



**CAPACITORS, FIXED, DC SELF-HEALING,
METALLISED FILM DIELECTRIC**

BASED ON TYPE PM90S

ESCC Detail Specification No. 3006/020

Issue 6	July 2020
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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
1346	Specification updated to incorporate changes per DCR.

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1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, and test and inspection data for the component type variants and/or the Component Type Variants and 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 APPLICABLE DOCUMENTS

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

- (a) ESCC Generic Specification No. [3006](#).

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

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: 300602001155KH

- Detail Specification Reference: 3006020
- Component Type Variant Number: 01 (01 to 21, as required or as applicable)
- Characteristic code: Capacitance Value (1.5 μ F): 155 (as required)
- Characteristic code: Capacitance Tolerance (\pm 10%): K (as required)
- Rating code: Rated Voltage (250V): H (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) Capacitance Value, C, expressed by means of the following codes in accordance with ESCC Basic Specification No. [21700](#). The unit quantity shall be picofarads (pF).

Capacitance Value C (pF)	Code
XX 10 ³	XX3
XX 10 ⁴	XX4
XX 10 ⁵	XX5
XX 10 ⁶	XX6
XX 10 ⁷	XX7

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

Tolerance (±)	Code Letter
10%	K
20%	M

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

DC Rated Voltage U_R (V)	Code Letter
50	C
100	E
250	H
400	K
630	Z

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:

Type Variant(s) (Note 1)	Capacitance Value C (μ F) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)
01, 09, 17	8.2	50	3.1	4.9
	10		3.8	
	12		4	
	3.3	100	1.6	
	3.9		2	
	4.7		2.4	
	5.6		2.8	
	6.8		3.1	
	1	250	1.2	
	1.2		1.3	
	1.5		1.5	
	1.8		1.8	
	2.2		2.2	
	2.7		2.8	

Type Variant(s) (Note 1)	Capacitance Value C (μ F) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)
01, 09, 17	0.39	400	1.1	4.9
	0.47		1.3	
	0.56		1.6	
	0.68		1.9	
	0.82		0.9	
	0.22	630	1.1	
	0.27		0.9	
02, 10, 18	15	50	5	6
	8.2	100	3.7	
	3.3	250	3.4	
	3.9		4	
	1	400	2.4	
	1.2		2.9	
	0.33	630	1.3	
	0.39		1.6	
03, 11, 19	18	50	6.9	9.5
	22		8.4	
	10	100	5.1	
	12		6.1	
	4.7	250	4.8	
	5.6		5.8	
	1.5	400	3.6	
	1.8		4.3	
	0.47	630	1.9	
	0.56		2.3	
	0.68		2.8	
	0.68		2.8	
04, 12, 20	27	50	10.4	13.6
	33		12.5	
	39		12.5	
	15	100	7.7	
	18		9.2	
	22		10.1	

Type Variant(s) (Note 1)	Capacitance Value C (μ F) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)				
04, 12, 20	6.8	250	7.5	13.6				
	8.2		8.5					
	10		10.3					
	2.2	400	5.3		13.6			
	2.7		6					
	3.3		7.9					
	0.82	630	3.3			13.6		
	1		4.1					
	1.2		5					
05, 13, 21	47	50	12.5	20.4				
	56	100						
	27							
	33	250	12.4		20.4			
	12							
	15		12.5					
	3.9	400	9.4			20.4		
	4.7		11.3					
	1.5	630	6.1				20.4	
	1.8		7.3					
06, 14	33	50	7.2	21.2				
	39		100					8.5
	47							10.3
	18	100	6.3		21.2			
	22		7.7					
	33		11.4					
	6.8	250	4.6			21.2		
	10		6.7					
	12		8					
	2.2	400	3				21.2	
	3.3		4.5					
	4.7		6.4					
	1	630	2.2					21.2
	1.5		3.3					
	1.8		4					

Type Variant(s) (Note 1)	Capacitance Value C (μ F) (Note 2)	DC Rated Voltage (U_R) (V)	AC Rated Current (I_{RA}) (A)	Weight Max (g)	
07, 15	68	50	15	37.3	
	82				
	100				
	39	100	13.5		
	47		15		
	56				
	18	250	12		
	22		15		
	27				
	5.6	400	7.6		
	6.8		9.3		
	8.2		11.5		
	10		14		
	2.2	630	4.9		
	2.7		6		
	3.3		7.3		
3.9	8.7				
08, 16	120	50	15	54.2	
	150				
	68	100			
	82				
	100				
	33	250			
	39				
	12	400			
	15				
	4.7	630			10.3
	5.6				12.5

NOTES:

1. See Para. 1.6.
2. All Capacitance Values are available with tolerances of $\pm 10\%$ and $\pm 20\%$.

1.5 MAXIMUM RATINGS

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.

