

Page 1 of 19

CAPACITORS, FIXED, CERAMIC DIELECTRIC, TYPE II, HIGH VOLTAGE, 1kV TO 5kV

BASED ON TYPES VR, CV AND CH

ESCC Detail Specification No. 3001/034



Document Custodian: European Space Agency – see https://escies.org



PAGE 2

ISSUE 4

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2017. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without prior the permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.



No. 3001/034

ISSUE 4

DOCUMENTATION CHANGE NOTICE

(Refer to https://escies.org for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
726	Specification updated to incorporate changes per DCR.
	Specification produced in MSWORD. Changes in presentation are possible.



ISSUE 4

TABLE OF CONTENTS

1	GENERAL	5
1.1	SCOPE	5
1.2	APPLICABLE DOCUMENTS	5
1.3	TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS	5
1.4	THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS	5
1.4.1	The ESCC Component Number	5
1.4.2	Component Type Variants and Range of Components	7
1.5	MAXIMUM RATINGS	8
1.6	PHYSICAL DIMENSIONS	9
1.6.1	Case Type VR with Radial Leads	9
1.6.2	Case Type CV with Radial Leads	10
1.6.3	Case Type CH with Straight DIL Leads	11
1.6.4	Case Type CH with L DIL Leads	12
1.7	FUNCTIONAL DIAGRAM	12
2	REQUIREMENTS	13
2.1	GENERAL	13
2.1.1	Deviations from the Generic Specification	13
2.2	MARKING	13
2.3	ROBUSTNESS OF TERMINATIONS	14
2.4	ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES	14
2.4.1	Room Temperature Electrical Measurements	14
2.4.2	High and Low Temperatures Electrical Measurements	15
2.5	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	16
2.6	BURN-IN	18
APPEND	DIX A	19



ISSUE 4

1 <u>GENERAL</u>

1.1 <u>SCOPE</u>

This specification details the ratings, physical and electrical characteristics, and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 <u>APPLICABLE DOCUMENTS</u>

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

(a) ESCC Generic Specification No. 3001.

1.3 <u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u> For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number The ESCC Component Number shall be constituted as follows:

Example: 300103401472KR

- Detail Specification Reference: 3001034
- Component Type Variant Number: 01 (as required)
- Characteristic code: Capacitance Value (4.7nF): 472 (as required)
- Characteristic code: Capacitance Tolerance (±10%): K (as required)
- Rating code: Rated Voltage (3kV): R (as required)

1.4.1.1 Characteristics and Ratings Codes

Characteristics and ratings to be codified as part of the ESCC Component Number shall be as follows:

(a) Rated Capacitance Value, C_n, expressed by means of the following codes in accordance with ESCC Basic Specification No. 21700. The unit quantity shall be picofarad (pF).

Capacitance Value Cn (pF)	Code
XX 10 ¹	XX1
XX 10 ²	XX2
XX 10 ³	XX3
XX 10 ⁴	XX4
XX 10 ⁵	XX5

ESCC Detail Specification



No. 3001/034

ISSUE 4

(b) Capacitance Tolerance expressed by the following codes in accordance with ESCC Basic Specification No. 21700:

Tolerance (± %)	Code Letter
10	К
20	М

(c) Rated Voltage, U_R , expressed by the following codes:

Rated Voltage U _R (kV)	Code Letter
1	М
2	Р
3	R
4	S
5	Z



ISSUE 4

1.4.2 Component Type Variants and Range of Components

The component type variants and range of components applicable to this specification are as follows:

