



RESISTORS, FIXED, WIREWOUND, ACCURATE

BASED ON TYPE RBR 56

ESCC Detail Specification No. 4002/001

ISSUE 1

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	ESCC Detail Specification		PAGE ii ISSUE 1
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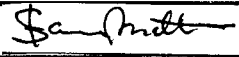

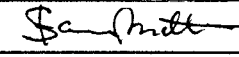
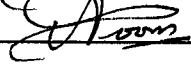
RESISTORS, FIXED, WIREWOUND, ACCURATE

BASED ON TYPE RBR 56

ESA/SCC Detail Specification No. 4002/001



**space components
coordination group**

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Issue 3	May 1998		
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 2 and incorporates all modifications defined in Revisions 'A', 'B', 'C', 'D' and 'E' to Issue 2 and the changes agreed in following DCRs:-		
		Cover page		None
		DCN		None
		Para. 2	: Item "(b)" deleted	21025
		Table 1(b)	: No. 7, Remarks deleted and "Note 2" added	221472
			: Note 2 added	221472
		Figure 1	: New Title added	221472
			: Existing Title amended and used as Undertitle	221472
		Para. 4.1	: Second paragraph added	21019
		Para. 4.2.2	: "None" deleted and Deviations added	221427
		Para. 4.3.1	: Existing text deleted and new text added	221472
		Para. 4.4.2	: Title and text amended	221025
		Para. 4.5.1	: Existing text deleted and new text added	221472
		Para. 4.5.2	: Type Variant added to Component Number	21021
			: Note added	221472
		Para. 4.5.5	: Deleted in toto	221472
		Para. 4.6.1	: Beginning of second sentence amended	221472
		Para. 4.7.1	: Beginning of second sentence amended	221472
		Table 2	: Fourth column heading amended	221472
			: Fourth and fifth column references amended	221472
			: Note 2 added	221472
		Table 3	: Fourth column heading amended	221472
			: Nos. corrected to "1(a)" and "1(b)" respectively	221472
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		Table 4	: "No." column added	221472
			: Third column heading amended	221472
			: Entry numbered as "1" and Characteristics and Symbol amended	221472
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			: Nos. 2 and 3 renumbered as "1" and "2" and Characteristics amended	221472
			: No. 2, Symbol amended	221472
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		Para. 4.8.3	: Title and first sentence amended	221472
		Appendix 'A'	: Appendix added	221472
'A'	Apr. '99	P1. Cover page		None
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		P8. Para. 4.2.2	: New Deviation "(a)" added and existing Deviations renumbered	221509
		P12. Table 2	: No. 3, in Test Conditions "(Note 2)" deleted	221509
			: Note 2 deleted	221509
		P15. Table 6	: No. 4, Test Method and Conditions amended	221509



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

This specification details the ratings, physical and electrical characteristics, test and inspection data for Resistors, Fixed, Wirewound, Accurate, based on Type RBR 56. It shall be read in conjunction with ESA/SCC Generic Specification No. 4002, the requirements of which are supplemented herein.

1.2 RANGE OF COMPONENTS

The range of resistors 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 resistors specified herein, are scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The parameter derating information applicable to the resistors specified herein is shown 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. 4002, Resistors, Fixed, Wirewound.

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:-

R_A = Resistance value measured at $T_{amb} = +22 \pm 3$ °C.

R_i = Insulation resistance.

V_T = Test voltage.

U_{proof} = d.c. or r.m.s. voltage proof.

$U_{over L}$ = Overload voltage.



TABLE 1(a) - RANGE OF COMPONENTS

Tolerance (%)	Resistance Range R_n (Ω)	Rated Dissipation P_n (mW)	Critical Resistance R_c (k Ω)
± 0.01	100 to 1.0M	125	178
± 0.05	500 to 300k	125	178
± 0.1	5.0 to 1.0M	125	178
± 0.25	5.0 to 1.0M	125	178
± 0.5	5.0 to 1.0M	125	178
± 1.0	5.0 to 1.0M	125	178
Temperature Characteristic of Resistance		± 25 ppm/ $^{\circ}$ C from 5.0 Ω to 100 Ω	
		± 5.0 ppm/ $^{\circ}$ C above 100 Ω	

