



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

**BASED ON TYPE MKT**

**ESCC Detail Specification No. 3006/019**

Issue 5	July 2020
---------	-----------



**LEGAL DISCLAIMER AND COPYRIGHT**

European Space Agency, Copyright © 2020. 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 the prior 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.

**DOCUMENTATION CHANGE NOTICE**

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

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

**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 RANGE OF COMPONENTS	5
1.4.1	The ESCC Component Number	5
1.4.1.1	Characteristics and Ratings Codes	5
1.4.2	Range of Components	6
1.5	MAXIMUM RATINGS	8
1.6	PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION	9
1.7	FUNCTIONAL DIAGRAM	9
1.8	MATERIALS AND FINISHES	10
1.8.1	Lead Material	10
1.8.2	Lead Finish	10
2	REQUIREMENTS	10
2.1	GENERAL	10
2.1.1	Deviations from the Generic Specification	10
2.1.1.1	Deviations from Qualification and Periodic Tests – Chart F4	10
2.2	MARKING	10
2.3	ROBUSTNESS OF TERMINATIONS	11
2.4	ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES	11
2.4.1	Room Temperature Electrical Measurements	11
2.4.2	High and Low Temperatures Electrical Measurements	12
2.5	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	12
2.6	BURN-IN CONDITIONS	14
	APPENDIX 'A'	15

## 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 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](#).
- (b) MIL-PRF-87217, Capacitors, Fixed, Supermetallized Plastic Film Dielectric, DC for Low Energy, High Impedance Applications.

### 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 RANGE OF COMPONENTS

#### 1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

Example: 300601901155KH

- Detail Specification Reference: 3006019
- Component Type Variant Number (mandatory): 01
- Characteristic code: Capacitance Value (1.5 $\mu$ 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 <sup>3</sup>	XX3
XX 10 <sup>4</sup>	XX4
XX 10 <sup>5</sup>	XX5
XX 10 <sup>6</sup>	XX6
XX 10 <sup>7</sup>	XX7

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

Tolerance (±)	Code Letter
5%	J
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
160	F
250	H
630	Z

#### 1.4.2 Range of Components

The range of components applicable to this specification are as follows:

Capacitance Value (C) ( $\mu$ F) (Note 1)	DC Rated Voltage ( $U_R$ ) (V)	Dimensions (mm) (Note 2)		Weight Max (g)
		$\varnothing A$ Max	B Max	
0.47	50	7.4	18.5	1.6
0.68				2.2
1				2.6
1.5		10.7	21	2.9
2.2				4.1
3.3				6
4.7				
6.8				
10				
0.1	100	7.4	18.5	1.6
0.15				2.2
0.22		8.4		
0.33				
0.47				
0.68				

Capacitance Value (C) ( $\mu$ F) (Note 1)	DC Rated Voltage ( $U_R$ ) (V)	Dimensions (mm) (Note 2)		Weight Max (g)
		$\varnothing A$ Max	B Max	
1	100	8.4	21	2.5
1.5				
2.2				
3.3				
4.7		10.7	34	5.4
6.8				
10				
22				
47				
100				
0.1	160	7.4	18.5	2.2
0.15				
0.22				
0.33		8.4	21	2.9
0.47				
0.68		9.4	34	9.5
1				
1.5				
2.2				
3.3		10.7	21	3.3
4.7				
6.8		11.7	34	11
10				
0.1		250	8.4	18.5
0.15				
0.22	9.4		21	2.6
0.33				
0.47	10.7		34	11
0.68				
1				
1.5				
2.2	11.7		34	14
3.3				
4.7	13.7	34	11	
10				
0.1	250	9.4	21	3.3
0.15				
0.22		10.7	34	11
0.33				
0.47				
0.68				
1		11.7	34	14
1.5				
2.2		13.7	34	11
3.3				
4.7	15.7	34	14	
10				

Capacitance Value (C) (μF) (Note 1)	DC Rated Voltage (U <sub>R</sub> ) (V)	Dimensions (mm) (Note 2)		Weight Max (g)
		ØA Max	B Max	
6.8	250	18.7	34	20
10		21.7		30
0.033	630	8.4	18.5	2.2
0.047		9.4		2.8
0.068		8.4	21	2.6
0.1		9.4		2.8
0.15		10.7		2.9
0.22		11.7		3.6
		12.7	18.5	3.8
0.33		13.7		21
0.47		12.7	25	4.8
		15.7	21	6
0.68		13.7	34	9
1		15.7		11
1.5		18.7		14.5
2.2		21.7		19
3.3		25.7		25
4.7		29.7		30

**NOTES:**

1. All Capacitance Values are available with tolerances of ±5%, ±10% and ±20%.
2. See Para. 1.6.

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.