Variant Number		Package (Not				Capacitance Range C _n (pF) (Note 4)							
	Case Type (Note 2)	Lead Type	No. of Leads	Lead Mat. & Finish (Note 3)	Rated Voltage U _R = 1kV	Rated Voltage U _R = 2kV	Rated Voltage U _R = 3kV	Rated Voltage U _R =4kV	Rated Voltage U _R = 5kV				
01	VR30S	Radial	2	A3	3900 to 20000	1500 to 820 to 1000 1800		-	-	1			
02	VR30	Radial	2	A3	27000 to 56000	2200 to 6800	820 to 3900	-	-	1			
03	VR40	Radial	2	A3	47000 to 120000	8200 to 15000	4700 to 10000	1800 to 2200	-	2			
04	VR50	Radial	2	A3	150000 to 270000	18000 to 33000	12000 to 18000	5600 to 8200	3300 to 3900	3			
05	VR66	Radial	2	A3	220000 to 560000	39000 to 82000	22000 to 39000	10000 to 15000	6800 to 10000	5			
06	VR84	Radial	2	A3	680000 to 1000000	47000 to 150000	47000 to 68000	18000 to 39000	12000 to 18000	8			
07	VR90	Radial	2	A3	1200000 to 2700000	180000 to82000 to330000180000		47000 to 120000	22000 to 56000	19			
08	CV41	Radial	2	A3	47000 to 120000	8200 to 4700 to 15000 10000		1800 to 2200	-	2			
09	CH41	Straight DIL	6	N9	47000 to 120000	8200 to 15000	4700 to 10000	1800 to 2200	-	2			
10	CH41	L DIL	6	N9	47000 to 120000	8200 to 4700 to 15000 10000		4700 to 1800 to 10000 2200		2			
11	CV51	Radial	2	A3	150000 to 270000	18000 to 33000	12000 to 18000	5600 to 8200	3300 to 3900	3			
12	CH51	Straight DIL	8	N9	150000 to 270000	18000 to 33000	12000 to 18000	5600 to 8200	3300 to 3900	3			
13	CH51	L DIL	8	N9	150000 to 270000	18000 to 33000	12000 to 18000	5600 to 8200	3300 to 3900	3			
14	CV61	Radial	2	A3	220000 to 560000	39000 to 82000	22000 to 39000	10000 to 15000	6800 to 10000	5			
15	CH61	Straight DIL	10	N9	220000 to 560000	39000 to 82000	22000 to 39000	10000 to 15000	6800 to 10000	5			
16	CH61	L DIL	10	N9	220000 to 560000	39000 to 82000	22000 to 39000	10000 to 15000	6800 to 10000	5			
17	CV76	Radial	2	A3	680000 to 1000000	47000 to 150000	47000 to 68000	18000 to 39000	12000 to 18000	8			
18	CH76	Straight DIL	12	N9	680000 to 1000000	47000 to 150000	47000 to 68000	18000 to 39000	12000 to 18000	8			
19	CH76	L DIL	12	N9	680000 to 1000000	47000 to 150000	47000 to 68000	18000 to 39000	12000 to 18000	8			
20	CV91	Radial	2	A3	1200000 to 2700000	180000 to 330000	82000 to 180000	47000 to 120000	22000 to 56000	19			

PAGE 7



ISSUE 4

Variant Number		Package (Not				Capacitance Range Cn (pF) (Note 4)						
	Case Type (Note 2)	Lead Type	No. of Leads	Lead Mat. & Finish (Note 3)	Rated Voltage U _R = 1kV	Voltage Voltage Voltage Voltage						
21	CH91	Straight DIL	28	N9	1200000 to 2700000	180000 to 330000	82000 to 180000	47000 to 120000	22000 to 56000	19		
22	CH91	L DIL	28	N9	1200000 to 2700000	180000 to 330000	82000 to 180000	47000 to 120000	22000 to 56000	19		

NOTES:

1. See Para. 1.6.

2. For Variants 01 to 07 (case type VR) the body shall be coated with epoxy resin. Variants 08 to 22 (case types CV & CH) are classified as non-insulated.