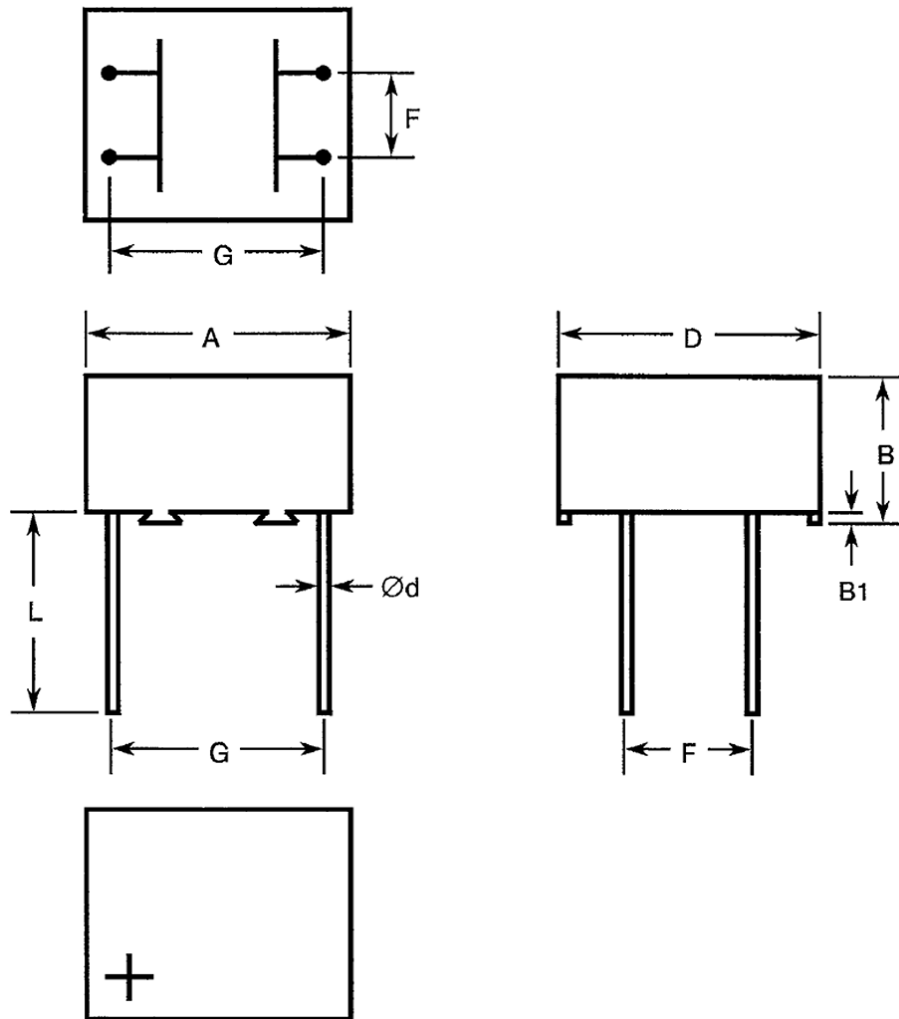
Characteristics	Symbols	Maximum Ratings	Units	Remarks
DC Rated Voltage	U_R	50, 100, 250, 400, 630	V	Note 1
AC Rated Voltage	U_A	$35\%U_R$	V _{rms}	50/60Hz
AC Rated Current	I_{RA}	See Para. 1.4.2	A _{rms}	50/60Hz
Operating Temperature Range	T_{op}	-55 to +100	°C	T_{amb}
Storage Temperature Range	T_{stg}	-55 to +100	°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 6mm from the case and the same lead shall not be resoldered until 3 minutes have elapsed.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1 Component Type Variants 01 to 08

