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Pages 1 to 18

RESISTORS, FIXED, CHIPS, FILM

BASED ON TYPE CHP HR 0505

ESA/SCC Detail Specification No. 4001/016



**space components
coordination group**

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**SCC**ESA/SCC Detail Specification
No. 4001/016

Rev. 'A'

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ISSUE 1**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
'A'	Feb. '01	P1. Cover page P2. DCN P6. Table 1(a)	: No. 01, Minimum Resistance Range value amended : No. 02, Minimum Resistance Range value amended	None None 221601 221601

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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 Resistors, Fixed, Chips, Film, based on Type CHP HR 0505. It shall be read in conjunction with ESA/SCC Generic Specification No. 4001, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of resistors covered by this specification is given 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 resistors specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the resistors specified herein is given in Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the resistors specified herein, are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram for the resistors 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. 4001, Resistors, Fixed, Film.

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 symbols are used:-

V_T = Test Voltage.
 TC = Temperature Coefficient.

TABLE 1(a) - RANGE OF COMPONENTS

No.	Resistance Range (Note 1)		Tolerance (±%)	Value Series	Temperature Coefficient (±10 ⁻⁶ /°C)
	Min.	Max.			
01	10.2Ω	1.0MΩ	1.0	E96	100
02	10.5Ω	1.0MΩ	2.0	E48	100
03	1.0Ω	10Ω	1.0	E96	200
04	1.0Ω	10Ω	2.0	E48	200

NOTES

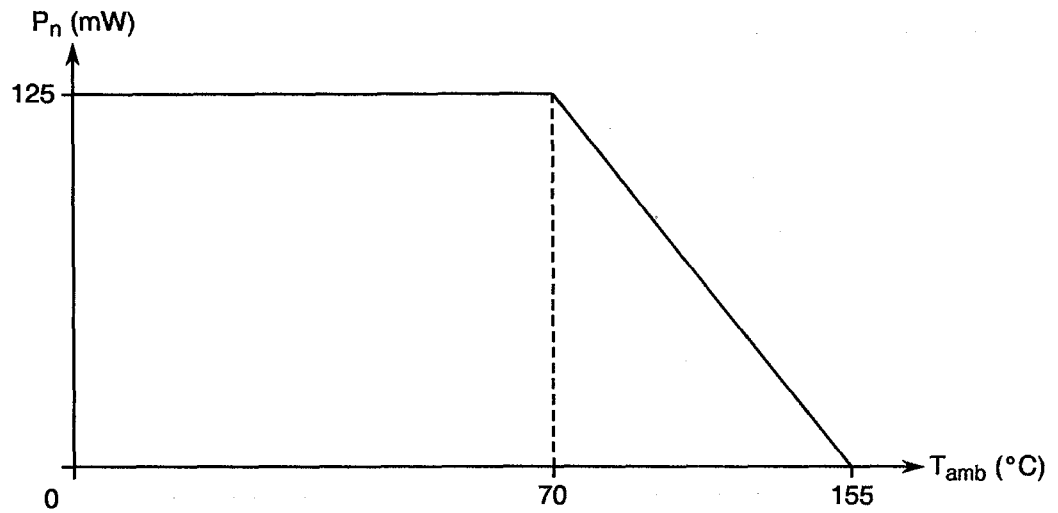
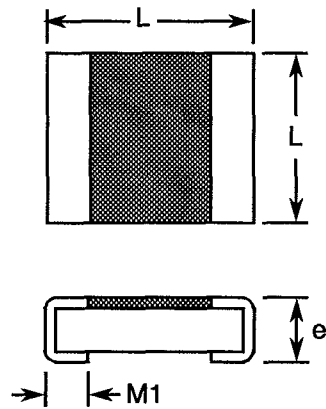
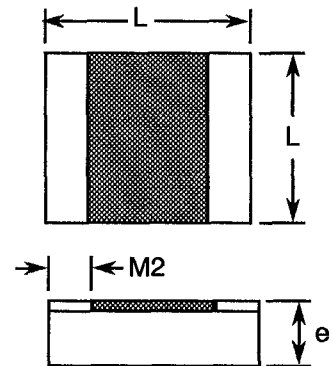
1. Critical resistance = 20 000Ω.
2. For Variants, see Figure 2 and Para.. 4.4.2.

