CAPACITORS, FIXED, DC SELF-HEALING,

METALLISED POLYESTER FILM DIELECTRIC,

BASED ON TYPE MKT

ESCC Detail Specification No. 3006/019

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
970	Specification upissued to incorporate technical changes per DCR.

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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, Metallised, Polyester Film Dielectric, based on Type MKT. It shall be read in conjunction with ESCC Generic Specification No. 3006, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of capacitors covered by this specification is scheduled 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

The parameter derating information applicable to the capacitors specified herein is shown in Figure 1.

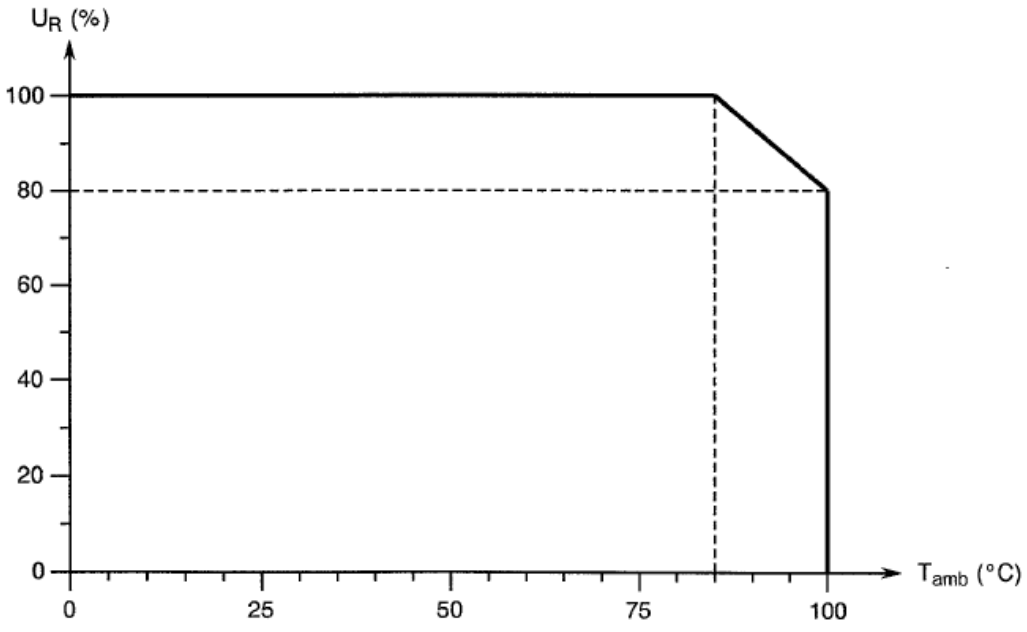
1.5 PHYSICAL DIMENSIONS

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.