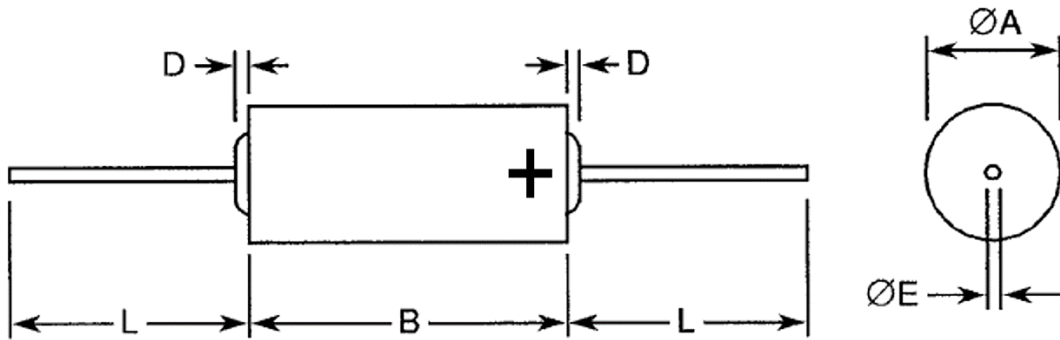
Characteristics	Symbols	Maximum Ratings	Units	Remarks
DC Rated Voltage	U <sub>R</sub>	50, 100, 160, 250, 630	V	Notes 1, 2
AC Rated Voltage	U <sub>A</sub>	35%U <sub>R</sub>	V <sub>rms</sub>	50/60Hz
Operating Temperature Range	T <sub>op</sub>	-55 to +100	°C	T <sub>amb</sub>
Storage Temperature Range	T <sub>stg</sub>	-55 to +100	°C	
Soldering Temperature	T <sub>sol</sub>	+260	°C	Note 3



**NOTES:**

1. As required; See Para. 1.4.2.
2. At  $T_{amb} \leq +85^{\circ}\text{C}$ . For  $T_{amb} > 85^{\circ}\text{C}$ , derate linearly to  $80\%U_R$  at  $T_{amb} = +100^{\circ}\text{C}$ .
3. 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

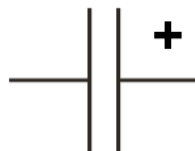


Symbols	Dimensions (mm)	
	Min	Max
D	-	1.5
$\varnothing E$ ( $\varnothing A < 8.5\text{mm}$ )	0.59	0.65
$\varnothing E$ ( $8.5\text{mm} \leq \varnothing A \leq 15\text{mm}$ )	0.75	0.88
$\varnothing E$ ( $\varnothing A > 15\text{mm}$ )	0.95	1.05
L	35	45

**NOTES:**

1. The limits of Dimensions  $\varnothing A$  and B are defined in Para. 1.4.2.
2. Terminal identification: A voltage polarity symbol shall be marked on the body, as shown, adjacent to the lead 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.

## 1.8 MATERIALS AND FINISHES

### 1.8.1 Lead Material

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

### 1.8.2 Lead Finish

The lead 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 (b), Temperature: +85 (+0 -5)°C
- Test Condition (c), Applied voltage:  $1.25 \times U_R$

(b) A new Subgroup 4, Electrical Subgroup, sample size 10 components and consisting of a Voltage Ramp test shall be added to Chart F4. No failures are permitted.