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Maximum Rating	Unit	Remarks
1	Rated Dissipation	P_n	125	mW	At $T_{amb} = +125^{\circ}$ C
2	Limiting Element Voltage	U_L	150	V	
3	Rated Voltage	U_R	$\sqrt{P_n R_n}$ (1) or U_L	V	R_n is the rated resistance
4	Operating Temperature Range	T_{op}	-55 to +155	$^{\circ}$ C	T_{amb}
5	Soldering Temperature	T_{sol}	+245	$^{\circ}$ C	Note 2

NOTES

1. Whichever is smaller.
2. Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body.



FIGURE 1 - PARAMETER DERATING INFORMATION

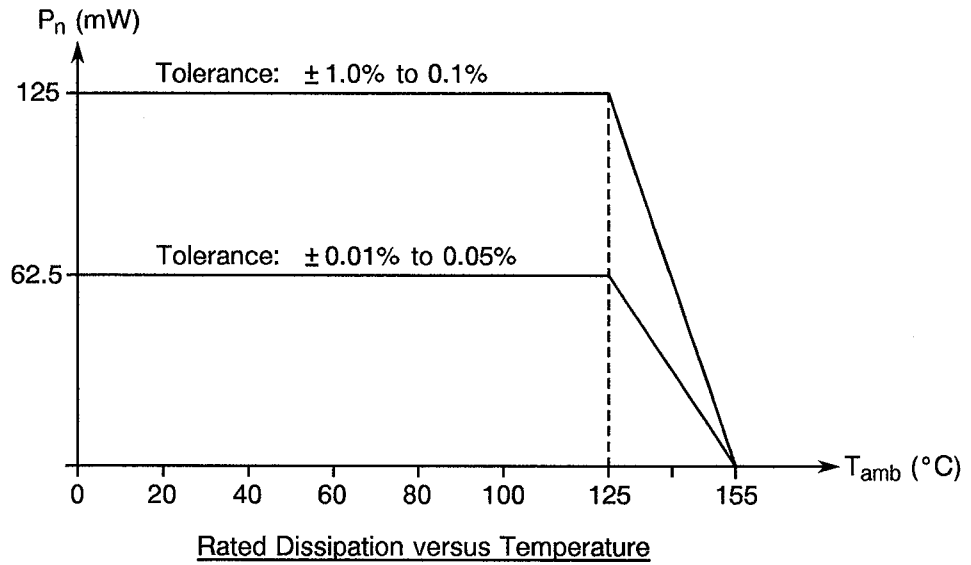
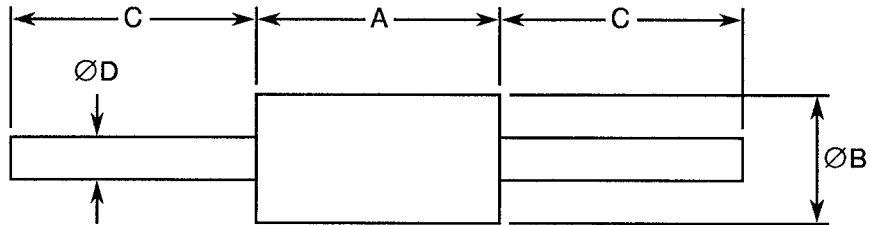
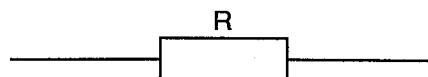


FIGURE 2 - PHYSICAL DIMENSIONS



SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	8.00	9.30
ØB	5.90	6.90
C	35	-
ØD	0.70	0.90

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. 4002 for Resistors, Fixed, Wirewound. 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: The conditions shall be as follows:-

Voltage : $\sqrt{2P_n R_n}$ or $2U_L$, whichever is less.

Duration: 10 minutes.

If better than 0.1%, use the Figure 1 curve.

(b) Para. 9.4, Dimension Check: May be performed at any point during the test sequence shown in the Chart.

(c) Para. 9.17, External Visual Inspection: Shall be performed before Overload.

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 resistors specified herein shall be verified in accordance with the requirements set out in Para. 9.4 of ESA/SCC Generic Specification No. 4002 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 0.95 grammes.

