# CAPACITORS, FIXED, METALLISED

# POLYCARBONATE DIELECTRIC,

# BASED ON TYPE CKM 111

# ESCC Detail Specification No. 3006/007

**ISSUE 1**

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# CAPACITORS, FIXED, METALLIZED POLYCARBONATE DIELECTRIC, BASED ON TYPE CKM 111

ESA/SCC Detail Specification No. 3006/007

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Approved by SCCG
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Date: 3-7-79
(Director General or his Deputy)

## DOCUMENTATION CHANGE NOTICE

| Rev. Letter | Rev. Date | Reference | CHANGE Item | Approved DCR No. |
|---|---|---|---|---|
| 'A' | Jul. '81 | This Issue incorporates all modifications agreed on the basis of Policy DCR 21016 for adaptation to new qualification requirements. | | |
| | | P1. Cover page | | None |
| | | P2. DCN | | None |
| | | P4. T of C | : References to Appendices added | 21019 |
| | | P6. Table 1(a) | : Modification of lead length for Items 18-19-20-25-26-27 | 22067 |
| | | P8. Para. 4.1 | : Reference to Appendices added | 21019 |
| | | P12. Table 3 | : Test 1, minimum limit changed | 22067 |
| | | | : Notes to Tables 2 and 3 modified | 22067 |
| | | P16. Table 6 | : Modification of Title | 22067 |
| 'B' | Aug. '84 | P1. Cover page | | None |
| | | P2 DCN | | None |
| | | P9. Para. 4.3.3 | : "Variants" substituted by "Lead Diameters" | 22282 |
| | | P12. Table 2 | : Modification of Voltage Proof symbol | None |
| | | Tables 2 and 3 | : Modification of Notes 1 and 2 | 22282 |
| | | P16. Table 6 | : Modification of $R_i$ limits for Operating Life and Ext. Oper. Life | 22282 |
| | | | : Modification of Voltage Proof symbol | None |
| | | | : Modification of Note | 22282 |
| | | This document has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist. | | |

## TABLE OF CONTENTS

## 1. GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Metallised, Polycarbonate Dielectric, based on Type CKM 111.

It shall be read in conjunction with ESA/SCC 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 rated voltage versus temperature derating is shown in Figure 1.

