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Pages 1 to 15

**CAPACITORS, FIXED, GLASS DIELECTRIC,**

**BASED ON TYPE CYR10**

**ESA/SCC Detail Specification No. 3004/001**



**space components  
coordination group**

| Issue/Rev. | Date          | Approved by   |                                       |
|------------|---------------|---------------|---------------------------------------|
|            |               | SCCG Chairman | ESA Director General<br>or his Deputy |
| Issue 2    | December 1995 |               |                                       |
|            |               |               |                                       |
|            |               |               |                                       |

**DOCUMENTATION CHANGE NOTICE**

| Rev. Letter | Rev. Date | Reference   | CHANGE Item  | Approved DCR No. |
|-------------|-----------|---|--|------------------|
|             |           | This Issue supersedes Issue 1 and incorporates all modifications defined in Revision 'A' to Issue 1 and the changes agreed in the following DCR's:- |  |                  |
|             |           | Cover page  |  | None             |
|             |           | DCN   |  | None             |
|             |           | Para. 2   | : Reference to MIL-STD-1276 deleted  | 21025            |
|             |           | Para. 3   | : Second sentence added  | 23785            |
|             |           | Table 1(a)  | : Table columns numbered   | 23785            |
|             |           |   | : Symbol 'U <sub>R</sub> ' added to rated voltage column heading   | 23785            |
|             |           |   | : '±' moved from tolerance values to column heading  | 23785            |
|             |           | Table 1(b)  | : Column heading 'Limit Ratings' amended to 'Maximum Ratings'  | 23785            |
|             |           |   | : Characteristic 'Test Voltage' deleted and others renumbered accordingly  | 23785            |
|             |           |   | : No 2, Characteristic amended to 'Operating Temperature Range', Symbol corrected to 'T <sub>op</sub> ' and Tamb added to the remarks column | 23785            |
|             |           |   | : No 3, Characteristic amended to 'Storage Temperature Range, Symbol corrected to 'T <sub>stg</sub> '  | 23785            |
|             |           |   | : No 4, Characteristic amended to 'Soldering Temperature', Symbol corrected to 'T <sub>sol</sub> ' and remarks moved to Note 1               | 23785            |
|             |           | Figure 2  | : Imperial dimensions deleted from Table   | 23785            |
|             |           | Para. 4.2.3   | : Title amended  | 23785            |
|             |           | Para. 4.2.4   | : Title amended and deviation added  | 23785            |
|             |           | Para. 4.2.5   | : Deviation added  | 23785            |
|             |           | Para. 4.3.1   | : Wording amended  | 23785            |
|             |           | Para. 4.3.3   | : Test conditions and method deleted   | 23785            |
|             |           | Para. 4.4.2   | : Wording amended  | 21025            |
|             |           | Para. 4.5.1   | : Wording amended  | 23785            |
|             |           | Para. 4.5.2   | : Type Variant reference added   | 21021            |
|             |           |   | : Note added   | 23785            |
|             |           | Para. 4.5.3   | : 'Tolerance (1%)' amended to 'Tolerance (± 1.0%)'   | 23785            |
|             |           | Para. 4.5.3.1   | : Wording amended  | 23785            |
|             |           | Para. 4.5.3.2   | : Wording amended and '±' moved to column heading  | 23785            |
|             |           | Para. 4.6   | : Title amended  | 23785            |
|             |           | Para. 4.6.1   | : Second sentence amended  | 23785            |
|             |           | Para. 4.7   | : Title amended  | 23785            |
|             |           | Para. 4.7.3   | : New paragraph added  | 23785            |
|             |           | Table 2   | : Columns standardised and entries reordered   | 23785            |
|             |           |   | : No 1, Limits entry amended to 'Note 1'   | 23785            |
|             |           |   | : No 2, Symbol corrected to 'Tgδ' and Note reference added   | 23785            |
|             |           |   | : No 4, Symbol corrected to 'VP', Limit entry amended to '2.0U <sub>R</sub> ' and Note reference added                                       | 23785            |
|             |           |   | : Notes 1 and 3 added and existing Note numbered as '2'  | 23785            |
|             |           | Table 3   | : Columns standardised   | 23785            |
|             |           | Figure 4  | : Title amended  | 23785            |
|             |           | Table 4   | : Column headings standardised   | 23785            |
|             |           |   | : Entries for 'Spec. and/or Test Method' and 'Test Condition' amended to 'As per Table 2'  | 23785            |