TABLE 1(b) - MAXIMUM RATINGS

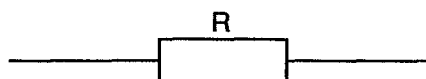
No.	Characteristics	Symbol	Limits	Unit	Remarks
1	Rated Dissipation	P _n	0.125	W	Note 1
2	Limiting Element Voltage	U _L	50	V	-
3	Rated Voltage	U _R	$\sqrt{(0.125 R_n)}$	V	Note 2
4	Insulation Voltage	U _i	75	V _{rms}	-
5	Operating Temperature Range	T _{op}	-55 to +155	°C	T _{amb}
6	Storage Temperature Range	T _{stg}	-55 to +155	°C	-
7	Soldering Temperature	T _{sol}	+260	°C	Note 3

NOTES

1. At T_{amb} ≤ +70°C. For derating at T_{amb} > +70°C, see Figure 1.
2. Shall never exceed Limiting Element Voltage.
3. Duration 10 seconds maximum.

FIGURE 1 - PARAMETER DERATING INFORMATION

Rated Dissipation versus Temperature
FIGURE 2 - PHYSICAL DIMENSIONS
FIGURE 2(a) - VARIANTS 01 AND 03

FIGURE 2(b) - VARIANT 02


SYMBOL	MILLIMETRES	
	MIN.	MAX.
L	1.12	1.42
e	0.64	0.65
M1	0.20	0.40
M2	0.10	0.30

FIGURE 3 - FUNCTIONAL DIAGRAM




4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the resistors specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 4001. 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)

(a) Para. 9.1, Overload: Before Overload, the resistors shall be submitted to Para. 12, Rapid Change of Temperature.

The test conditions for Overload shall be:-

Voltage: $\sqrt{0.1875 R_n}$ or 50V, whichever is less.

Duration: 24 hours minimum.

(b) Para. 9.2, Third Harmonic Control or Current Noise: Not applicable.

(c) Para. 9.5.3, Electrical Measurements at High and Low Temperatures: Shall be performed.

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

(a) Para. 9.5.3, Electrical Measurements at High and Low Temperatures: Shall not be performed.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.1, Overload: Test conditions as Para. 4.2.2(a) and in addition, Resistance Change measurements shall be performed as given in Table 6 of this specification.

(b) Para. 9.9, Solderability: Not applicable for Variant 02.

(c) Para. 9.10, Robustness of Terminations: Not applicable for Variant 02.

(d) Para. 9.11, Resistance to Soldering Heat: Not applicable for Variant 02.

(e) Para. 9.13, Vibration: Not applicable.


4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.9, Solderability: Not applicable for Variant 02.

(b) Para. 9.10, Robustness of Terminations: Not applicable for Variant 02.

(c) Para. 9.11, Resistance to Soldering Heat: Not applicable for Variant 02.

(d) Para. 9.13, Vibration: Not applicable.

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4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the resistors specified herein shall be verified in accordance with the requirements set out in Para. 9.4 of ESA/SCC Generic Specification No. 4001 and shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the resistors specified herein shall be 0.002 grammes.

4.3.3 Robustness of Terminations

The requirements and test conditions for robustness of terminations are specified in Para. 9.10.2 of ESA/SCC Generic Specification No. 4001.

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 components 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 alumina substrate shall be covered with a suitable inorganic coating.

4.4.2 Terminations

Variant 01

The resistors shall be terminated with gold/platinum with a solder coating of 62Sn, 36Pb, 2.0Ag%.

Variant 02

The resistors shall be terminated with thick film gold.

Variant 03

The resistors shall be terminated with gold/platinum with a nickel barrier and a solder coating of 95Sn, 5.0Pb%.

4.4.3 Films

Thick films shall be uniformly deposited. They shall be free from blisters, thin spots, areas inadequately bonded to the core, discoloured spots or other blemishes likely to cause flaking. Trimming shall occupy at maximum 30% of the width of the resistance element.



4.5 MARKING

4.5.1 General

The marking of all 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 specified, as much as space permits shall be marked and the marking information, in full, shall accompany each component in its primary package.