FIGURE 1 - PARAMETER DERATING INFORMATION



Rated Voltage versus Ambient Temperature

TABLE 1(a) - RANGE OF COMPONENTS

(1) Item No.	(2) Capacitance Value (C) (µF)	(3) DC Rated Voltage (U_R) (V)	(4) Dimensions (mm)		(5) Weight (g)
			ØA Max.	B Max.	
01	0.47	50	7.4	18.5	1.6
02	0.68	50	7.4	18.5	1.6
03	1	50	8.4	18.5	2.2
04	1	50	9.4	18.5	2.6
05	1.5	50	9.4	18.5	2.6
06	2.2	50	9.4	21	2.6
07	3.3	50	10.7	21	2.9
08	4.7	50	10.7	21	2.9
09	6.8	50	12.7	21	4.1
10	10	50	13.7	21	6
11	0.1	100	7.4	18.5	1.6
12	0.15	100	7.4	18.5	1.6
13	0.22	100	8.4	18.5	2.2
14	0.33	100	8.4	18.5	2.2
15	0.47	100	8.4	18.5	2.2
16	0.68	100	8.4	18.5	2.2
17	1	100	8.4	21	2.5
18	1.5	100	8.4	21	2.5
19	2.2	100	9.4	21	2.9
20	3.3	100	10.7	21	3.3
21	4.7	100	11.7	21	3.6
22	6.8	100	10.7	34	5.4
23	10	100	12.7	34	8
24	22	100	15.7	34	11
25	47	100	21.7	34	23
26	100	100	29.7	34	30
27	0.1	160	7.4	18.5	2.2
28	0.15	160	7.4	18.5	2.2
29	0.22	160	8.4	18.5	2.6
30	0.33	160	8.4	18.5	2.6
31	0.47	160	8.4	21	2.9
32	0.68	160	9.4	21	3.6
33	1	160	10.7	21	4.8
34	1.5	160	11.7	21	5.1
35	2.2	160	12.7	21	5.8
36	3.3	160	11.7	34	9.5
37	4.7	160	12.7	34	11
38	6.8	160	14.7	34	17
39	10	160	16.7	34	19
40	0.1	250	8.4	18.5	2.2
41	0.15	250	8.4	18.5	2.2
42	0.22	250	9.4	18.5	2.6
43	0.33	250	9.4	21	3.3
44	0.47	250	9.4	21	3.3
45	0.68	250	10.7	21	4.1
46	1	250	11.7	21	4.7
47	1.5	250	13.7	21	5.8
48	2.2	250	15.7	21	6.3

(1) Item No.	(2) Capacitance Value (C) (µF)	(3) DC Rated Voltage (U_R) (V)	(4) Dimensions (mm)		(5) Weight (g)
			ØA Max.	B Max.	
49	3.3	250	14.7	34	11
50	4.7	250	16.7	34	14
51	6.8	250	18.7	34	20
52	10	250	21.7	34	30
53	0.033	630	8.4	18.5	2.2
54	0.047	630	9.4	18.5	2.8
55	0.068	630	8.4	21	2.6
56	0.1	630	9.4	21	2.8
57	0.15	630	10.7	21	2.9
58	0.22	630	11.7	21	3.6
59	0.33	630	13.7	21	5.8
60	0.47	630	15.7	21	6
61	0.68	630	13.7	34	9
62	1	630	15.7	34	11
63	1.5	630	18.7	34	14.5
64	2.2	630	21.7	34	19
65	3.3	630	25.7	34	25
66	4.7	630	29.7	34	30
67	0.22	630	12.7	18.5	3.8
68	0.47	630	12.7	25	4.8

NOTES

1. The capacitors have tolerances of ±5%, ±10% and ±20% for all values.

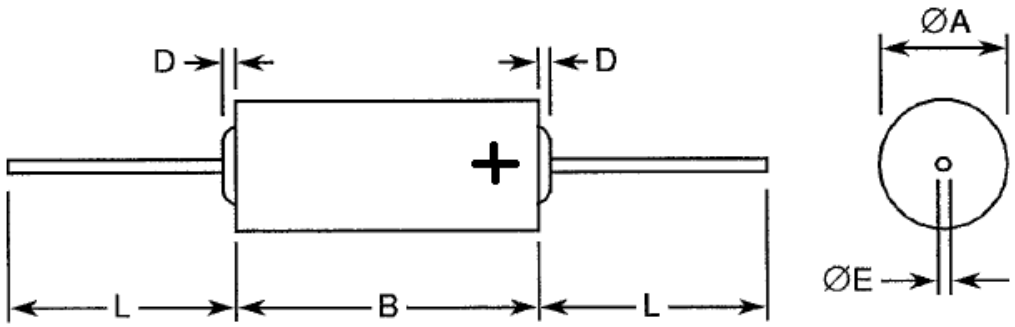
TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Maximum Ratings	Unit	Remarks
1	Rated Voltage DC	U_R	See Table 1(a)	V	Note 1
2	Rated Voltage AC (50/60Hz)	U_A	35% of U_R	Vrms	
3	Operating Temperature Range	T_{op}	-55 to +100	°C	T_{amb}
4	Storage Temperature Range	T_{stg}	-55 to +100	°C	
5	Soldering Temperature	T_{sol}	+260	°C	Note 2

NOTES

1. At $T_{amb} \leq +85°C$. For derating at $T_{amb} > +85°C$, see Figure 1.
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.