- 3. The lead materials and finishes shall be in accordance with the requirements of ESCC Basic Specification No. 23500.
- 4. Available capacitance values and tolerances are as follows:
 - Tolerance: ±10%; value series: E12
 - Tolerance: ±20%; value series: E12

1.5 <u>MAXIMUM RATINGS</u>

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Voltage	UR	1, 2, 3, 4, 5	kV	Note 1
Operating Temperature Range	T _{op}	-55 to +125	°C	Without derating. T _{amb}
Storage Temperature Range	T _{stg}	-55 to +125	°C	
Soldering Temperature	T _{sol}	+260	°C	Note 2

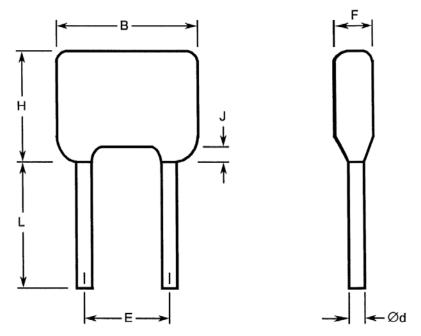
NOTES:

- 1. As required; See Para. 1.4.2.
- 2. Duration 5 seconds maximum at a distance of not less than 1.5mm from the body and the same lead shall not be resoldered until 3 minutes have elapsed.



PHYSICAL DIMENSIONS 1.6

1.6.1 Case Type VR with Radial Leads

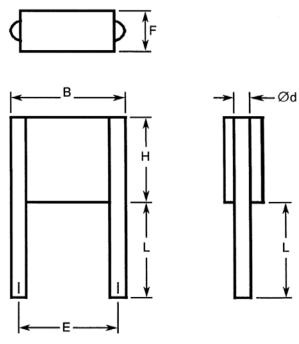


Variant	Case	Dimensions (mm)											
Number	Туре	B Max	Ø (Not	id te 1)	E	E Min Max		E		H Max	J Max	L Min	
			Min	Max	Min					(Note 1)			
01	VR30S	7.62	0.46	0.56	4.58	5.58	5	6.1	1.5	31.7			
02	VR30	7.62	0.46	0.56	4.58	5.58	5	9.62	1.5	31.7			
03	VR40	10.16	0.46	0.56	4.58	5.58	5	11.7	1.5	31.7			
04	VR50	12.7	0.59	0.69	9.66	10.66	5.1	14.2	1.5	31.7			
05	VR66	17.5	0.86	0.96	14.2	15.2	6.4	16.5	1.5	31.7			
06	VR84	23.62	0.86	0.96	20.4	22	6.4	19.78	1.5	31.7			
07	VR90	23.5	0.86	0.96	20.4	22	6.4	42	1.5	31.7			

NOTES: 1. Both leads.



Case Type CV with Radial Leads 1.6.2

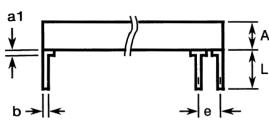


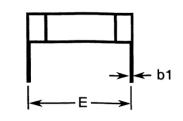
Variant	Case	Dimensions (mm)												
Number	Туре	B Max	Ød (Note 1)						E	E		H Max	l (Not	- te 1)
			Min	Max	Min	Min Max			Min	Max				
08	CV41	10.6	0.65	0.75	7.7	8.7	3.8	8.7	22	28				
11	CV51	11.9	0.85	0.95	9.66	10.66	3.8	10.7	22	28				
14	CV61	16.5	0.85	0.95	14.74	15.74	3.8	13.6	22	28				
17	CV76	22.7	0.85	0.95	20.4	22	3.8	16.6	22	28				
20	CV91	22.7	1.15	1.25	20.4	22	3.8	40.6	22	28				

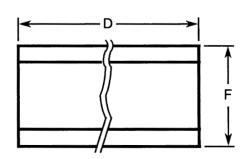
NOTES: 1. Both leads.