**DOCUMENTATION CHANGE NOTICE**

| Rev.<br>Letter | Rev.<br>Date | Reference   | CHANGE<br>Item  | Approved<br>DCR No. |
|----------------|--------------|-------------|---|---------------------|
|                |              | Table 5     | : Characteristic corrected to 'Capacitance Change'        | 23785               |
|                |              | Para. 4.8   | : Title amended and Symbol corrected to ' $V_T$ '         | 23785               |
|                |              | Para. 4.8.1 | : Title amended   | 23785               |
|                |              | Para. 4.8.2 | : Title and first sentence amended                        | 23785               |
|                |              |             | : Title and first sentence amended, second sentence added | 23785               |
|                |              | Para. 4.8.3 | : Title and first sentence amended                        | 23785               |
|                |              | Para. 4.8.5 | : New paragraph added                                     | 23785               |
|                |              | Table 6     | : Format amended and corrected                            | 23785               |



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**APPENDICES (Applicable to specific Manufacturers only)**

None.

**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Capacitors, Fixed, Glass Dielectric, based on Type CYR10. It shall be read in conjunction with ESA/SCC Generic Specification No. 3004, 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 (FIGURE 1)**

Not applicable.

**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.

**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. 3004 for Capacitors, Fixed, Glass Dielectric.

**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. In addition, the following symbol is used:-

$V_T$  = Test Voltage.

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

| (1)<br>Item No. | (2)<br>Capacitance Range<br>(pF) | (3)<br>Tolerance |        | (4)<br>Rated Voltage<br>$U_R$<br>(V) |
|-----------------|----------------------------------|------------------|--------|--------------------------------------|
|                 |                                  | (± %)            | (± pF) |                                      |
| 01              | 0.5 to 12                        | -                | 0.25   | 500                                  |
| 02              | 5.6 to 200                       | 5.0              | -      | 500                                  |
| 03              | 13 to 200                        | 2.0              | -      | 500                                  |
| 04              | 27 to 200                        | 1.0              | -      | 500                                  |
| 05              | 220 to 300                       | 5.0              | -      | 300                                  |
| 06              | 220 to 300                       | 2.0              | -      | 300                                  |
| 07              | 220 to 300                       | 1.0              | -      | 300                                  |

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

| No. | Characteristics             | Symbol    | Maximum Ratings | Unit | Remarks   |
|-----|-----------------------------|-----------|-----------------|------|-----------|
| 1   | Rated Voltage               | $U_R$     | See Table 1(a)  | V    |           |
| 2   | Operating Temperature Range | $T_{op}$  | - 55 to + 125   | °C   | $T_{amb}$ |
| 3   | Storage Temperature Range   | $T_{stg}$ | - 55 to + 125   | °C   |           |
| 4   | Soldering Temperature       | $T_{sol}$ | + 350           | °C   | Note 1    |

**NOTES**

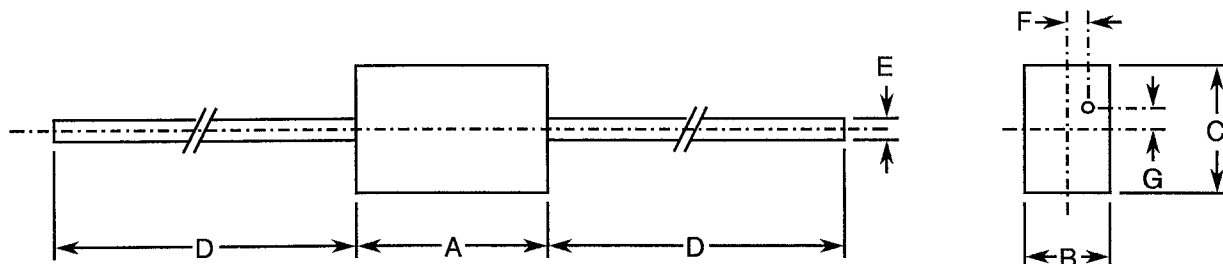
1. Duration 5.0 seconds maximum at a distance of not less than 3.0mm from the device body.

**FIGURE 1 - PARAMETER DERATING INFORMATION**

Not applicable.

