# CAPACITORS, CHIP, TANTALUM,

# SOLID ELECTROLYTE,

# BASED ON TYPE 1005

# ESCC Detail Specification No. 3011/001

| | |
|---|---|
| Issue 3 | January 2014 |

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

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## DOCUMENTATION CHANGE NOTICE

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| DCR No. | CHANGE DESCRIPTION |
|---|---|
| 819 | Specification upissued to incorporate editorial and technical changes per DCR. |

**TABLE OF CONTENTS**

## 1 GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Chip, Tantalum, Solid Electrolyte, based on Type 1005.

It shall be read in conjunction with ESCC Generic Specification No. 3011, 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 of the capacitors specified herein is shown in Figure 3.

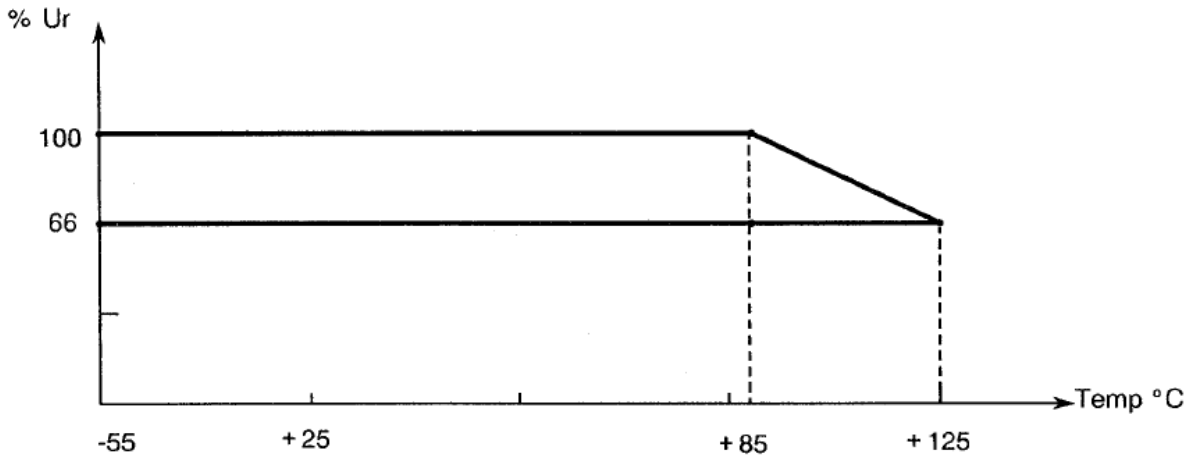
**TABLE 1(a) - RANGE OF COMPONENTS**

| Capacitance Value (µF) | Tolerance (%) | Rated Voltage (V) |
|---|---|---|
| 0.1 | 10 and 20 | 50 |
| 0.15 | | 50 |
| 0.22 | | 40 |
| 0.33 | | 25 |
| 0.47 | | 20 |
| 0.68 | | 16 |
| 1 | | 10 |
| 1.5 | | 6.3 |
| 2.2 | | 4 |

**TABLE 1(b) - MAXIMUM RATINGS**

| No. | Characteristics | Symbol | Maximum Ratings | | Units | Remarks |
|---|---|---|---|---|---|---|
| | | | Min | Max | | |
| 1 | Rated Voltage | $U_R$ | See Table 1(a) | | Vdc | |
| 2 | Surge Voltage | $U_S$ | - | $1.3U_R$ | Vdc | |
| 3 | Operating Temperature Range | $T_{op}$ | -55 | +125 | ºC | |
| 4 | Storage Temperature Range | $T_{stg}$ | -55 | +125 | ºC | |
| 5 | Soldering Temperature | $T_{sol}$ | - | +260 | ºC | Soldering time: ≤ 10 seconds |