Case Type CH with Straight DIL Leads 1.6.3





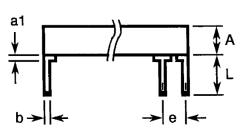


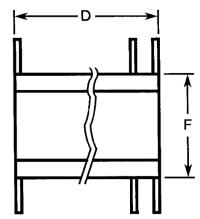
Variant	Case	Dimensions (mm)													
Number	Туре	A Max	a1 Max		o te 1)	b1 (Note 1)		D Max		E (Note 1)		e te 1)	F Max	l (Not	L te 1)
			(Note 1)	Min	Max	Min	Max		Min	Max	Min	Max		Min	Max
09	CH41	3.8	2	0.45	0.55	0.204	0.304	8.7	7.7	8.7	2.49	2.59	9.2	12	14
12	CH51	3.8	2	0.45	0.55	0.204	0.304	10.7	9.66	10.66	2.49	2.59	10.7	12	14
15	CH61	3.8	2	0.45	0.55	0.204	0.304	13.6	13.5	14.5	2.49	2.59	14.9	12	14
18	CH76	3.8	2	0.45	0.55	0.204	0.304	16.6	19.52	21.12	2.49	2.59	21.6	12	14
21	CH91	3.8	2	0.45	0.55	0.204	0.304	40.6	19.52	21.12	2.49	2.59	24	12	14

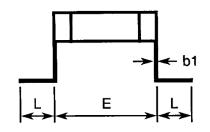
NOTES: 1. All leads.



1.6.4 Case Type CH with L DIL Leads







Variant	Case	Dimensions (mm)													
Number	Туре	A Max	a1 Max		o te 1)	b (Not		D Max		<u>=</u> te 1)	e (Not		F Max	l (Not	- te 1)
			(Note 1)	Min	Max	Min	Max		Min	Max	Min	Max		Min	Max
10	CH41	3.8	2	0.45	0.55	0.204	0.304	8.7	7.7	8.7	2.49	2.59	9.2	2.04	3.04
13	CH51	3.8	2	0.45	0.55	0.204	0.304	10.7	9.66	10.66	2.49	2.59	10.7	2.04	3.04
16	CH61	3.8	2	0.45	0.55	0.204	0.304	13.6	13.5	14.5	2.49	2.59	14.9	2.04	3.04
19	CH76	3.8	2	0.45	0.55	0.204	0.304	16.6	19.52	21.12	2.49	2.59	21.6	2.04	3.04
22	CH91	3.8	2	0.45	0.55	0.204	0.304	40.6	19.52	21.12	2.49	2.59	24	2.04	3.04

NOTES:

All leads. 1.

FUNCTIONAL DIAGRAM 1.7



NOTES: 1. Fo For case type CH, all leads on each side of the component are connected to the same capacitor terminal.



ISSUE 4

2 <u>REQUIREMENTS</u>

2.1 <u>GENERAL</u>

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

- 2.1.1.1 Deviations from Special In-Process Controls (Chart F2)
 - (a) Robustness of Terminations: Shall be replaced with a lead peel test as specified in Para. 2.3 herein.
- 2.1.1.2 Deviations from Qualification and Periodic Tests (Chart F4)
 - (a) Steady State Humidity (85/85): Not applicable and shall be replaced in Chart F4 Group 1 of the Generic Specification by a Damp Heat Steady State test as follows:

Components shall be subjected to Test Cab of IEC Publication No. 60068-2-78. The following details shall apply:

- Test Conditions:
 - (a) Temperature: 40 ±2°C
 - (b) Relative humidity: 93 ±3%
 - (c) Duration: 56 days
 - (d) Bias during test: Half the samples shall have no voltage applied; the remaining half shall have 100V applied.
- Data Points

Prior to the test, Capacitance shall be measured as specified in Para. 2.5 Intermediate and End-Point Electrical Measurements.

On completion of testing the components shall be subjected to standard atmospheric conditions for recovery for 6 to 24 hours.