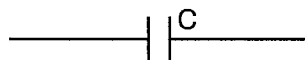


**FIGURE 2 - PHYSICAL DIMENSIONS**



| Symbol | Millimetres |      |
|--------|-------------|------|
|        | Min.        | Max. |
| A      | 7.50        | 9.90 |
| B      | 1.20        | 2.80 |
| C      | 3.60        | 5.20 |
| D      | 28.60       | -    |
| E      | 0.49        | 0.61 |
| F      | -           | 0.40 |
| G      | -           | 0.40 |

**FIGURE 3 - FUNCTIONAL DIAGRAM**







#### 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. 3004 for Capacitors, Fixed, Glass 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 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)

(a) Para. 9.12, Terminal Strength: Applied Force : 20N.

###### 4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.12, Terminal Strength: Applied Force : 20N.

##### 4.3 MECHANICAL REQUIREMENTS

###### 4.3.1 Dimension Check

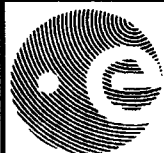
The dimensions of the capacitors specified herein shall be verified in accordance with the requirements set out in Para. 9.5 of ESA/SCC Generic Specification No. 3004 and they shall conform to those shown in Figure 2 of this specification.

###### 4.3.2 Weight

The maximum weight of the capacitors specified herein shall be 0.5 grammes.

###### 4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Para. 9.12 of ESA/SCC Generic Specification No. 3004.



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 shall be glass, hermetically sealed.

4.4.2 Lead Material and Finish

The lead material shall be Type 'C' with Type '3' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

4.5 MARKING

4.5.1 General

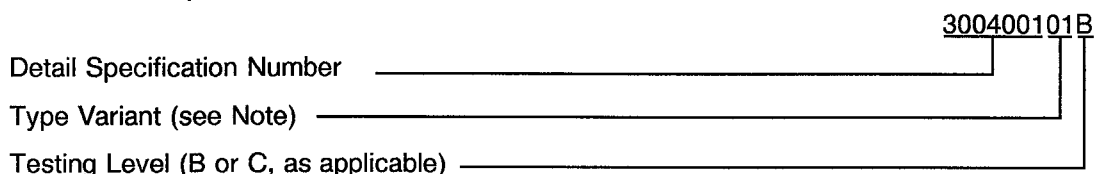
The marking of components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking as specified, as much as space permits shall be marked and the 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) 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:-



**N.B.**

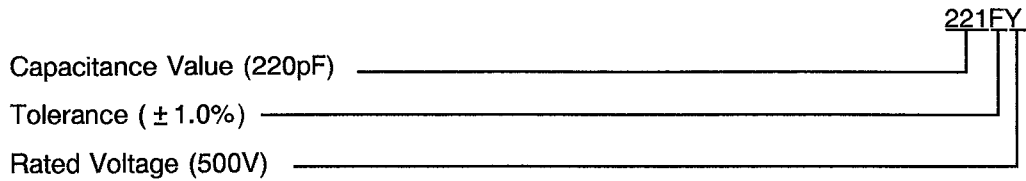
Marking of the Type Variant Number is mandatory. No further reference to Type Variants is made in this specification.

**4.5.3 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:-

**4.5.3.1 Capacitance Values**

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

| Capacitance Value | Code |
|-------------------|------|
| X.X               | XCX  |
| XX                | XX0  |
| XX10 <sup>1</sup> | XX1  |

**4.5.3.2 Tolerances**

The tolerances on capacitance values shall be indicated by the code letters specified hereafter.

| Tolerance ( $\pm$ ) | Code Letter |
|---------------------|-------------|
| 1.0%                | F           |
| 2.0%                | G           |
| 5.0%                | J           |
| 0.25pF              | C           |

**4.5.3.3 Rated Voltage**

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

| Rated Voltage ( $U_R$ ) (V) | Code Letter |
|-----------------------------|-------------|
| 300                         | V           |
| 500                         | Y           |



#### 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. Unless otherwise specified, 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. 3004.

##### 4.6.3 Circuits for Electrical Measurements

A circuit for use in performing the electrical measurements listed in Table 2 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. 3004. 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 performance of the end-measurements.

##### 4.7.3 Electrical Circuit for Burn-in (Figure 5)

Not applicable.