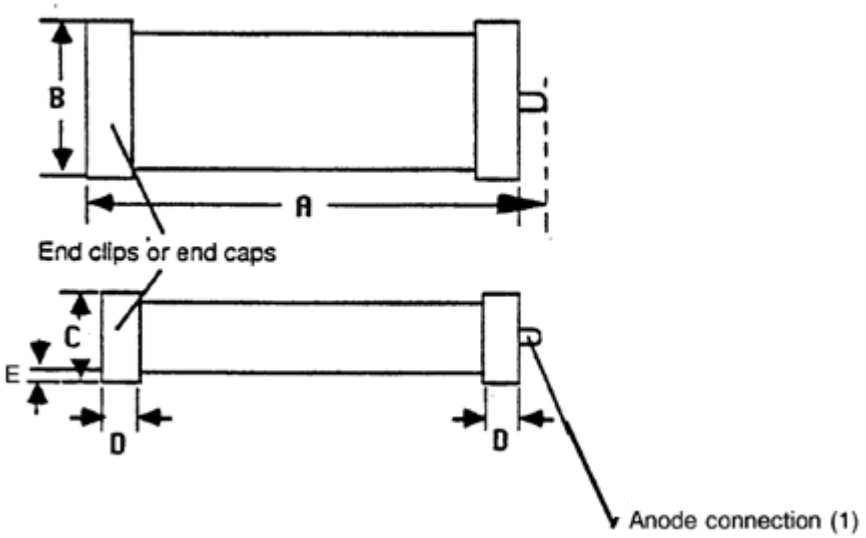
**FIGURE 1 - PARAMETER DERATING INFORMATION**




VOLTAGE VERSUS TEMPERATURE

**FIGURE 2 - PHYSICAL DIMENSIONS**

VARIANTS 01, 05

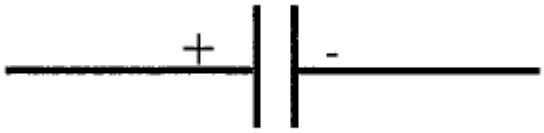



| Dimensions (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A | | B | | C | | D | | E | |
| Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| 2.1 | 2.9 | 0.9 | 1.7 | 0.9 | 1.7 | 0.5 | 1 | - | 0.15 |

**NOTES**

1. The anode terminal shall be identified by the riser wire connection, which extends from the case size by 0.4mm max.

**FIGURE 3 - FUNCTIONAL DIAGRAM**




## 2 APPLICABLE DOCUMENTS

The following document forms part of this specification and shall be read in conjunction with it:

(a) ESCC Generic Specification No. 3011 for Capacitors, Chip, Tantalum, Solid Electrolyte.

## 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. 3011. 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

The following deviations from ESCC Generic Specification No. 3011 shall apply:

#### 4.2.1 Deviations from Special In-process Controls

Not applicable.

#### 4.2.2 Deviations from Final Production Tests (Chart II)

None.

#### 4.2.3 Deviations from Burn-in Tests (Chart III)

None.

#### 4.2.4 Deviations from Qualification, Environmental and Endurance 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 verified in accordance with the requirements set out in Para 9.3 of ESCC Generic Specification No. 3011 and shall conform to those shown in Figure 2 of this specification.

#### 4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.03 grammes.

#### 4.3.3 Adhesion

The requirements for adhesion are specified in Para 9.3 of ESCC Generic Specification No. 3011.

### 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 Terminations

The capacitors shall be terminated in accordance with the requirements of ESCC Basic Specification No. 23500, as follows:

(a) Variant 01:
With clips or end caps Type 'E' with Type '2' finish.

(b) Variant 05:
With clips or end caps Type 'E' with Type '18' finish.

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 subparagraphs. These components being too small to accommodate the marking as specified hereafter, the marking information in full shall accompany each component in its primary package. Such marking shall comprise:

(a) The ESCC Component Number.
(b) Electrical Characteristics and Ratings.
(c) Traceability Information.

4.5.2 The ESCC Component Number

The ESCC component number shall be constituted and marked as follows:

Example: 301100101B

- Detail Specification Number: 3011001
- Type Variant (as applicable, see Para 4.4.1): 01
- Testing Level (B or C, as appropriate): B

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:

Example: 155KG

– Capacitance value (1.5µF): 155
– Tolerance (±10%): K
– Rated voltage (25V): G

*4.5.3.1 Capacitances*

The capacitance values shall be expressed by means of the following codes. The unit quantity for marking shall be picofarads.

| Numerical Value (%) | Code |
|---|---|
| $XX10^4$ | XX4 |
| $XX10^5$ | XX5 |
| $XX10^6$ | XX6 |

*4.5.3.2 Tolerances*

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

| Tolerance (%) | Code Letter |
|---|---|
| ±10 | K |
| ±20 | M |

*4.5.3.3 Rated Voltage*

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

| Rated Voltage (V) | Code Letter |
|---|---|
| 50 | K |
| 40 | J |
| 25 | G |
| 20 | F |
| 16 | E |
| 10 | D |
| 6.3 | A |
| 4 | M |

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESCC Basic Specification No. 21700.