4.3.3 Robustness of Terminations

The requirements for robustness of termination testing are specified in Section 9 of ESA/SCC Generic Specification No. 4002. The test conditions shall be as follows:-

Test U_{a1} : Tensile.

Applied Force : 10N.

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 resistors 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 Enclosure or Protective Coating

Resistor assemblies shall be protected by a coating or enclosure of moisture-resistant insulating material which shall completely cover the outside of the resistor element, including connections of terminations. The coating shall not crack, craze, drip, run or form globules at any temperature up to and including +155°C, regardless of the mounting position of the resistor.

The protective coating or enclosure shall be such that it minimises the establishment of leakage paths between the terminals resulting from collection of moisture film on the outside surface of the resistor.

4.4.2 Lead Material and Finish

The lead material shall be Type 'A' with Type '3 or 4' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

4.4.3 Wire

Each resistor shall be wound with a conductor having no joints, welds or bonds within each terminated resistance element.

4.5 MARKING

4.5.1 General

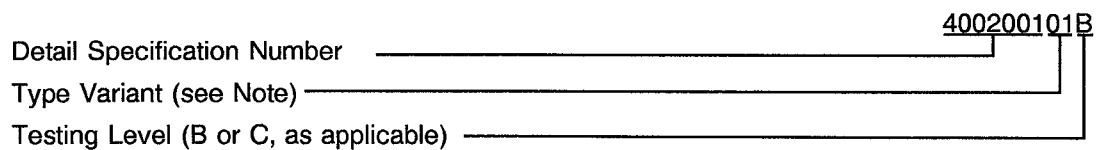
The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the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

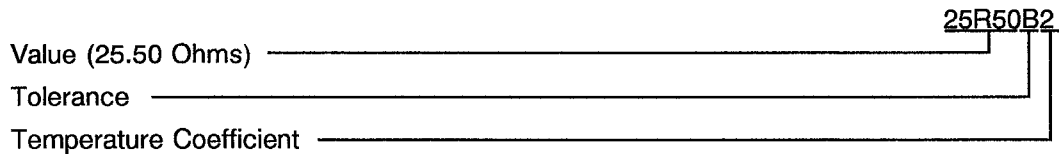


4.5.3 Electrical Characteristics and Ratings

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

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

The information shall be constituted and marked as follows:



4.5.3.1 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
X.XXX	XRXXX
XX.XX	XXRXX
XXX.X	XXXRX
XXXX	XXXX0
XXXX10 ¹	XXXX1
XXXX10 ²	XXXX2

For values of 1 000 and above, the first 4 digits (X) represent significant figures and the last digit specifies the number of zeros to follow.

When values of less than 1 000 are required, the letter 'R' is used to indicate the decimal point. When the letter is used, all successive digits represent significant figures.

4.5.3.2 Tolerance

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

Tolerance (\pm %)	Code Letter
0.01	L
0.05	W
0.1	B
0.25	C
0.5	D
1.0	F

4.5.3.3 Temperature Coefficient

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

Digit	Temperature Coefficient (\pm ppm/ $^{\circ}$ C)
1	5.0
2	25



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 on a sample basis at high and low temperatures are scheduled in Table 3. AQL shall be 0.65% out of the total production lot.

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.

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. 4002. The conditions for burn-in shall be as specified in Table 5 of this specification.

The resistors shall be tested with a d.c. voltage with a ripple less than 5.0%.

A voltage of 150V or $P_n R_n$ (see Figure 5) shall be applied in cycles of 90 minutes "on" and 30 minutes "off" throughout the test.

The resistors shall be connected by their terminations to suitable clips on a rack of insulating material. They shall be so arranged that the temperature of any one resistor does not appreciably influence the temperature of any other resistor. There shall be no undue draft over the resistors. After the period specified in the Generic Specification, the resistors shall be removed from the chamber and allowed to cool under normal atmospheric conditions for a minimum of 4 hours.