The information to be marked and the order of precedence, shall be as follows:-

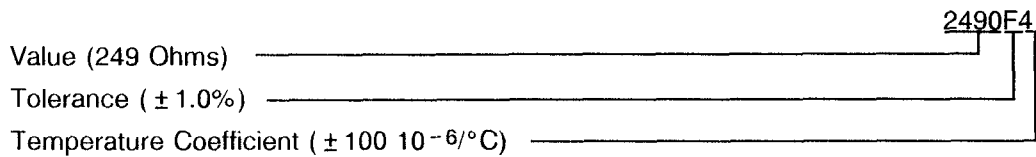
- (a) Electrical Characteristics and Ratings.
- (b) The SCC Component Number.
- (c) Traceability Information.

4.5.2 Electrical Characteristics and Ratings

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

- (a) Resistance Value.
- (b) Tolerance.
- (c) Temperature Coefficient.

The information shall be constituted and marked as follows:



4.5.2.1 Resistance Values

Resistance values shall be expressed by means of the following codes. The unit quantity for marking shall be Ohms (Ω).

Resistance Value	Code
XX.X	XXRX
XXX	XXX0
XXX10 ¹	XXX1
XXX10 ²	XXX2
XXX10 ³	XXX3
XXX10 ⁴	XXX4

For values of 100 Ω and above, the first 3 digits (X) represent significant figures and the last digit specifies the number of zeros to follow.

When values of less than 100 Ω are required, the letter 'R' is used to indicate the decimal point. When the letter is used, all successive digits represent significant figures.



4.5.2.2 Tolerance

The tolerance on resistance values shall be indicated by the code letters specified hereafter.

Tolerance ($\pm\%$)	Code Letter
1.0	F
2.0	G

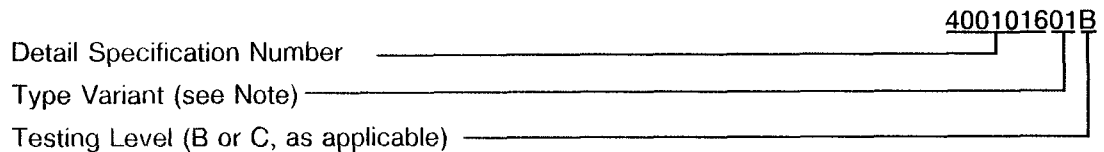
4.5.2.3 Temperature Coefficient

The temperature coefficient shall be indicated by the numerical codes specified hereafter.

Digit	Temperature Coefficient ($\pm 10^{-6}/^{\circ}\text{C}$)
4	100
6	200

4.5.3 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:



N.B.

For Variants, see Para. 4.4.2.

4.5.4 Traceability Information

Each component shall be marked in respect of traceability information 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 on a sample basis at high and low temperatures are scheduled in Table 3.

The distribution of the sample shall be as follows:

- 1/3 with the lowest resistance value,
- 1/3 with the highest resistance value,
- 1/3 with the median resistance value or the critical resistance value if procured, of the procured range.

**4.6.3** Circuits for Electrical Measurements (Figure 4)

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 $T_{amb} = +22 \pm 3$ °C. The parameter drift values (Δ) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified in Table 2 for a given parameter 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. 4001. The conditions for burn-in shall be as specified in Table 5 of this specification.

After 168(+24 - 0) hours, the resistors shall be removed from the chamber and allowed to cool under normal atmospheric conditions for a minimum of 4 hours. They shall then be visually examined. There shall be no evidence of damage and the marking shall still be legible.

4.7.3 Electrical Circuit for Burn-in

The circuit for use in performing the burn-in test is shown in Figure 5 of this specification.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbol	ESA/SCC 4001 Test Method	Test Conditions	Tolerance (±%)	Limits		Unit
						Min.	Max.	
1	Resistance	R _A	Para. 9.5.1	Para. 9.5.1	1.0	0.99 R _n	1.01 R _n	Ω
					2.0	0.98 R _n	1.02 R _n	

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESA/SCC 4001 Test Method	Test Conditions (Note 1)	Limits		Unit
					Min.	Max.	
2	Resistance Change between -55(+3-0) °C and +22±3 °C	$\frac{\Delta R}{R}$	Para. 9.5.1	Para. 9.5.1 ±100 10 ⁻⁶ /°C ±200 10 ⁻⁶ /°C	-0.77 -1.54	+0.77 +1.54	%
3	Resistance Change between +155(+0-3) °C and +22±3 °C	$\frac{\Delta R}{R}$	Para. 9.5.1	Para. 9.5.1 ±100 10 ⁻⁶ /°C ±200 10 ⁻⁶ /°C	-1.33 -2.66	+1.33 +2.66	%

NOTES

- The measurements shall be performed on a sample basis in accordance with Special Inspection Level S-3, Table IIA, AQL = 1.0% of IEC Publication No. 410 on the total production lot. In addition, see Para. 4.6.2 for distribution of the sample.