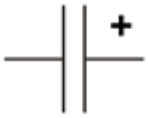
FIGURE 2 - PHYSICAL DIMENSIONS



Symbol	Millimetres		Remarks
	Min.	Max.	
ØA	Note 1		
B	Note 1		
D	-	1.5	
ØE	0.59	0.65	Note 2
ØE	0.75	0.88	Note 3
ØE	0.95	1.05	Note 4
L	35	45	

NOTES
1. See Table 1(a) for dimensions.
2. For ØA < 8.5mm.
3. For 8.5mm ≤ ØA ≤ 15mm.
4. For ØA > 15mm.

FIGURE 3 - FUNCTIONAL DIAGRAM



NOTES
1. These capacitors are not polarised, however, marking includes the voltage polarity symbol indicated above, which should be respected in use.

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 for Capacitors, Fixed, Metallised Plastic Dielectric, Hermetically Sealed in Metal Cases.
(b) MIL-C-87217, Capacitors, Fixed, Supermetallised Film Dielectric, DC for Low Energy.

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.

4 REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein are stated in this specification and ESCC Generic Specification No. 3006 for Capacitors, Fixed, Film Dielectric. 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 ESCC 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, Seal Test: Not applicable.

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

(a) Para. 9.2, Seal Test: Not applicable.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.2, Seal Test: Not applicable.

(b) A Voltage Ramp Test shall be performed on 10 additional components in accordance with MIL-C-87217, Para. 4.7.4. Test Conditions shall be as follows:

- Maximum Temperature:+90°C.
- Minimum Temperature:-50°C.
- Voltage Ramp: Test voltage:0 to 30V.
  Charge time: 2V/minute.

During the test, Leakage Current is to be measured with limits as defined below. No failures are allowed.

Rated Voltage (V)	Leakage Current Limits	
	C ≤ 1µF	C > 1µF
630	0.05µA	0.05µA × C (µF)
≤ 250	0.5µA	0.5µA × C (µF)

(c) Para. 9.16, Operating Life: Shall be performed at $1.25U_R$.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.2, Seal Test: Not applicable.
(b) The Voltage Ramp Test specified in Para. 4.2.4(b) shall be performed.
(c) Para. 9.16, Operating Life: Shall be performed at $1.25U_R$.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the capacitors specified herein shall be checked. They shall conform to those shown in Figure 2 and Table 1(a).

4.3.2 Weight

The maximum weight of the capacitors specified herein shall be as specified in Table 1(a).

4.3.3 Robustness of Terminations

The requirements for robustness of terminations are specified in Section 9 of ESCC Generic Specification No. 3006. The test conditions shall be as follows:

- Test Condition: Ua, Tensile
- Applied Force: 10 Newtons
- Duration: 5 to 10 seconds

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 Case

Aluminium tube: End seals: epoxy resin.
Sleeve: polyolefin.

4.4.2 Lead Material and Finish

The lead material shall be Type 'A' in accordance with the requirements of ESCC Basic Specification No. 23500. The finish shall be Sn95Pb5.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC 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) Polarity
(b) Lead Identification.
(c) The ESCC Component Number.
(d) Electrical Characteristics and Ratings.
(e) Traceability Information.

4.5.2 Polarity
Polarity shall be marked in accordance with Figures 2 and 3 of this specification.

4.5.3 Lead Identification
Not applicable.

4.5.4 The ESCC Component Number
The ESCC Component Number shall be constituted and marked as follows:

300601901B

- Detail Specification Number: 3006019
- Type Variant (see Note): 01
- Testing Level (B or C, as applicable): B

N.B.
Marking of the Type Variant Number is mandatory. No further reference to type variants is made in this specification.