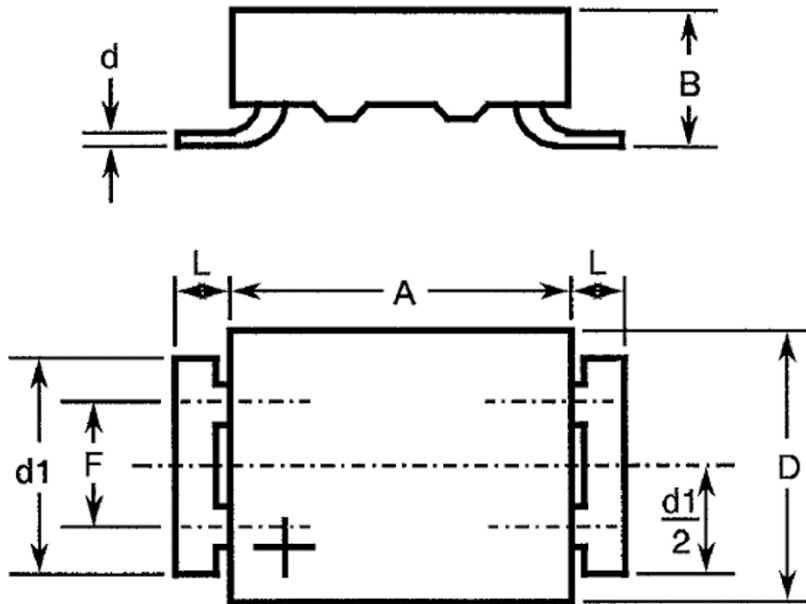


Type Variant	Dimensions (mm)												
	A		B Max.	B1 Min.	D		Ød		F		G		L Min.
	Min.	Max.			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
01	19.5	20.5	6.5	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
02	19.5	20.5	8	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
03	19.5	20.5	12.5	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
04	19.5	20.5	20	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
05	19.5	20.5	30	0.25	19.5	20.5	0.95	1.1	9.66	10.66	17.3	18.3	20
06	30.5	31.5	12.5	0.4	31.5	32.5	0.95	1.1	14.74	15.74	27.44	28.44	20
07	30.5	31.5	22	0.4	31.5	32.5	0.95	1.1	14.74	15.74	27.44	28.44	20
08	30.5	31.5	32	0.4	31.5	32.5	0.95	1.1	14.74	15.74	27.44	28.44	20

NOTES:

- Terminal identification: A voltage polarity symbol shall be marked on the top of the body, as shown, to indicate the row of terminals which should be connected to the highest potential.

1.6.2 Component Type Variants 09 to 16

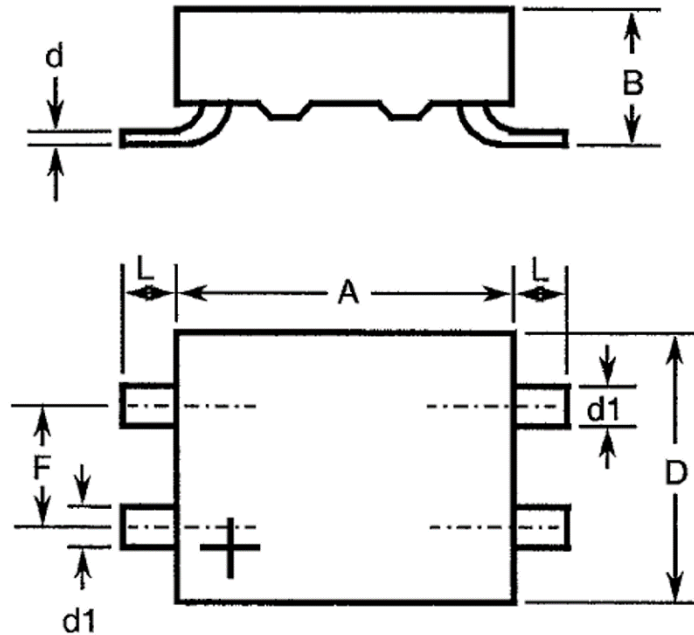


Type Variant	Dimensions (mm)												
	A		B		D		d Max.	d1		F		L	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.
09	19.5	20.5	6.5	7.5	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
10	19.5	20.5	8	9	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
11	19.5	20.5	12.5	13.5	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
12	19.5	20.5	20	21	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
13	19.5	20.5	30	31	19.5	20.5	0.3	14.5	15.5	9.5	10.5	2.75	3.25
14	30.5	31.5	12.5	13.5	31.5	32.5	0.3	23.5	24.5	14.5	15.5	2.75	3.25
15	30.5	31.5	22	23	31.5	32.5	0.3	23.5	24.5	14.5	15.5	2.75	3.25
16	30.5	31.5	32	33	31.5	32.5	0.3	23.5	24.5	14.5	15.5	2.75	3.25

NOTES:

- Terminal identification: A voltage polarity symbol shall be marked on the top of the body, as shown, to indicate the row of terminals which should be connected to the highest potential.