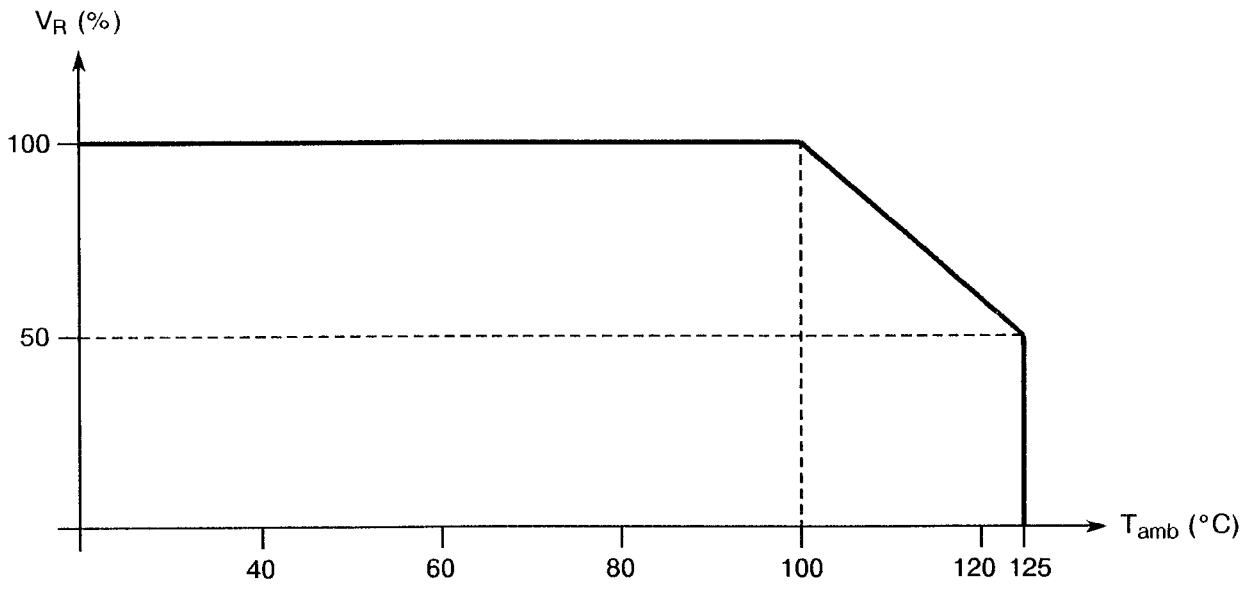
### 1.5 PHYSICAL DIMENSIONS

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**



## TABLE 1(a) - RANGE OF COMPONENTS

| Item No. | Capacitance Range (1) (µF) | | | Rated Voltage | | Dimensions (mm) | | | Mean Weight (g) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | (Vdc) | (Vrms) | L Max. | D | Ø (+10 −5.0) % | |
| 01 | 0.0261 | to | 0.0536 | 63 | 40 | 19 | 6.4 | 0.6 | 1.5 |
| 02 | 0.0549 | to | 0.115 | 63 | 40 | 19 | 8.4 | 0.6 | 2.5 |
| 03 | 0.118 | to | 0.255 | 63 | 40 | 23.5 | 8.4 | 0.8 | 3.0 |
| 04 | 0.261 | to | 0.536 | 63 | 40 | 23.5 | 11 | 0.8 | 4.5 |
| 05 | 0.549 | to | 1.15 | 63 | 40 | 23.5 | 13.2 | 0.8 | 5.2 |
| 06 | 1.18 | to | 2.55 | 63 | 40 | 36 | 13.2 | 1.0 | 7.3 |
| 07 | 2.61 | to | 3.74 | 63 | 40 | 36 | 14.8 | 1.0 | 8.2 |
| 08 | 3.83 | to | 5.36 | 63 | 40 | 36 | 17 | 1.0 | 9.0 |
| 09 | 0.0118 | to | 0.0255 | 160 | 100 | 19 | 6.4 | 0.6 | 1.5 |
| 10 | 0.0261 | to | 0.0536 | 160 | 100 | 19 | 8.4 | 0.6 | 2.5 |
| 11 | 0.0549 | to | 0.115 | 160 | 100 | 23.5 | 8.4 | 0.8 | 3.0 |
| 12 | 0.118 | to | 0.255 | 160 | 100 | 23.5 | 11 | 0.8 | 4.5 |
| 13 | 0.261 | to | 0.536 | 160 | 100 | 23.5 | 13.2 | 0.8 | 5.2 |
| 14 | 0.549 | to | 1.15 | 160 | 100 | 36 | 13.2 | 1.0 | 7.3 |
| 15 | 0.00374 | to | 0.00825 | 250 | 160 | 16 | 6.4 | 0.6 | 1.5 |
| 16 | 0.00845 | to | 0.0115 | 250 | 160 | 19 | 6.4 | 0.6 | 1.5 |
| 17 | 0.0118 | to | 0.0255 | 250 | 160 | 19 | 8.4 | 0.6 | 2.5 |
| 18 | 0.0261 | to | 0.0536 | 250 | 160 | 23.5 | 8.4 | 0.8 | 3.0 |
| 19 | 0.0549 | to | 0.115 | 250 | 160 | 23.5 | 11 | 0.8 | 4.5 |
| 20 | 0.118 | to | 0.221 | 250 | 160 | 23.5 | 13.2 | 0.8 | 5.2 |
| 21 | 0.226 | to | 0.511 | 250 | 160 | 36 | 13.2 | 1.0 | 7.3 |
| 22 | 0.00100 | to | 0.00365 | 400 | 200 | 16 | 6.4 | 0.6 | 1.5 |
| 23 | 0.00374 | to | 0.00536 | 400 | 200 | 19 | 6.4 | 0.6 | 1.5 |
| 24 | 0.00549 | to | 0.0115 | 400 | 200 | 19 | 8.4 | 0.6 | 2.5 |
| 25 | 0.0118 | to | 0.0255 | 400 | 200 | 23.5 | 8.4 | 0.8 | 3.0 |
| 26 | 0.0261 | to | 0.0536 | 400 | 200 | 23.5 | 11 | 0.8 | 4.5 |
| 27 | 0.0549 | to | 0.115 | 400 | 200 | 23.5 | 13.2 | 0.8 | 5.2 |
| 28 | 0.118 | to | 0.255 | 400 | 200 | 36 | 13.2 | 1.0 | 7.3 |