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 4002 Test Method	Test Conditions	Tolerance ($\pm\%$)	Limits		Unit
						Min.	Max.	
1	Resistance	R_A	Para. 9.5.1.1	Para. 9.5.1.1	0.01	0.9999 R_n	1.0001 R_n	Ω
					0.05	0.9995 R_n	1.0005 R_n	
					0.1	0.9990 R_n	1.0010 R_n	
					0.25	0.9975 R_n	1.0025 R_n	
					0.5	0.995 R_n	1.005 R_n	
					1.0	0.990 R_n	1.010 R_n	
2	Insulation Resistance	R_i	Para. 9.5.1.2	Para. 9.5.1.2.1 (Note 1)	All	1 000	-	$M\Omega$
3	Voltage Proof	U_{proof}	Para. 9.5.1.3	Para. 9.5.1.3.1	All	750	-	Vrms

NOTES

- Measurements shall be performed on a sample basis; sample size as specified in Para. 4.6.2, Level II, AQL = 0.65%.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	ESA/SCC 4002 Test Method	Test Conditions (Note 1)	Resistance Range	Limits		Unit
						Min.	Max.	
1(a)	Resistance Change between $-55(+3-0)^\circ\text{C}$ and $+22\pm 3^\circ\text{C}$	$\frac{\Delta R}{R}$	Para. 9.5.1.1	Para. 9.5.1.1	$R_n \leq 100$ $R_n > 100$	- 0.2 - 0.04	+ 0.2 + 0.04	%
1(b)	Resistance Change between $+155(+0-3)^\circ\text{C}$ and $+22\pm 3^\circ\text{C}$	$\frac{\Delta R}{R}$	Para. 9.5.1.1	Para. 9.5.1.1	$R_n \leq 100$ $R_n > 100$	- 0.35 - 0.07	+ 0.35 + 0.07	%

NOTES

- Sample size as specified in Para. 4.6.2: Level II, AQL = 0.65%.

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	± 0.02 or (1) ± 0.01	% Ω

NOTES

1. Whichever is greater.

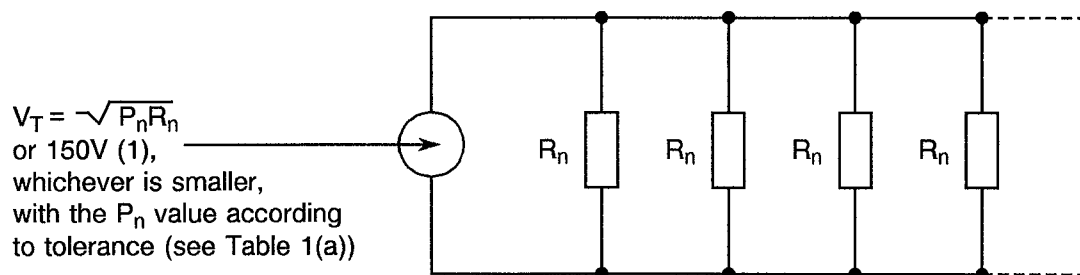
TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

No.	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	$+ 125 \pm 3$	$^{\circ}C$
2	Test Voltage	V_T	$\sqrt{P_n R_n}$, or 150V, whichever is less (1)	V

NOTES

1. If tolerance is better than 0.1%, use Figure 1 derating curve for burn-in only.

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



NOTES

1. For 0.01% and 0.05% tolerance, use the Figure 1 derating curve.



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 4002)

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. 4002. The conditions for operating life testing shall be as specified in Table 5 and Para. 4.7.2 of this specification.