(a) Manufacturing date code.
(b) Manufacturer's name.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2. Unless otherwise specified, these measurements shall be performed at $T_{amb}$ = +22±3 ºC.

4.6.2 Electrical Measurements at High and Low Temperatures (Table 3)

The parameters to be measured at high and low temperatures are scheduled in Table 3.

4.6.3 Circuit for Electrical Measurements

Not applicable.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE**

| No. | Characteristics | Symbol | ESCC 3011 Test Method | Test Conditions | Limits | | Unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | Min. | Max. | | |
| 1 | Capacitance | $C_n$ | Para. 9.4.1.1 | $V_T \leq 0.5$Vrms<br>$V_P$ = 2.1 to 2.5V<br>f = 100±5Hz or<br>f = 120±5Hz | $C_n$<br>-10<br>-20 | $C_n$<br>+10<br>+20 | µF<br>%<br>% | See Table 1(a) |
| 2 | DC Leakage Current | $I_L$ | Para. 9.4.1.2 | $V_T = U_R$±2%<br>Series Resistor = 1kΩ | - | (Note 1) | µA | |
| 3 | Dissipation Factor | DF | Para. 9.4.1.3 | f = 100±5Hz or<br>f = 120±5Hz | - | 6 | % | |

**NOTES**

1. 0.01C x $U_R$ or 1, whichever is the greater.

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

| No. | Characteristics | Symbol | ESCC 3011 Test Method | Test Conditions (Note 1) | Limits | | Unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | Min. | Max. | | |
| 1 | Capacitance | $C_n$ | Para. 9.4.1.1 | $V_T \leq 0.5$Vrms<br>$V_P$ = 2.1 to 2.5V<br>f = 100±5Hz or<br>f = 120±5Hz<br><br>- 55 °C, + 85 °C<br>+ 125 °C | $C_n$<br><br><br><br><br>-10<br>-15 | $C_n$<br><br><br><br><br>+10<br>+15 | µF<br><br><br><br><br>%<br>% | See Table 1(a) |
| 2 | DC Leakage Current | $I_L$ | Para. 9.4.1.2 | $V_T = U_R$±2%<br>Series Resistor = 1kΩ<br><br>+85 °C<br>+125 °C | <br><br><br><br>-<br>- | <br><br><br><br>(Note 2)<br>(Note 3) | µA | |
| 3 | Dissipation Factor | DF | Para. 9.4.1.3 | f = 100±5Hz or<br>f = 120±5Hz<br>-55 °C, +85 °C,<br>+125 °C | - | 8 | % | |

**NOTES**

1. Inspection Level II, Single Sampling, AQL 2.5% for each capacitance value. Each capacitance value shall be considered as constituting a complete lot.
2. 0.1C x $U_R$ or 10, whichever is the greater.
3. 0.12C x $U_R$ or 12, whichever is the greater.

4.7 SELECTIVE LEVEL TESTING

4.7.1 Parameter Drift Value

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise specified, these measurements shall be performed at $T_{amb}$ = +22±3 ºC.

The parameter drift value (Δ) applicable to the parameter 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. 3011. The conditions for burn-in shall be as specified in Table 5 of this specification.

Upon completion of burn-in, a recovery period of 24 ± 2 hours is necessary before performance of the end measurements.

4.7.3 Electrical Circuit for Burn-in

Not applicable.