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	Resistance Change	$\frac{\Delta R_A}{R_A}$	As per Table 2	As per Table 2	±0.5 or (1) ±0.05	% Ω

NOTES

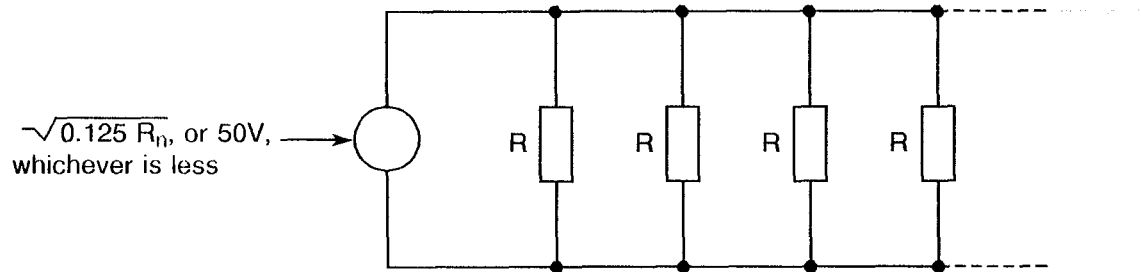
- Whichever is greater.



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

No.	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	$+70 \pm 3$	$^{\circ}C$
2	Test Voltage	V_T	$\sqrt{0.125 R_n}$, or 50V, whichever is less	V

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





4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION No. 4001)

The resistors shall be mounted as prescribed in ESA/SCC Generic Specification No. 4001, Para. 9.20. The substrate material shall be epoxy glass laminated pointing board.

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 $T_{amb} = +22 \pm 3$ °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 as scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °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 testing are as scheduled in Table 6 of this specification. 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. 4001. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.5 Electrical Circuits for Operating Life Tests

Circuits for use in performing the operating life tests are shown in Figure 5 of this specification.

4.8.6 Conditions for High Temperature Storage Test (Part of Endurance Testing)

The requirements for the high temperature storage test are specified in ESA/SCC Generic Specification No. 4001. The conditions for high temperature storage shall be $T_{amb} = +155(+0-5)$ °C. Unless otherwise stated, electrical measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.



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. 4001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Overload	Para. 9.1 and Paras 4.2.2 and 4.2.4 of this spec.	Initial Measurements Chart IV Resistance Final Measurements Visual Examination Chart II Resistance Chart IV Resistance Change	Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage and marking legible Table 2 Item 1 Table 2 Item 1	R_A - R_A $\Delta R_A/R_A$	Record Values Table 2 Item 1 $\pm (0.5 + \frac{0.05\Omega \times 100}{R_n})$	%	
02	Seal Test (Hermetically Sealed only)	Para. 9.3	Not applicable					
03	Insulation Resistance (Insulated only)	Para. 9.6	Final Measurements Insulation Resistance	Para. 9.6.2 of ESA/SCC 4001 (2)	R_i	1000	-	M Ω
04	Temperature Coefficient	Para. 9.7 Procedure I	Temperature Coefficient	Para. 9.5.1 of ESA/SCC 4001	TC	- 100 - 200	+ 100 + 200	10 ⁻⁶ / °C
05	Voltage Proof	Para. 9.8	During Test Visual Examination	1.4 x U _i (3) for 60 ± 5 sec No breakdown or flashover	-	-	-	-
06	Solderability	Para. 9.9 and Paras 4.2.4 and 4.2.5 of this spec. Procedure I	Initial Measurements Resistance Final Measurements Resistance Change	After Drying Table 2 Item 1 24 ± 4 hrs after soldering Table 2 Item 1	R_A $\Delta R_A/R_A$	Record Values $\pm (0.25 + \frac{0.05\Omega \times 100}{R_n})$	%	
07	Robustness of Terminations	Para. 9.10.2 and Paras 4.2.4 and 4.2.5 of this spec. Adhesion	Initial Measurements Resistance Final Measurements Resistance Change	After Mounting Table 2 Item 1 Table 2 Item 1	R_A $\Delta R_A/R_A$	Record Values $\pm (0.25 + \frac{0.05\Omega \times 100}{R_n})$	%	
			Visual Examination	No damage, lifting, cracking or dry joints	-	-	-	-
			Initial Measurements Resistance Final Measurements Resistance Change	Table 2 Item 1 Board in bent position Table 2 Item 1	R_A $\Delta R_A/R_A$	Record Values $\pm (0.25 + \frac{0.05\Omega \times 100}{R_n})$	%	
			Visual Examination	No damage, lifting, cracking or dry joints	-	-	-	-
08	Resistance to Soldering Heat	Para. 9.11 and Paras 4.2.4 and 4.2.5 of this spec. Procedure I	Initial Measurements Resistance Final Measurements Visual Examination	After Drying Table 2 Item 1 No evidence of damage and marking legible	R_A -	Record Values -	Ω -	
			Resistance Change	After 24 ± 4 hours Table 2 Item 1	$\Delta R_A/R_A$	$\pm (0.5 + \frac{0.05\Omega \times 100}{R_n})$	%	