**NOTES**

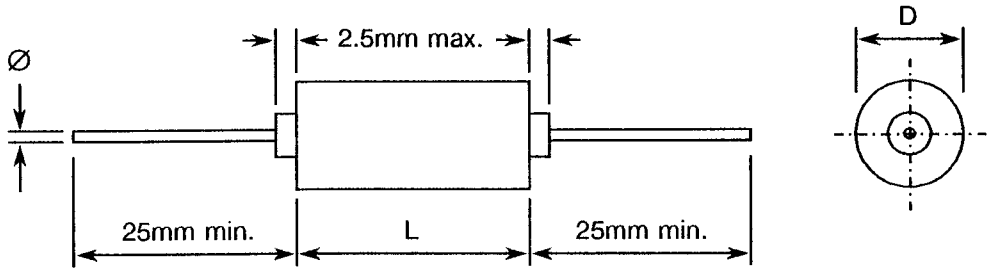
1. The capacitance tolerances and associated standard value series are:-

   E96 = ± 1.0%.
   E48 = ± 2.0%.

## TABLE 1(b) - MAXIMUM RATINGS

| No. | Characteristics | Symbol | Maximum Ratings | | Unit | Remarks |
|---|---|---|---|---|---|---|
| | | | Min. | Max. | | |
| 1 | Rated Voltage d.c. | $U_R$ | See Table 1(a) | | Vdc | |
| 2 | Rated Voltage a.c. | $U_A$ | See Table 1(a) | | Vrms | All frequencies to 50Hz |
| 3 | Operating Temperature Range | $T_{amb}$ | −55 | +125 | °C | |
| 4 | Storage Temperature Range | $T_{amb}$ | −55 | +125 | °C | |
| 5 | Maximum Soldering Temperature | $T_L$ | - | +260 | °C | Soldering time:<br>$t_s \leq 5$ seconds at 6.0mm from the body |

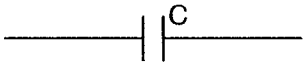
## FIGURE 2 - PHYSICAL DIMENSIONS




**NOTES**

1. See Table 1(a) for dimensions.

## FIGURE 3 - FUNCTIONAL DIAGRAM



## 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. 3006 for Capacitors, Fixed, Metallised Plastic Dielectric, Hermetically Sealed in Metal Cases.

(b) MIL-STD-1276B, Leads, Weldable for Electronic Component Parts.

## 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.

## 4. REQUIREMENTS

### 4.1 GENERAL

The complete requirements for procurement of the capacitors specified herein are stated in this specification and ESA/SCC Generic Specification No. 3006 for Capacitors, Fixed, Metallised Plastic Dielectric, Hermetically Sealed in Metal Cases. 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)

None.

#### 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 checked. They shall conform to those shown in Figure 2 and Table 1(a) of this specification.

#### 4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 1.2 times the mean weight specified in Table 1(a).

4.3.3 Robustness of Terminations

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

(a) For lead diameters equal to, or less than, 0.8mm

Applied Force: 10 Newtons.

(b) For lead diameters exceeding 0.8mm

Applied Force: 20 Newtons.

The force shall be applied gradually to the terminal and then maintained for a period of 5 to 10 seconds. After this test, the capacitors shall be examined for evidence of breaking and loosening of terminals.

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

The case material shall be non-magnetic metal, hermetically sealed and covered with an insulating sleeve.

4.4.2 Leads

The capacitors shall be equipped with tinned copper leads according to Type 'C' of MIL-STD-1276. Therefore, these leads may be either electrically welded or soldered. The leads shall be free from non-conductive and foreign materials beyond the maximum specified "clean lead to clean lead" body dimension. At any cross-section, the maximum thickness of the sheath shall not exceed twice the minimum thickness of the sheath.

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs.

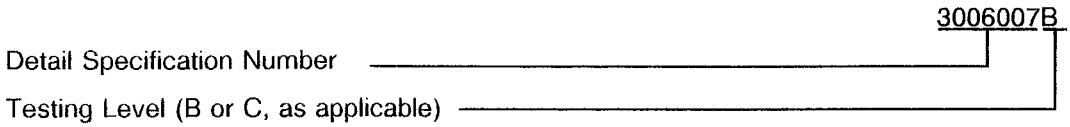
(a) The SCC Component Number.

(b) Electrical Characteristics and Ratings.

(c) Traceability Information.