**TABLE 4 - PARAMETER DRIFT VALUES**

| No | Characteristics | Symbol | Test Method And Condition | Limits | Unit |
|---|---|---|---|---|---|
| 1 | Capacitance Change | $\Delta C/C$ | ESCC No. 3011 Paras. 9.4.2 & 9.4.1.1 | ±5 | % |
| 2 | DC Leakage Change | $\Delta I_L/I_L$ | ESCC No. 3011 Para 9.4.1.2 | (1) +200% of initial value measured or +(25% + 0.05µA) of limit value, whichever is smaller | % |

**NOTES**

1. Leakage currents ≤ 0.1µA are considered as a 0.1µA value.

**FIGURE 4 - TEST CIRCUIT**

(Not applicable)

**TABLE 5 - CONDITIONS FOR BURN-IN**

| No | Characteristics | Symbol | Limits | Unit |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | +125 | ºC |
| 2 | Test Voltage | $V_T$ | $0.66U_R$ | V |
| 3 | Duration | t | 168 | Hours |

**FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN**

(Not applicable)

4.8 ENVIRONMENTAL AND ENDURANCE TESTS

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 testing shall be those specified in Table 6.

Unless otherwise specified, these measurements shall be performed at $T_{amb}$ = +22±3 ºC.

4.8.2 Measurements and Inspections 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 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of endurance tests shall be those specified in Table 6. Unless otherwise specified, these measurements shall be performed at $T_{amb}$ = +22±3 ºC.

4.8.4 Conditions for Operating Life Test (Part of Endurance Testing)

The requirements for operating life test are specified in Section 9 of ESCC Generic Specification No. 3011. The conditions for operating life test shall be as specified in Table 7 of this specification.

4.8.5 Electrical Circuit for Operating Life Test

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. 3011 | | Measurements And Inspections | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | Environmental And Endurance Tests (1) | Test Method And Conditions | Identification | Conditions | | Min. | Max. | |
| 01 | Visual Inspection | Para. 9.1 | Visual Inspection | ESCC 20400 | - | - | - | - |
| 02 | Mounting on Substrates | Para. 9.2 | **Final Measurements** | | | | | |
| | | | Capacitance | Table 2, Item 1 | C | Table 2, Item 1 (2) | | |
| | | | DC Leakage Current | Table 2, Item 2 | $I_L$ | Table 2, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | Table 2, Item 3 | | |
| | | | Visual Examination | Good Tinning | - | - | - | |
| 03 | Adhesion | Para. 9.5 | **Final Examination** | | | | | |
| | | | Visual Examination | no damage or loosening from substrate | - | - | - | |
| | | | Capacitance | Table 2, Item 1 | C | Table 2, Item 1 | | |
| 04 | Solderability | Para. 9.6 | Visual Examination | no damage | - | - | - | - |
| 05 | Rapid Change of Temperature | Para. 9.7 | **Initial Measurements** | | | | | |
| | | | Capacitance | Table 2, Item 1 or value recorded in 02 | C | Table 2, Item 1 | | |
| | | | **Final Measurements** | After 4 hours minimum recovery | | | | |
| | | | Visual Examination | No corrosion, mechanical damage or obliteration of marking | | - | - | |
| | | | Capacitance Change | Table 2, Item 1 | ΔC/C | -5 | +5 | % |
| | | | DC Leakage Current | Table 2, Item 2 | $I_L$ | Table 2, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | Table 2, Item 3 | | |
| 06 | Vibration | Para. 9.8 | **Intermediate Measurements** | During last cycle | | | | |
| | | | Electrical Measurements | Intermittent operation, intermittent contact, arcing, open or shorts | - | - | - | - |
| | | | **Final Examination** | | | | | |
| | | | Visual Examination | No damage | - | - | - | - |
| 07 | Shock or Bump | Para. 9.9 | **Final Examination** | | | | | |
| | | | Visual Examination | No damage | - | - | - | - |