NOTES

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Test Voltage: $V_T = 100V$.
3. For value of U_i, see Table 1(b) Item 4.



TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

NO.	ESA/SCC GENERIC SPEC. NO. 4001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
09	Rapid Change of Temperature	Para. 9.12	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change	Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage Table 2 Item 1	R _A - ΔR _A /R _A	Record Values - ± (0.25 + $\frac{0.05\Omega \times 100}{R_n}$)	- - %	-
10	Vibration	Para. 9.13 and Paras 4.2.4 and 4.2.5 of this spec.	Not applicable					
11	Climatic Sequence	Para. 9.14 Procedure I	Initial Measurements Resistance Final Measurements Visual Examination Insulation Resistance Resistance Change	After Drying Table 2 Item 1 Following completion of D.C. load test and after a recovery period of 1-2 hrs No evidence of damage and marking legible Para. 9.6 of ESA/SCC 4001 (2) Table 2 Item 1	R _A - R _i ΔR _A /R _A	Record Values - 1000 ± (1.0 + $\frac{0.05\Omega \times 100}{R_n}$)	- - - %	MΩ
12	Operating Life	Para. 9.15 Chart IV	Initial Measurements Resistance Intermediate Measurements (1000 hrs) Visual Examination Resistance Change Final Measurements (2000 hrs) Visual Examination Resistance Change Insulation Resistance	Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage Table 2 Item 1 Para. 9.6 of ESA/SCC 4001 (2)	R _A - ΔR _A /R _A - ΔR _A /R _A R _i	Record Values - ± (1.0 + $\frac{0.05\Omega \times 100}{R_n}$) - ± (1.5 + $\frac{0.05\Omega \times 100}{R_n}$) 1000	- - - - - %	MΩ
		Para. 9.15 Chart V	Initial Measurements Resistance Final Measurements (1000 hrs) Visual Examination Resistance Change Insulation Resistance	Table 2 Item 1 After a recovery period of 1-2 hrs No evidence of damage Table 2 Item 1 Para. 9.6 of ESA/SCC 4001 (2)	R _A - ΔR _A /R _A R _i	Record Values - ± (1.0 + $\frac{0.05\Omega \times 100}{R_n}$) 1000	- - %	MΩ

NOTES: See Page 16.



TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

NO.	ESA/SCC GENERIC SPEC. NO. 4001		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT	
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.		
13	High Temperature Storage	Para. 9.16	Initial Measurements	Table 2 Item 1	R _A	Record Values			
			Resistance	After a recovery period of 1-2 hrs					
			Intermediate Measurements	No evidence of damage	-	-	-		
			(1000 hrs)	Table 2 Item 1	ΔR _A /R _A	± (1.0 + 0.05Ω × 100) / R _n			%
			Visual Examination	Resistance Change					
			Final Measurements	After a recovery period of 1-2 hrs	-	-	-		
(2000 hrs)	No evidence of damage								
Visual Examination	Table 2 Item 1	ΔR _A /R _A	± (1.5 + 0.05Ω × 100) / R _n		%				
Resistance Change	Insulation Resistance								
			Para. 9.6 of ESA/SCC 4001 (2)		R _i	1000	-	MΩ	
14	Permanence of Marking	Para. 9.19	-	-	-	-	-	-	

NOTES: See Page 16.