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

| No. | Characteristics       | Symbol | ESA/SCC 3004 Test Method | Limits            |      | Unit             | Remarks |
|-----|-----------------------|--------|--------------------------|-------------------|------|------------------|---------|
|     |                       |        |                          | Min.              | Max. |                  |         |
| 1   | Capacitance           | C      | Para. 9.3.1.1            | Note 1            |      | pF               |         |
| 2   | Tangent of Loss Angle | Tgδ    | Para. 9.3.1.2            | -                 | 10   | 10 <sup>-4</sup> | Note 2  |
| 3   | Insulation Resistance | Ri     | Para. 9.3.1.3            | 50                | -    | GΩ               |         |
| 4   | Voltage Proof         | VP     | Para. 9.3.1.4            | 2.0U <sub>R</sub> | -    | V                | Note 3  |

**NOTES**

1. See Columns 2 and 3 of Table 1(a).
2. Or 15.10<sup>-4</sup> for values ≤ 47pF.
3. See Column 4 of Table 1(a) for U<sub>R</sub>.

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

| No. | Characteristics                           | Symbol | ESA/SCC 3004 Test Method | Test Conditions (Note 1) | Limits |      | Unit |
|-----|---|--------|--------------------------|--------------------------|--------|------|------|
|     |   |        |                          |                          | Min.   | Max. |      |
| 3   | Insulation Resistance (Between Terminals) | Ri     | Para. 9.3.1.3            | + 125 ± 3 °C             | 10     | -    | GΩ   |

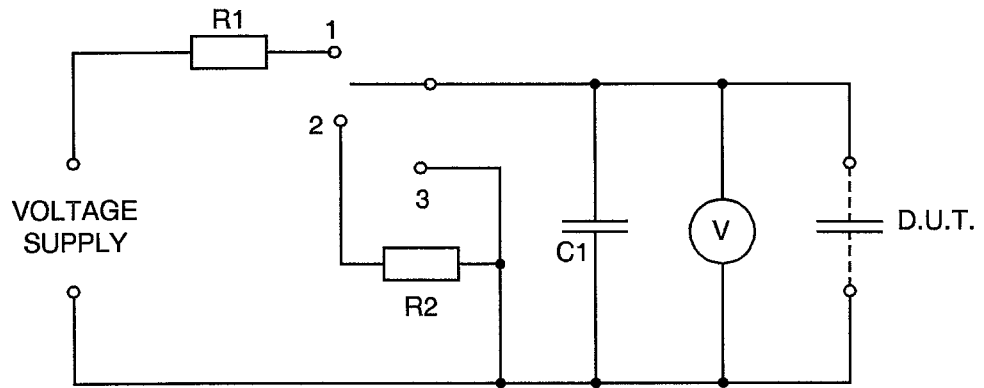
**NOTES**

1. These measurements shall be performed on a sample basis AQL = 2.5, Inspection Level II.



**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

**FIGURE 4(a) - TEST CIRCUIT FOR VOLTAGE PROOF**



**NOTES**

1. The resistance of the Voltmeter shall be not less than 10000 Ω/V. The capacitance of C shall be at least 10 times that of 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               | Spec. and/or Test Method | Test Conditions | Change Limits (Δ)        | Unit        |
|-----|--------------------|----------------------|--------------------------|-----------------|--------------------------|-------------|
| 1   | Capacitance Change | $\frac{\Delta C}{C}$ | As per Table 2           | As per Table 2  | ± 0.5<br>or (1)<br>± 0.5 | %<br><br>pF |

**NOTES**

1. Whichever is greater, referred to the initial value.

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

| No. | Characteristic      | Symbol           | Condition         | Unit |
|-----|---------------------|------------------|-------------------|------|
| 1   | Ambient Temperature | T <sub>amb</sub> | + 125             | °C   |
| 2   | Test Voltage        | V <sub>T</sub>   | 1.5U <sub>R</sub> | V    |

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

Not applicable.



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3004)

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  $T_{amb} = +22 \pm 3 \text{ }^{\circ}\text{C}$ .

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  $T_{amb} = +22 \pm 3 \text{ }^{\circ}\text{C}$ .

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  $T_{amb} = +22 \pm 3 \text{ }^{\circ}\text{C}$ .