| No. | ESCC Generic Spec. No. 3011 | | Measurements And Inspections | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | Environmental And Endurance Tests (1) | Test Method And Conditions | Identification | Conditions | | Min. | Max. | |
| 08 | Climatic Sequence | Para. 9.10 | **Initial Measurements** | | | | | |
| | | | Capacitance | Value recorded in 02 | C | Table 2, Item 1 | | |
| | Dry Heat | Para. 9.10.2 | **Intermediate Measurements** | At High Temperature | | | | |
| | | | Capacitance Change | Table 3, item 1 | ΔC/C | Table 3, item 1 | | |
| | | | DC Leakage Current | Table 3, Item 2 | $I_L$ | Table 3, Item 2 | | |
| | Cold Test | Para. 9.10.4 | **Intermediate Measurements** | At Low Temperature | | | | |
| | | | Capacitance Change | Table 3, item 1 | ΔC/C | Table 3, item 1 | | |
| | Damp Heat | Para. 9.10.6 | **Final Measurements** | Recovery period 1 to 24 hours | | | | |
| | | | Visual Inspection | Gen. 3011, Para. 9.10.7 | - | - | - | - |
| | | | Capacitance Change | Table 2, item 1 | ΔC/C | -10 | +10 | % |
| | | | DC Leakage Current | Table 2, item 2 | $I_L$ | Table 2, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | - | Note 3 | |
| 09 | Damp Heat, Steady State | Para. 9.11 | **Initial Measurements** | | | | | |
| | | During 56 days | Capacitance | Value recorded in 02 | C | Table 2, item 1 | | |
| | | | **Final Measurements** | Recovery Period 6 to 24 ± 2 hours | | | | |
| | | | Visual Examination | No damage | - | - | - | - |
| | | | Capacitance Change | Table 2, item 1 | ΔC/C | -10 | +10 | % |
| | | | DC Leakage Current | Table 2, item 2 | $I_L$ | Table 2, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | - | Note 3 | |
| 10 | High and Low Temperature Stability | Para. 9.12 | Capacitance Change | Table 3, Item 1 | ΔC/C | Table 3, Item 1 | | |
| | | | DC Leakage Current at all but Step 2 | Table 3, item 2 | $I_L$ | Table 3, Item 2 | | |
| | | | Dissipation Factor | Table 3, Item 3 | DF | Table 3, Item 3 | | |
| 11 | Surge Voltage | Para. 9.13 | Final Measurements | After temperature stabilisation | | | | |
| | | | Capacitance | Table 2, item 1 | C | Table 2, item 1 | | |
| | | | DC Leakage Current | Table 2, item 2 | $I_L$ | Table 2, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | Table 2, Item 3 | | |

| No. | ESCC Generic Spec. No. 3011 | | Measurements And Inspections | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | Environmental And Endurance Tests (1) | Test Method And Conditions | Identification | Conditions | | Min. | Max. | |
| 12 | Operating Life | Para. 9.15 | **Initial Measurements** | | | | | |
| | | | Capacitance | Value recorded in 02 | C | Table 2, item 1 | | % |
| | | | DC Leakage Current | Table 2, item 2 | $I_L$ | Table 2, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | Table 2, Item 3 | | |
| | | | **Intermediate Measurements** | at 250 and 1000 hours | | | | |
| | | | | At High Temperature | | | | |
| | | | DC Leakage Current | Table 3, Item 2 | $I_L$ | Table 3, Item 2 | | |
| | | | **Final Measurements** | At 1000 and 2000 hours and after 24 hours recovery | | | | |
| | | | Capacitance Change | Table 2, Item 1 | ΔC/C | -5 | +5 | % |
| | | | DC Leakage Current | Table 2, Item 2 | $I_L$ | | | |
| | | | | At +25 ºC | | Table 2, Item 2 | | |
| | | | | At +85 ºC | | Table 3, Item 2 | | |
| | | | | At +125 ºC | | Table 3, Item 2 | | |
| | | | Dissipation Factor | Table 2, Item 3 | DF | Table 2, item 3 | | |
| | | | Visual Examination | No damage | - | - | - | - |
| 13 | Permanence of Marking | Para. 9.17 | **Final Examination** | | | | | |
| | | | Visual Examination | ESCC No. 24800 | - | - | - | - |

**NOTES**

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Value to be recorded.
3. 1.2 x value specified in Table 2 Item 3.

## TABLE 7 - CONDITIONS FOR OPERATING LIFE

| No | Characteristics | Symbol | Condition | Unit |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | +85<br>+125 | °C |
| 2 | Test Voltage | $U_R$ | Rated Voltage (1)<br>Derated Voltage | Vdc |

**NOTES**

1. The test voltage shall be the rated voltage (see Table 1(a)) for +85 °C ambient temperature and the derated voltage (see Figure 1) for +125 °C ambient temperature.