After recovery, the components shall be visually examined. There shall be no evidence of damage. Capacitance, Change in Capacitance, Tangent of Loss Angle, Insulation Resistance and Voltage Proof (Body Insulation) shall be measured as specified in Para. 2.5 Intermediate and End-Point Electrical Measurements. Change in Capacitance shall be related to the initial measurements.

2.2 <u>MARKING</u>

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number.
- (c) Traceability information.



PAGE 14

ISSUE 4

2.3 ROBUSTNESS OF TERMINATIONS

The terminations of these devices are classified as rigid.

Robustness of Terminations shall be performed as a lead peel test on a sample of 5 components from each manufacturing lot with 0 failures allowed. The sample components shall be leaded but not encapsulated or coated. Where necessary, the leads of the component under test shall be bent through 90° in the plane of the joint such that a tensile force applied to the leads will result in a peeling force being applied to the leads' joint.

A tensile force shall be applied evenly across the length, on the capacitor terminal, to all leads on that side of the component together, until the lead joint peels. All leads shall be tested.

The minimum peeling force shall be as follows:

- (a) For case types VR & CV: 8.9N
- (b) For case type CH: 22.25N

2.4 <u>ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES</u> Electrical measurements shall be performed at room, high and low temperatures.

2.4.1 <u>Room Temperature Electrical Measurements</u>

The measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

Characteristics	Symbols	Test Method and Conditions	Tolerance	Li	Units	
		Conditions	(± %)	Min	Max	
Capacitance	CA	ESCC No. 3001				pF
(Note 1)			10	0.9Cn	1.1C _n	
			20	0.8Cn	1.2Cn	
Tangent of Loss Angle	tgō	ESCC No. 3001	All	-	250 ×10 ⁻⁴	-
Insulation	R _{ID}	ESCC No. 3001	All			
Resistance (Dielectric)		C _n ≤ 10000pF		100	-	GΩ
		C _n > 10000pF		1000	-	GΩ.nF
Insulation Resistance (Body Insulation)	R _{IB}	ESCC No. 3001 Case type VR only Note 2	All			
		C _n ≤ 10000pF		100	-	GΩ
		C _n > 10000pF		1000	-	GΩ.nF
Voltage Proof	VPD	ESCC No. 3001	All			V
(Dielectric)		For U _R = 1000V		1.5U _R	-	
		For U _R ≥ 2000V		1.3U _R	-	
Voltage Proof (Body Insulation)	VPB	ESCC No. 3001 Case type VR only Note 2	All			V
		For U _R = 1000V		1.5U _R	-	
		For U _R ≥ 2000V		1.3U _R	-	



ISSUE 4

NOTES:

- 1. Capacitance limits may be adjusted to take into account capacitance ageing, as specified in the Generic Specification.
- 2. The measurements shall be performed on a sample of 5 components from each manufacturing lot with 0 failures allowed. In the event of any failure a 100% inspection may be performed. In the case of a 100% inspection, a 1% total percent defective is allowed.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols		Limits		Units
	(Note 1)		Min	Max	
Temperature Characteristic	TC	ESCC No. 3001 T _{amb} = -55 ±2°C, +20 ±2°C, +125 ±2°C Note 2			%
		For V_T = no voltage applied	-20	+20	
		For V _T = 500V	-50	+30	

NOTES:

- 1. The measurements shall be performed on a sample of 5 components from each manufacturing lot with 0 failures allowed. In the event of any failure a 100% inspection may be performed.
- 2. In the case of a 100% inspection, a 1% total percent defective is allowed.



PAGE 16 ISSUE 4

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3°C.

Unless otherwise specified the test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1 Room Temperature Electrical Measurements.