4.5.2 The SCC Component Number

The SCC Component Number shall be constituted and marked as follows:-




4.5.3 Electrical Characteristics and Ratings

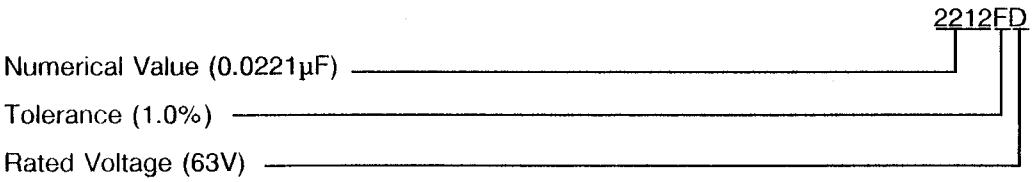
The electrical characteristics and ratings to be marked in the following order of precedence are:-

(a) Numerical Value.

(b) Tolerance.

(c) Rated Voltage.

The information shall be constituted and marked as follows:-




4.5.3.1 Numerical Values

Numerical values shall be coded as follows. The unit quantity for marking shall be picofarads.

| Numerical Value | Code |
|---|---|
| XX.X | XXRX |
| XXX | XXX0 |
| XXX10[1] | XXX1 |
| XXX10[2] | XXX2 |
| XXX10[3] | XXX3 |
| XXX10[4] | XXX4 |
| XXX10[5] | XXX5 |
| XXX10[6] | XXX6 |
| XXX10[7] | XXX7 |

4.5.3.2 Tolerances

The tolerances on numerical values shall be indicated by the letter code specified hereafter.

| Tolerance (%) | Code Letter |
|---|---|
| ±1.0 | F |
| ±2.0 | G |

4.5.3.3 Rated Voltage

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

| Rated Voltage (V) | Code Letter |
|---|---|
| 63 | D |
| 160 | F |
| 250 | H |
| 400 | K |

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESA/SCC 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. 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. The AQL shall be 2.5% for each capacitance value. Each capacitance value shall be considered as constituting a complete lot. For qualification or lot acceptance testing, the sample size shall be as specified in ESA/SCC Generic Specification No. 3006.

4.6.3 Circuits for Electrical Measurements

The circuit for use in performing the electrical measurements listed in Tables 2 and 3 of this specification is shown in Figure 4.

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 ($\Delta$) 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 ESA/SCC 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 $24 \pm 2$ hours is necessary before the end-measurements.

## TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

| No. | Characteristics | Symbol | ESA/SCC 3006 Test Condition | Limits | | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Max. | | |
| 1 | Voltage Proof (Between Terminals) | $U_T$ | Para. 9.6.1.1 | $1.6U_R$ | - | V | See $U_R$ Table 1(a) |
| 3 | Insulation Resistance | $R_i$ | Para. 9.6.1.4 | 50 (1) | - | GΩ | |
| 5 | Capacitance | C | Para. 9.6.1.2 | $C_n$ −1.0 −2.0 | $C_n$ +1.0 +2.0 | µF % % | See Table 1(a) |
| 6 | Tangent of Loss Angle | tgδ | Para. 9.6.1.3 | - | 20 | $10^{-4}$ | C≤1.0µF |
| | | | | - | 15 | $10^{-4}$ | C>1.0µF |

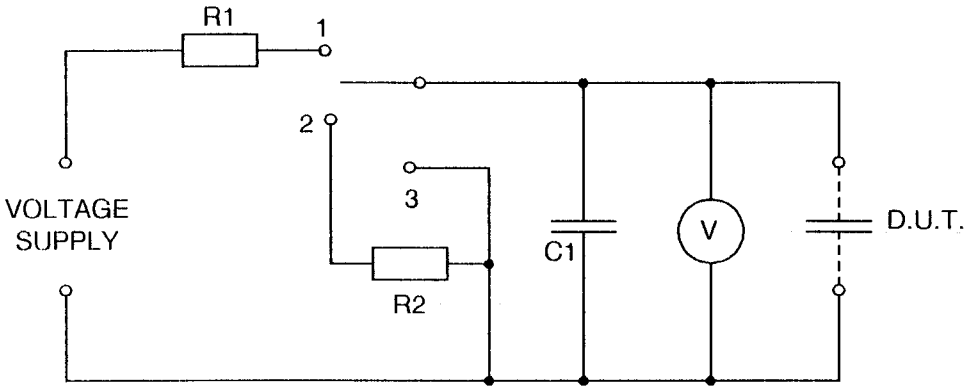
## TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

| No. | Characteristics | Symbol | ESA/SCC 3006 Test Condition | Limits | | Unit |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| 1 | Insulation Resistance at +125±3°C (Between Terminals) | $R_i$ | Para. 9.6.1.4 | 500 (2) | - | MΩ |
| 2 | Capacitance Change at −55±3°C | $\frac{\Delta C}{C}$ | Para. 9.6.1.2 | −3.0 | - | % |
| 3 | Capacitance Change at +125±3°C | $\frac{\Delta C}{C}$ | Para. 9.6.1.2 | −2.0 | +1.0 | % |

