. 3009 for Capacitors, Fixed, Chips, 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 symbols are used:-

V_T = Test Voltage.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3009 for Capacitors, Fixed, Chips, 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

None.

4.2.2 Deviations from Final Production Tests (Chart II)

- (a) Para. 9.2.1, Drying: 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)

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. 3009 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 0.3 grammes.

4.3.3 Adhesion

The requirements for adhesion are specified in Para. 9.5 of ESA/SCC Generic Specification No. 3009.

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 Terminations

- Variant 01: The capacitors shall be terminated with AgPd pads.
- Variant 02: The capacitors shall be terminated with AgPd with solder coating, 62 Sn, 36 Pb, 2.0 Ag %, + 188°C.
- Variant 03: The capacitors shall be terminated with AgPdPt pads.
- Variant 04: The capacitors shall be terminated with AgPdPt with solder coating, 62 Sn, 36 Pb, 2.0 Ag %, + 188°C.
- Variant 05: The capacitors shall be terminated with Ag, Ni barrier with solder coating, 62 Sn, 36Pb, 2.0 Ag %, + 188°C.
- Variant 06: The capacitors shall be terminated with Ag, Ni barrier with coating tin-lead, near eutectic, minimum 10% lead.

All the above Variants are suitable for reflow soldering.

N.B.

Variant 06 is the preferred termination finish for the specified chip size (see Figure 2).

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.

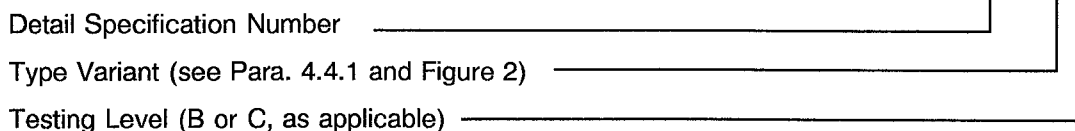
These components being too small to accommodate the marking as specified hereafter, the marking information in full shall accompany each component in its primary package. Such marking shall comprise:-

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

4.5.2 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:

300900601B



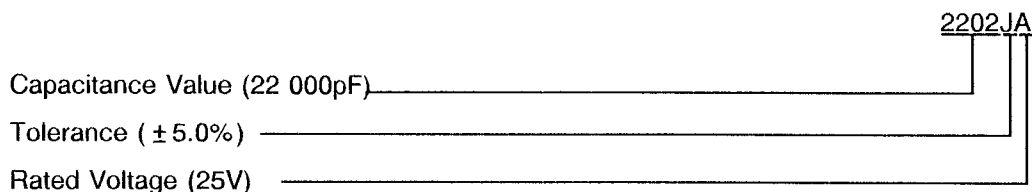


4.5.3 Electrical Characteristics and Ratings

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 (pF).

CAPACITANCE VALUE	CODE
XXX	XXX0
XXX10 ¹	XXX1
XXX10 ²	XXX2

4.5.3.2 Tolerances

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

TOLERANCE (%)	CODE LETTER
± 1.0	F
± 2.0	G
± 5.0	J
± 10	K

4.5.3.3 Rated Voltage

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

RATED VOLTAGE (U _R) (V)	CODE LETTER
25	A
50	C
100	E



4.5.4 Traceability Information

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

(a) Manufacturing Date Code.

(b) Manufacturer's Name.

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, 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

A circuit for use in performing the electrical measurements listed in Table 2 of this specification is shown in ESA/SCC Generic Specification No. 3009.

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 scheduled parameters 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. 3009. The conditions for burn-in shall be as specified in Table 5 of this specification.

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

4.7.3 Electrical Circuits for Burn-in (Figure 5)

Not applicable.

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

No.	CHARACTERISTICS	SYMBOL	ESASCC 3009 TEST CONDITIONS	LIMITS		UNIT
				MIN.	MAX.	
1	Capacitance	C	Para. 9.4.1.1	See Table 1(a)		-
2	Tangent of Loss Angle	T _{gδ}	Para. 9.4.1.2	-	15	10 ⁻⁴
3	Insulation Resistance	R _i	Para. 9.4.1.3	100(1)	-	GΩ
4	Voltage Proof	VP	Para. 9.4.1.4	2.5U _R	-	Vdc

NOTES

1. For C equal to, or less than 10 000pF.

For C greater than 10 000pF, R_i × C = 1 000 seconds minimum.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	ESASCC 3009 TEST CONDITIONS	LIMITS		UNIT	REMARKS
				MIN.	MAX.		
3	Insulation Resistance at +125 ± 3°C	R _i	Para. 9.4.1.3	10 000	-	MΩ	Notes 1, 2 and 4
5(i)	Temperature Coefficient	TC	Para. 9.11 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 5
5(ii)	Temperature Coefficient	TC	Para. 9.11 Between +20 ± 2 and +125°C	- 30	+ 30	10 ⁻⁶ /°C	5 parts for each dielectric lot. Notes 3 and 5

NOTES

1. Single sample; Inspection Level S3; AQL = 2.5%.

2. Applicable to Level 'B' only.

3. Applicable to Level 'C' only.

4. For C equal to, or less than 10 000pF.

For C greater than 10 000pF, R_i × C = 100 seconds minimum.