4.8.5 Electrical Circuit for Operating Life Tests

The electrical circuit for use in performing the operating life tests is 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 Section 9 of ESA/SCC Generic Specification No. 4002. The conditions for high temperature storage shall be $T_{amb} = +155(+0 - 5)$ °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. 4002		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 Para. 4.2.2 of this specification	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change	Table 2 Item 1 After 1 to 2 hrs recovery No damage Legible marking Table 2 Item 1	R _A - ΔR _A /R _A	Table 2 Item 1 - ±(0.25 + $\frac{0.05 \times 100}{R_n}$)	- - %	
02	Permanence of Marking	Para. 9.6	Final Measurements Visual Examination	No corrosion or obliteration of marking	-	-	-	
03	Temperature Characteristic of Resistance	Para. 9.7 Procedure II	During Test Temperature Characteristic of Resistance	Para. 9.7.3 of ESA/SCC No. 4002	TCR	Table 1(a)	ppm/°C	
04	Voltage Proof (Altitude)	Para. 9.8	During Test Visual Examination	200Vrms for 5 seconds No Breakdown or Flashover	-	-	-	
05	Solderability	Para. 9.9 Procedure II	Final Measurements Visual Examination	No damage Legible marking	-	-	-	
06	Robustness of Terminations	Para 9.10 and Para. 4.3.3 of this specification	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change	Table 2 Item 1 No damage Table 2 Item 1	R _A - ΔR _A /R _A	Table 2 Item 1 - ±(0.01% + 0.1Ω)	- - Ω	
07	Resistance to Soldering Heat	Para. 9.11 Procedure I	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change	Table 2 Item 1 After 24 ± 4 hours recovery No damage Legible marking Table 2 Item 1	R _A - ΔR _A /R _A	Table 2 Item 1 - ±(0.01% + 0.1Ω)	- - Ω	
08	Rapid Change of Temperature	Para. 9.12 and Table 1(b) of this spec.	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change	Table 2 Item 1 After 1 to 2 hrs recovery No damage Table 2 Item 1	R _A - ΔR _A /R _A	Table 2 Item 1 - ±(0.5% + 0.01Ω)	- - Ω	
09	Vibration	Para. 9.13	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change	Table 2 Item 1 No damage Table 2 Item 1	R _A - ΔR _A /R _A	Table 2 Item 1 - ±(0.01% + 0.01Ω)	- - Ω	

NOTES

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



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. 4002		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
10	Climatic Sequence	Para. 9.14 Procedure I	Initial Measurements Resistance Final Measurements Visual Examination Resistance Change Insulation Resistance	After Drying Table 2 Item 1 After 1 to 2 hrs recovery No damage Legible marking Table 2 Item 1 Table 2 Item 2	R_A $\Delta R_A/R_A$ R_I	Table 2 Item 1 $\pm (0.01\% + 0.01\Omega)$ 1000	- -	Ω M Ω
11	Operating Life	Para. 9.15 Chart IV	Initial Measurements Resistance Intermediate Measurements Resistance Change Final Measurements Resistance Change Visual Examination	Table 2 Item 1 1000 ± 48 hrs After 1 to 2 hrs recovery Table 2 Item 1 2000 ± 48 hrs After 1 to 2 hrs recovery Table 2 Item 1 No damage	R_A $\Delta R_A/R_A$ $\Delta R_A/R_A$ -	Table 2 Item 1 $\pm (0.07\% + 0.01\Omega)$ $\pm (0.1\% + 0.01\Omega)$ -	- -	Ω -
		Para. 9.15 Chart V	Initial Measurements Resistance Final Measurements Resistance Change Visual Examination	Table 2 Item 1 1000 ± 48 hrs After 1 to 2 hrs recovery Table 2 Item 1 No damage	R_A $\Delta R_A/R_A$ -	Table 2 Item 1 $\pm (0.07\% + 0.01\Omega)$ -	- -	Ω -
12	High Temperature Storage	Para. 9.16	Initial Measurements Resistance Intermediate Measurements Resistance Change Final Measurements Resistance Change	Table 2 Item 1 1000 ± 48 hrs Table 2 Item 1 2000 ± 48 hrs Table 2 Item 1	R_A $\Delta R_A/R_A$ $\Delta R_A/R_A$	Table 2 Item 1 $\pm (0.07\% + 0.01\Omega)$ $\pm (0.1\% + 0.01\Omega)$	- -	Ω Ω
13	External Visual Inspection	Para. 9.17	Visual Inspection	ESA/SCC No. 20500	-	-	-	-
14	Maximum Time Constant (Not applicable to inductive resistors)	Para. 9.18	Time Constant	Para. 9.18.1 of ESA/SCC No. 4002	L/R	Table 1(b)	-	ns

NOTES: See Page 15.



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APPENDIX 'A'

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AGREED DEVIATIONS FOR SFERNICE (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.2	Para. 4.4, Marking: The Type Variant defined in Para. 4.5.2 of this specification need not be marked on the component.