1.6.3 Component Type Variants 17 to 21

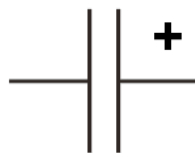


Type Variant	Dimensions (mm)												
	A		B		D		d Max.	d1		F		L	
	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.	Min.	Max.
17	19.5	20.5	6.5	7.5	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
18	19.5	20.5	8	9	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
19	19.5	20.5	12.5	13.5	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
20	19.5	20.5	20	21	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25
21	19.5	20.5	30	31	19.5	20.5	0.3	2	3	9.5	10.5	2.75	3.25

NOTES:

1. Terminal identification: A voltage polarity symbol shall be marked on the top of the body, as shown, to indicate the row of terminals which should be connected to the highest potential.

1.7 FUNCTIONAL DIAGRAM



NOTES:

1. These capacitors are not polarised; however, marking includes the voltage polarity symbol (see Para. 1.6) which should be respected in use.
2. For Component Type Variants 01 to 08 and 17 to 21, each row of terminals is connected internally to a single electrode.

1.8 MATERIALS AND FINISHES

1.8.1 Lead/Terminal Material

The lead/terminal material shall be Type A in accordance with the requirements of ESCC Basic Specification No. [23500](#).

1.8.2 Lead/Terminal Finish

The lead/terminal finish shall be 95% tin, remainder lead.

2 REQUIREMENTS

2.1 GENERAL

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 Qualification and Periodic Tests – Chart F4*

- (a) Operating Life: Test Condition (c), Applied voltage: $1.25 \times U_R$
- (b) Robustness of Terminations: for Component Type Variants 09 to 21 Robustness of Terminations shall be performed as follows:
The components shall be mounted on a suitable substrate. After mounting, examination shall be made for good tinning as evidenced by flowing of the solder with wetting of the terminations. A force of 10N shall be applied normal to the line joining the terminals and in a plane parallel to the substrate, for a duration of $10 \pm 1s$. The components shall then be examined and there shall be no evidence of damage or loosening of the components from the substrate.

2.2 MARKING

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) Terminal Identification (see Para. 1.6).
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number (see Para. 1.4.1).
- (d) Traceability information.

2.3 **ROBUSTNESS OF TERMINATIONS**

The terminals of the components are rigid.

For Component Type Variants 01 to 08 the test conditions for Robustness of Terminations shall be as specified in the ESCC Generic Specification and as follows:

- Test U_a, tensile, with an applied force of 20N and a duration of 7.5 ±2.5s

All leads of the component shall be tested.

2.4 **ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES**

Electrical measurements shall be performed at room, high and low temperatures.

2.4.1 **Room Temperature Electrical Measurements**

The measurements shall be performed at T_{amb} = +22 ±3°C.

Characteristics	Symbols	Test Method and Conditions	Limits		Units	
			Min	Max		
Capacitance	C	ESCC No. 3006 Test Frequency = 1kHz	Note 1	Note 2	µF	
Tangent of Loss Angle	tgδ	ESCC No. 3006 Test Frequency = 1kHz	-	10×10 ⁻³	-	
Insulation Resistance, Dielectric	R _I	ESCC No. 3006				
		C ≤ 0.33µF; U _R ≤ 100V	3750	-	MΩ	
		U _R > 100V	7500	-	MΩ	
		C > 0.33µF; U _R ≤ 100V	1250	-	MΩ.µF	
U _R > 100V (Note 3)	2500	-	MΩ.µF			
Insulation Resistance, Body Insulation	R _{IB}	ESCC No. 3006	50	-	GΩ	
Voltage Proof, Terminal-to-Terminal	VP	ESCC No. 3006	1.6×U _R (Note 3)	-	V	
Voltage Proof, Terminal-to-Case	VP _B	ESCC No. 3006	U _R = 50V	200	-	V
			U _R ≥ 100V (Note 3)	2×U _R (Note 3)	-	V

NOTES:

1. Capacitance Value of the component minus the applicable Tolerance (see Para. 1.4.2).
2. Capacitance Value of the component plus the applicable Tolerance (see Para. 1.4.2).
3. For the applicable Rated Voltage (U_R) see Para. 1.4.2.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Temperature Coefficient	$\Delta C/C$	ESCC No. 3006 Test Frequency = 1kHz $T_{amb} = -55 \pm 2^{\circ}C$	-	-10 (Note 2)	%
		$T_{amb} = +100 \pm 2^{\circ}C$	-	+8 (Note 2)	%

NOTES:

1. The measurements shall be performed on a sample of 6 components from each manufacturing lot with 0 failures allowed. In the event of any failure a 100% inspection may be performed.
2. The Temperature Coefficient limits are with respect to the capacitance at $+22 \pm 2^{\circ}C$ (reference point temperature).