The test shall be performed in accordance with Para. 4.7.4 of MIL-PRF-87217 and the following test conditions shall apply:

- Upper temperature extreme: +90°C
- Lower temperature extreme: -50°C
- Test voltage: 0 to 30VDC
- Charge time: 2V/minute

The Leakage Current of the components shall be measured during the test. The following Leakage Current limits apply:

- For  $U_R \leq 250V$  and  $C \leq 1\mu F$ :  $0.5\mu A$
- For  $U_R \leq 250V$  and  $C > 1\mu F$ :  $0.5\mu A \times C$  (in  $\mu F$ )
- For  $U_R = 630V$  and  $C \leq 1\mu F$ :  $0.05\mu A$
- For  $U_R = 630V$  and  $C > 1\mu F$ :  $0.05\mu A \times C$  (in  $\mu F$ )

### 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 test conditions for Robustness of Terminations shall be as specified in the ESCC Generic Specification and as follows:

- Test U<sub>a</sub>, with an applied force of 10N and a duration of 7.5 ±2.5s.

Both 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<sub>amb</sub> = +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 <sup>-3</sup>	-
Insulation Resistance, Dielectric	R <sub>I</sub>	ESCC No. 3006 C ≤ 0.33µF C > 0.33µF	15 5000	- -	GΩ GΩ.nF
Insulation Resistance, Body Insulation	R <sub>IB</sub>	ESCC No. 3006	15	-	GΩ
Voltage Proof, Terminal-to-Terminal	VP	ESCC No. 3006	1.6×U <sub>R</sub> (Note 3)	-	V
Voltage Proof, Terminal-to-Case	VP <sub>B</sub>	ESCC No. 3006 U <sub>R</sub> = 50V U <sub>R</sub> ≥ 100V (Note 3)	200 2×U <sub>R</sub> (Note 3)	- -	V 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<sub>R</sub>) 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 $T_{amb} = -55 \pm 2^{\circ}C$	-	-15 (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		$\mu F$
	Capacitance	C	Note 1		$\mu F$
	Change in Capacitance	$\Delta C/C$	-5	+15	%
	Insulation Resistance, Dielectric	$R_i$			
	$C \leq 0.33\mu F$ $C > 0.33\mu F$		Note 1 Note 1	- -	$G\Omega$ $G\Omega.nF$
	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		$\mu F$
	Capacitance	C	Note 1		$\mu F$
	Change in Capacitance	$\Delta C/C$	-5	+15	%
	Tangent of Loss Angle	$tg\delta$	-	Note 4	-

Test Reference per ESCC No. 3006	Characteristics	Symbols	Limits		Units
			Min	Max	
Climatic Sequence					
Initial Measurements	Capacitance	C	Note 1		μF
Final Measurements	Voltage Proof (Sleeve)	VP <sub>S</sub>	4	-	kV
	Insulation Resistance (Sleeve)	R <sub>IS</sub>	10	-	GΩ
	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-5	+15	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Voltage Proof, Terminal-to-Terminal	VP	2xU <sub>R</sub> (Note 5)	-	V
	Voltage Proof, Terminal-to-Case	VP <sub>B</sub>			V
		U <sub>R</sub> = 50V U <sub>R</sub> ≥ 100V		Note 1 Note 1	- -
	Insulation Resistance, Dielectric	R <sub>I</sub>			
		C ≤ 0.33μF C > 0.33μF		150 50	- -
	Insulation Resistance, Body Insulation	R <sub>IB</sub>	5	-	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	+15	%
Final Measurements (1000 or 2000 hours) (Note 6)	Capacitance	C	Note 1		μF
	Change in Capacitance	ΔC/C	-5	+15	%
	Tangent of Loss Angle	tgδ	-	Note 4	-
	Insulation Resistance, Dielectric	R <sub>I</sub>			
		C ≤ 0.33μF C > 0.33μF		Note 7 Note 7	- -
	Insulation Resistance, Body Insulation	R <sub>IB</sub>	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.
- 1.5x the limit specified in Para. 2.4.1.
- For the applicable Rated Voltage (U<sub>R</sub>) see Para. 1.4.2.
- 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.

7. 50% of the limit specified in Para. 2.4.1.

## 2.6 BURN-IN CONDITIONS

Characteristics	Symbols	Conditions (Note 1)	Units
Ambient Temperature	$T_{amb}$	+85 (+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>