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. 3004. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.5 Electrical Circuit 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. | ESA/SCC GENERIC SPEC.NO. 3004         |   | MEASUREMENTS AND INSPECTIONS  |   | SYMBOL  | LIMITS   |  | UNIT   |
|-----|---------------------------------------|---|---|---|---|--|--|--|
|     | ENVIRONMENTAL AND ENDURANCE TESTS (1) | TEST METHOD AND CONDITIONS  | IDENTIFICATION  | CONDITIONS  |   | MIN.   | MAX.   |  |
| 01  | Moisture Resistance                   | Para. 9.8<br>During first 10 cycles loading voltage of 90 to 100V to be applied | <b>During Test</b><br><b>Final Measurements</b><br>Insulation Resistance<br>Visual Examination<br>Capacitance<br>Tangent of Loss Angle<br>Voltage Proof   | Once a day<br>Shorts<br>After a recovery period of 1 to 4 hours<br>Table 2 Item 3<br>Between 4 and 24 hours later<br>Corrosion or mechanical damage<br>Table 2 Item 1<br>Table 2 Item 2<br>Table 2 Item 4 | -<br>Ri<br>-<br>C<br>T <sub>g</sub> δ<br>VP   | -<br>50<br>-<br>Table 2 Item 1<br>-<br>2.0U <sub>R</sub>     | -<br>-<br>-<br>10 (2)<br>-                                   | -<br>GΩ<br>-<br>pF<br>10 <sup>-4</sup><br>V  |
| 02  | Shock                                 | Para. 9.9   | <b>During Shock</b><br>Intermittent Contact<br>Visual Examination   | Open or Shorts<br>Arcing or Damage  | -<br>-  | -<br>-   | -<br>-   | -<br>-   |
| 03  | Vibration                             | Para. 9.10  | <b>During Last Cycle</b><br>Intermittent Contact  | Open or Shorts  | -   | -  | -  | -  |
| 04  | Solderability                         | Para. 9.11  | Visual Examination  | MIL-STD-202,<br>Method 208,<br>Solid Wire<br>Termination Criteria   | -   | -  | -  | -  |
| 05  | Terminal Strength                     | Para. 9.12 and Para's 4.2.4 and 4.2.5 of this spec.                             | Visual Examination  | Loose/ruptured terminals or damage to terminals or seal   | -   | -  | -  | -  |
| 06  | Barometric Pressure                   | Para. 9.13<br>During test 1.5U <sub>R</sub> for between 1 and 5 seconds         | Visual Examination  | Arcing, breakdown or damage   | -   | -  | -  | -  |
| 07  | Temperature Coefficient               | Para. 9.14.1  | Temperature Coefficient   | Para. 9.14.1 of ESA/SCC 3004  | TC  | 115  | 165  | ppm  |
| 08  | Capacitance Drift                     | Para. 9.14.2  | Capacitance Change  | Para. 9.14.2 of ESA/SCC 3004  | $\frac{\Delta C}{C}$  | -  | +0.1   | % or (3) pF  |
| 09  | Resistance to Soldering Heat          | Para. 9.15  | <b>Initial Measurements</b><br>Capacitance<br><b>Final Measurements</b><br>Capacitance Change<br>Tangent of Loss Angle<br>Insulation Resistance   | Table 2 Item 1<br>After a recovery period of 10 ± 1 minutes<br>Table 2 Item 1<br>Table 2 Item 2<br>Table 2 Item 3   | C<br>$\frac{\Delta C}{C}$<br>T <sub>g</sub> δ<br>Ri   | Table 2 Item 1<br>-0.5<br>-<br>50                            | Table 2 Item 1<br>+0.5<br>10 (2)<br>-                        | pF<br>% or (3) pF<br>10 <sup>-4</sup><br>GΩ  |
| 10  | Operating Life                        | Para. 9.16  | <b>Initial Measurements</b><br>Capacitance<br><b>Intermediate Measurements</b><br>Capacitance Change<br>Tangent of Loss Angle<br>Insulation Resistance<br><b>Final Measurements</b><br>Capacitance Change<br>Tangent of Loss Angle<br>Insulation Resistance | Table 2 Item 1<br>Table 2 Item 1<br>Table 2 Item 2<br>Table 2 Item 3<br>Table 2 Item 1<br>Table 2 Item 2<br>Table 2 Item 3  | C<br>$\frac{\Delta C}{C}$<br>T <sub>g</sub> δ<br>Ri<br>$\frac{\Delta C}{C}$<br>T <sub>g</sub> δ<br>Ri | Table 2 Item 1<br>-0.5<br>-<br>50 (4)<br>-0.5<br>-<br>50 (4) | Table 2 Item 1<br>+0.5<br>15 (4)<br>-<br>+0.5<br>15 (4)<br>- | pF<br>% or (3) pF<br>10 <sup>-4</sup><br>GΩ<br>% or (3) pF<br>10 <sup>-4</sup><br>GΩ |

**NOTES**

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Or 15.10<sup>-4</sup> for values ≤ 47pF.
3. Whichever is greater, referred to the initial value.
4. For information only.