Test Reference per ESCC	Characteristics	Symbols	Limits		Units
No. 3001			Min	Max	
Rapid Change of Temperature					
Initial Measurements	Capacitance	CA	Note 1		
Final Measurements	Capacitance	CA	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	Tangent of Loss Angle	tgō	-	500 ×10 ⁻⁴	-
Damp Heat Steady State					
Initial Measurements	Capacitance	CA	Note 1		
Final Measurements	Capacitance	CA	N	ote 1	
	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	Tangent of Loss Angle	tgō	-	500 ×10 ⁻⁴	-
	Insulation Resistance (Dielectric):	Rid			
	C _n ≤ 10000pF		3	-	GΩ
	C _n > 10000pF		30	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Note 2):	R _{IB}			
	C _n ≤ 10000pF		3	-	GΩ
	C _n > 10000pF		30	-	GΩ.nF
	Voltage Proof (Body Insulation) (Note 2)	V _{PB}	N	ote 1	



ISSUE 4

Test Reference per ESCC	Characteristics	Symbols	Li	Units	
No. 3001			Min	Max	
Operating Life					
Initial Measurements	Capacitance	CA	Note 1		
Intermediate Measurements	Capacitance	CA	Note 1		
(1000 hours) (Note 3)	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	Insulation Resistance (Dielectric):	Rid			
	C _n ≤ 10000pF		10	-	GΩ
	C _n > 10000pF		100	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Note 2):	Rıв			
	C _n ≤ 10000pF		10	-	GΩ
	C _n > 10000pF		100	-	GΩ.nF
Final Measurements	Capacitance	CA	N	ote 1	
(1000 or 2000 hours) (Note 4)	Change in Capacitance	$\Delta C_A/C_A$	-10	+10	%
	Tangent of Loss Angle	tgō	-	500 ×10 ⁻⁴	-
	Insulation Resistance (Dielectric):	Rid			
	C _n ≤ 10000pF		10	-	GΩ
	C _n > 10000pF		100	-	GΩ.nF
	Insulation Resistance (Body Insulation) (Note 2):	Rıв			
	C _n ≤ 10000pF		10	-	GΩ
	C _n > 10000pF		100	-	GΩ.nF
	Voltage Proof (Dielectric)	Vpd	N	ote 1	
	Voltage Proof (Body Insulation) (Note 2)	V _{PB}	N	ote 1	
Capacitance-Temperature Characteristics	Temperature Characteristic	TC	Note 5		
Resistance to Soldering Heat					
Initial Measurements	Capacitance	CA	Note 1		
Final Measurements	Capacitance	CA	Note 1		
	Change in Capacitance	$\Delta C_A/C_A$	-15	+15	%
	Insulation Resistance (Dielectric)	Rid	N	ote 1	
	Insulation Resistance (Body Insulation) (Note 2)	Rıв	No	ote 1	



ISSUE 4

NOTES:

- 1. As specified in Para. 2.4.1.
- 2. Case type VR only.
- 3. Intermediate measurements are optional at the Manufacturer's discretion.
- 4. 1000 hours is applicable to Periodic Testing for extension of qualification. 2000 hours is applicable to Qualification Testing, and to Periodic Testing for renewal of qualification after lapse.
- 5. As specified in Para. 2.4.2.

2.6 <u>BURN-IN</u>

The requirements for Burn-in are specified in the ESCC Generic Specification. The following conditions shall also apply:

• After Burn-in, the components shall be removed from the chamber and allowed to cool under normal atmospheric conditions for recovery for 24 hours minimum.

ESCC Detail Specification



PAGE 19

No. 3001/034

ISSUE 4

APPENDIX A AGREED DEVIATIONS FOR AVX LTD (GB)

Items Affected	Description of Deviations						
Deviations from Generic Specification:	Microsection Inspection: may be performed using AVX inspection document as per PID.						
Special In-Process Controls (Chart F2)	Internal Visual Inspection: may be performed using AVX inspection document as per PID.						
Deviations from Generic Specification: Screening (Chart F3)	External Visual Inspection: may be performed using AVX inspection document as per PID.						
Deviations from Generic Specification: Qualification and Periodic Tests (Chart F4)	External Visual Inspection: may be performed using AVX inspection document as per PID.						