4.5.5 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:

Example: 155KH

- Capacitance Value (1.5µF): 155
- Tolerance (10%): K
- Rated Voltage (250V): H

4.5.5.1 Capacitance Values
Capacitance values shall be coded as follows.The unit quantity for marking shall be picofarads.

Numerical Value	Code
$XX10^3$	XX3
$XX10^4$	XX4
$XX10^5$	XX5
$XX10^6$	XX6
$XX10^7$	XX7

4.5.5.2 Tolerances
The tolerances on capacitance values shall be indicated by the letter code specified hereafter.

Tolerance (±%)	Code Letter
5	J
10	K
20	M

4.5.5.3 Rated Voltage

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

Rated Voltage (V)	Code Letter
50	C
100	E
160	F
250	H
630	Z

4.5.6 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESCC 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, the measurements shall be performed at T_{amb} = +22 ±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

Not applicable.

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 ±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 ESCC Generic Specification No. 3006. 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 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	ESCC 3006 Test Method	Test Condition	Limits		Unit
					Min.	Max.	
1	Capacitance	C	Para. 9.6.1.2	Test frequency: 1kHz	See Table 1(a) (Note 1)		µF
2	Tangent of Loss Angle	Tgδ	Para. 9.6.1.3	Test frequency: 1kHz	-	10	10^{-3}
3	Insulation Resistance Terminal to Terminal	Ri	Para. 9.6.1.4	C ≤ 33µF C > 0.33µF	15 5000	- -	GΩ sec.
4	Insulation Resistance Terminals to Case	Ri_B	Para. 9.6.1.4		15	-	GΩ
5	Voltage Proof Terminal to Terminal	VP	Para. 9.6.1.1		1.6 U_R (2)	-	V
6	Voltage Proof Terminals to Case	VP_B	Para. 9.6.1.1		2 U_R (2)	-	V

NOTES
1. ± Ordered Tolerance.
2. For U_R, see Column 3 of Table 1(a). For VP_B, minimum 200V.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESCC 3006 Test Method	Test Condition (Note 1)	Limits		Unit
					Min.	Max.	
1(a)	Capacitance Change	ΔC/C	Para. 9.6.1.2	T_{amb} = -55°C Test frequency: 1kHz	-	-15 (2)	%
1(b)	Capacitance Change	ΔC/C	Para. 9.6.1.2	T_{amb} = +100°C Test frequency: 1kHz	-	+8 (2)	%

NOTES
1. These measurements shall be performed on a sample basis (see Para. 7.4.2 of ESCC Generic Specification No. 3006). AQL: 1.0%.
2. Related to value recorded at T_{amb} = +22°C.

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	ΔC/C	As per Table 2	As per Table 2	±3	%

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

No.	Characteristic	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	+85 (+0 -5)	°C
2	Test Voltage	V_T	$1.25U_R$ (Note 1)	V

NOTES
1. See Column 3 of Table 1(a).

FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TESTS

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION NO. 3006)