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

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

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 No. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Resistance to Soldering Heat Initial Measurements Final Measurements	Capacitance	C	Note 1		μF
	Capacitance	C	Note 1		μF
	Change in Capacitance	$\Delta C/C$	-3	+3	%
	Insulation Resistance (Terminal-to-Terminal) $C \leq 0.33\mu F; U_R \leq 100V$ $U_R > 100V$ $C > 0.33\mu F; U_R \leq 100V$ $U_R > 100V$	R_i	Note 1	-	$M\Omega$
			Note 1	-	$M\Omega$
			Note 1	-	$M\Omega.\mu F$
		Note 1	-	$M\Omega.\mu F$	
	Tangent of Loss Angle	$tg\delta$	-	Note 1	-
Temperature Coefficient	Temperature Coefficient (Note 2)	$\Delta C/C$	Note 3		%
Rapid Change of Temperature Initial Measurements Final Measurements	Capacitance	C	Note 1		μF
	Capacitance	C	Note 1		μF
	Change in Capacitance	$\Delta C/C$	-3	+3	%
	Tangent of Loss Angle	$tg\delta$	-	Note 1	-

Test Reference per ESCC No. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Climatic Sequence					
Initial Measurements	Capacitance	C	Note 1		μF
Final Measurements	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-3	+3	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Voltage Proof, Terminal-to-Terminal	VP	Note 1	-	V
	Voltage Proof, Terminal-to-Case	VP _B			V
			U _R = 50V	Note 1	-
			U _R ≥ 100V	Note 1	-
	Insulation Resistance, Dielectric	R _I			
			C ≤ 0.33μF; U _R ≤ 100V	Note 4	-
			U _R > 100V	Note 4	-
		C > 0.33μF; U _R ≤ 100V	Note 4	-	
		U _R > 100V	Note 4	-	
	Insulation Resistance, Body Insulation	R _{IB}	Note 4	-	GΩ
Operating Life					
Initial Measurements	Capacitance	C	Note 1		μF
Intermediate Measurements (1000 hours)	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-5	+5	%
Final Measurements (1000 or 2000 hours) (Note 5)	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-5	+5	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Insulation Resistance, Dielectric	R _I			
			C ≤ 0.33μF; U _R ≤ 100V	Note 4	-
			U _R > 100V	Note 4	-
		C > 0.33μF; U _R ≤ 100V	Note 4	-	
		U _R > 100V	Note 4	-	
	Insulation Resistance, Body Insulation	R _{IB}	5	-	GΩ

NOTES:

- As specified in Para. 2.4.1.
- The test method and test conditions shall be as specified in Para. 2.4.2.
- As specified in Para. 2.4.2.
- 50% of the limit specified in Para. 2.4.1.
- 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.

2.6

BURN-IN CONDITIONS

Characteristics	Symbols	Conditions (Note 1)	Units
Ambient Temperature	T_{amb}	+100 (+0 -5)	°C
Test Voltage	V_T	1.25× U_R (Note 2)	V

NOTES:

1. On completion of Burn-in the components shall be removed from the burn-in chamber and allowed to cool, under normal atmospheric conditions, for recovery for 24 ±2 hours.
2. For the applicable Rated Voltage (U_R) see Para. 1.4.2.

APPENDIX 'A'
AGREED DEVIATIONS FOR EXXELIA TECHNOLOGIES (F)

Items Affected	Description of Deviations
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Screening Tests – Chart F3	<p>All procurement lots shall have 100% Serialisation carried out at any point during Chart F3 testing prior to the performance of High and Low Temperatures Electrical Measurements.</p> <p>If a particular lot is required to undergo testing in accordance with Chart F4, then the Temperature Coefficient measurements, made during High and Low Temperatures Electrical Measurements on a sample of 6 randomly-selected serialised capacitors, shall be Read-and-Record measurements. See “Deviations from Qualification and Periodic Tests – Chart F4” below.</p>
Para. 2.1.1.1, Deviations from Qualification and Periodic Tests – Chart F4	<p>The Temperature Coefficient testing specified in Subgroup 2B of Chart F4 may not be performed.</p> <p>In instances when Temperature Coefficient testing per Subgroup 2B of Chart F4 is not performed, the Read-and-Record measurements data obtained during High and Low Temperature Electrical Measurements (part of Chart F3, Screening Tests) shall be submitted instead.</p>