5. If 1 failure out of 5 parts, then test 100%.

1.0% rejects maximum allowed in case of 100% testing.

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
1	Capacitance Change	$\frac{\Delta C}{C}$	ESA/SCC Gen. Spec. 3009	Para's. 9.4.2 and 9.4.1.1	± 1.0	%

FIGURE 4 - TEST CIRCUITS

Not applicable.

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

No.	CHARACTERISTIC	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+ 125	°C
2	Test Voltage	V_T	2.0U _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. 3009)

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 $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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 $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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

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. 3009. The conditions for operating life testing shall be as specified in Table 5 for the Burn-in test.

4.8.5 Electrical Circuits 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 SPECIFICATION NO. 3009		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Mounting	Para. 9.15	Final Examination Terminals Final Measurements Capacitance Tangent of Loss Angle Insulation Resistance	Good Tinning Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	- C $T_{g\delta}$ R_i	- Record Values Table 2 Item 2 Table 2 Item 3	- pF 10^{-4} GΩ	
02	Adhesion	Para. 9.5	Final Examination Visual Examination Capacitance	Damage or loosening Table 2 Item 1	- C	- Table 2 Item 1	- pF	
03	Solderability	Para. 9.6	Final Examination Visual Examination	Para. 9.6	-	-	-	
04	Rapid Change of Temperature	Para. 9.7	Initial Measurements Capacitance Final Measurements Visual Examination Capacitance Change Tangent of Loss Angle	Table 2 Item 1 Recovery period 24 ± 2 hours No damage Table 2 Item 1 Table 2 Item 2	C - $\frac{\Delta C}{C}$ $T_{g\delta}$	Item 01 Value - -1.0 +1.0 - (2)	pF - % 10^{-4}	
05	Climatic Test Sequence	Para. 9.8	Initial Measurements Capacitance Final Measurements Visual Inspection Capacitance Change Tangent of Loss Angle Insulation Resistance	Table 2 Item 1 Recovery Period 1 -24 hrs Para. 9.8.7 Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C - $\frac{\Delta C}{C}$ $T_{g\delta}$ R_i	Item 01 Value - -2.0 +2.0 - (2) 10 (3)	pF - % 10^{-4} GΩ	
06	Damp Heat Steady State	Para. 9.9	Initial Measurements Capacitance Final Measurements Visual Examination Capacitance Change Tangent of Loss Angle Insulation Resistance	Table 2 Item 1 Recovery Period 6 - 24 hrs No damage Table 2 Item 1 Table 2 Item 2 Table 2 Item 3	C - $\frac{\Delta C}{C}$ $T_{g\delta}$ R_i	Item 01 Value - -2.0 +2.0 - (2) 10 (3)	pF - % 10^{-4} GΩ	

NOTES

- The tests in this table refer to either Chart IV or V and shall be used as applicable.
- Twice the values specified in Table 2 of this specification.
- For $C \leq 10\,000\text{pF}$;
For $C > 10\,000\text{pF}$, $R_i \times C = 100$ seconds minimum.



SCC

ESA/SCC Detail Specification
No. 3009/006

Rev. 'A'

PAGE 16



ISSUE 6

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 SPECIFICATION NO. 3009		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT	
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.		
07	Operating Life	Para. 9.10	Initial Measurements	Table 2 Item 1 Recovery period 1 hour min	C	Item 01 Value		pF	
			Capacitance						
			Intermediate Measurements	Table 2 Item 1	$\frac{\Delta C}{C}$	-3.0	+3.0	%	
			to be performed at 1000 hrs (Chart IV)						
			Capacitance Change						
			Insulation Resistance	Table 2 Item 3	R_i	10 (3)	-	GΩ	
			Final Measurements	Recovery period 24 ± 2 hours	$\frac{\Delta C}{C}$	-3.0	+3.0	%	
Capacitance Change	Table 2 Item 1								
Tangent of Loss Angle	Table 2 Item 2	$T_g \delta$	-	(2)					10 ⁻⁴
Insulation Resistance	Table 2 Item 3	R_i	10 (3)	-					GΩ
Voltage Proof	Table 2 Item 4	VP	Table 2 Item 4		V				
Visual Examination	No damage	-	-	-	-				
08	Temperature Coefficient	Para. 9.11	Capacitance Changes	Table 3 Item 5(i) or 5(ii)	TC	Table 3 Item 5(i) or 5(ii)		10 ⁻⁶ /°C	

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Twice the values specified in Table 2 of this specification.
3. For $C \leq 10\,000\text{pF}$;
For $C > 10\,000\text{pF}$, $R_i \times C = 100$ seconds minimum.

		<p>ESA/SCC Detail Specification No. 3009/006</p>	<p>Rev. 'A'</p>	<p>PAGE 17 ISSUE 6</p>
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APPENDIX 'A'

Page 1 of 1

AGREED DEVIATIONS FOR VITRAMON LTD. (UK)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.1	Microsectioning may be performed using Vitramon document QCN-020 (Issue as per P.I.D.).