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 ±3°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 ±3°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 ±3°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 ESCC Generic Specification No. 3006. 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.	ESCC Generic Spec. No. 3006		Measurements And Inspections		Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification	Conditions		Min.	Max.	
01	Seal Test (Hermetically Sealed)	Para. 9.2	Not applicable					
02	Rapid Change of Temperature	Para. 9.3.2	**Initial Measurements** Capacitance **Final Measurements** Visual Examination Capacitance Change Tangent of Loss Angle	 Table 2 Item 1 After recovery of 24 ±2 hours No damage Table 2 Item 1 Table 2 Item 2	 C ΔC/C Tgδ	 Record values -5 -	 +15 +5	 % 10^{-3}
03	Corrosion (Hermetically Sealed)	Para. 9.8, Half without sleeving (2)	Not applicable					
04	Robustness of Terminations	Para. 9.9 and Para. 4.3.3 of this spec.	**Final Measurements** Visual Examination	 No damage	 -	 -	 -	
05	Resistance to Soldering Heat	Para. 9.10	**Initial Measurements** Capacitance **Final Measurements** Insulation Resistance Capacitance Change Tangent of Loss Angle	 Table 2 Item 1 After recovery of 1 to 2 hrs Table 2 Item 3 Table 2 Item 1 Table 2 Item 2	 C Ri ΔC/C Tgδ	 Record values Table 2 -5 -	 - +15 Table 2	 %
06	Solderability	Para. 9.11 Method 3	**Final Measurements** Visual Examination	 IEC No. 68-2-20 Para. 4.6.4, 4.7.4 or 4.9.3	 -	 -	 -	
07	Vibration	Para. 9.12	 **Measurements during Tests** During Last Cycle **Final Measurements** Visual Examination	50% U_R (3) applied No intermittent contacts > 0.5ms or Open or Short Circuits No evidence of damage	 - -	 - -	 - -	
08	Shock or Bump	Para. 9.13	 **Measurements during Tests** During Last Cycle **Final Measurements** Visual Examination	50% U_R (3) applied No intermittent contacts > 0.5ms or Open or Short Circuits No evidence of damage, breakdown, arcing or fractures	 - -	 - -	 - -	

No.	ESCC Generic Spec. No. 3006		Measurements And Inspections		Symbol	Limits		Unit
	Environmental And Endurance Tests (1)	Test Method And Conditions	Identification	Conditions		Min.	Max.	
09	Climatic Sequence	Para. 9.14	**Initial Measurements**					
			Capacitance	Table 2 Item 1	C	Record Values		
			Final Measurements	After recovery of 24 hrs max.				
			Visual Examination	No evidence of corrosion or unwrapping or mechanical damage to the sleeve	-	-	-	
			Voltage Proof (2)	ESCC No. 3006 Para. 9.6.1.1	VP_S	4	-	kV
			Insulation Resistance (2)	ESCC No. 3006 Para. 9.6.1.4 After removal of sleeve (2)	Ri_S	10	-	GΩ
			Voltage Proof	Table 2 Item 5	VP	$20U_R$ (3)	-	
			Voltage Proof	Table 2 Item 6	VP_B	$2U_R$ (3)	-	
			Insulation Resistance	Table 2 Item 3	Ri	150	-	MΩ
						50	-	sec.
			Insulation Resistance	Table 2 Item 4	Ri_B	5	-	GΩ
			Capacitance Change	Table 2 Item 1	ΔC/C	-5	+15	%
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	-	+5	10^{-3}
10	Temperature Coefficient	Para. 9.15		ESCC No. 3006 Para. 9.15				
			Final Measurements					
			Capacitance Change	Table 3 Item 1(a)	ΔC/C	-	-15	%
				Table 3 Item 1(b)	ΔC/C	-	+6	%
11	Operating Life	Para. 9.16 and Paras. 4.2.4 and 4.2.5 of this spec.	**Initial Measurements**			Record values		
			Capacitance	Table 2 Item 1	C			
			During Tests	$1.25U_R$ (3)				
			Intermediate Measurements	After recovery of 24 ±2 hours				
			Capacitance Change	Table 2 Item 1	ΔC/C	-5	+15	%
			Final Measurements	After removal of sleeves (2) and after 24 hrs recovery				
			Capacitance Change	Table 2 Item 1	ΔC/C	-5	+15	%
			Tangent of Loss Angle	Table 2 Item 2	Tgδ	-	+5	10^{-3}
			Insulation Resistance	Table 2 Item 3	Ri	Note 4	-	
			Insulation Resistance	Table 2 Item 4	Ri_B	5	-	GΩ
			Visual Examination	No evidence of damage or corrosion	-	-	-	
12	Permanence of Marking	Para. 9.17	**Final Measurements**					
			Visual Examination	No corrosion or obliteration of marking	-	-	-	

NOTES

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

3. For U_R, see Column 3 of Table 1(a). For VP_B, minimum 200V.
4. Greater than 50% of the value given in Table 2.