**NOTES**

1. 10 GΩ.µF (or RC≥ 10 000 seconds) for C>0.22µF.
2. 100 MΩ.µF (or RC≥ 100 seconds) for C>0.22µF.

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS




**NOTES**

1. The resistance of the Voltmeter shall be not less than 10 000Ω/V. The capacitance of C shall be at least 10 times that of the D.U.T.
2. The resistances of R1 and R2 shall be such that the initial charging and discharging current does not exceed 0.05A at the highest test voltage.

## TABLE 4 - PARAMETER DRIFT VALUES

| No. | Characteristics | Symbol | Specification | Test Conditions | Change Limits (Δ) | Unit |
|---|---|---|---|---|---|---|
| 1 | Capacitance | $\frac{\Delta C}{C}$ | ESA/SCC 3006 | Para. 9.6.1.2 | ± 0.5 | % |

## TABLE 5 - CONDITIONS FOR BURN-IN

| No. | Characteristic | Symbol | Condition | Unit |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | + 125 | °C |
| 2 | Test Voltage | $U_T$ | $0.7U_R$ | V |

## 4.8 ENVIRONMENTAL AND ENDURANCE TESTS

### 4.8.1 Electrical Measurements on Completion of Environmental Tests

The parameters to be measured on completion of environmental tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

### 4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests

The parameters to be measured at intermediate points during endurance tests are scheduled in Table 6.

### 4.8.3 Electrical Measurements on Completion of Endurance Tests

The parameters to be measured on completion of endurance testing are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °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 ESA/SCC Generic Specification No. 3006. The conditions for operating life testing shall be as specified in Table 5 of this specification.

## TABLE 6 - ELECTRICAL MEASUREMENTS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

| ESA/SCC 3006 Paragraph | Characteristic | Symbol | Measurement | Condition ESA/SCC 3006 Paragraph | Limits | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | | Min. | Max. | |
| 9.8 | Damp Heat Steady State (Duration: 56 Days) | $U_T$ | Voltage Proof | 9.6.1.1 | 1.0 $U_R$ | - | V |
| | | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −0.5 | +0.5 | % |
| | | tgδ | Tangent of Loss Angle | 9.6.1.3 | See Table 2 | | |
| | | $R_i$ | Insulation Resistance | 9.6.1.4 | 50% of Table 2 | - | GΩ |
| 9.9 | Robustness of Terminations | | | External Visual Inspection | | | |
| 9.10 | Resistance to Soldering Heat | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −0.25 | +0.25 | % |
| 9.11 | Solderability | | External Visual Inspection | Solder Globule Method | | | |
| 9.3 | Rapid Change in Temperature | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −0.5 | +0.5 | % |
| | | tgδ | Tangent of Loss Angle | 9.6.1.3 | See Table 2 | | |
| 9.12 | Vibration | | | External Visual Inspection | | | |
| 9.13.1 | Bump | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −0.5 | +0.5 | % |
| 9.13.2 | Shock | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −0.5 | +0.5 | % |
| 9.14 | Climatic Sequence | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −0.5 | +0.5 | % |
| | | tgδ | Tangent of Loss Angle | 9.6.1.3 | See Table 2 | | |
| | | $R_i$ | Insulation Resistance | 9.6.1.4 | 50% of Table 2 | - | GΩ |
| 9.16 | Operating Life | $\frac{\Delta C}{C}$ | Capacitance Change | 9.6.1.2 | −2.0 | +2.0 | % |
| | | tgδ | Tangent of Loss Angle | 9.6.1.3 | See Table 2 | | |
| | | $R_i$ | Insulation Resistance (between terminals) | 9.6.1.4 | 40 (1) | - | GΩ |

**NOTES**

1. $R_i \geq 8.0$ GΩ.μF (or RC ≥ 8000 seconds) for C > 0.22μF.