RESISTORS, FIXED, WIREWOUND, POWER-TYPE,

CHASSIS-MOUNTED, 5 WATT, SEMI-PRECISION

BASED ON TYPE RER 60

ESCC Detail Specification No. 4003/001

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Pages 1 to 20

RESISTORS, FIXED, WIREWOUND, POWER-TYPE, CHASSIS-MOUNTED, 5 WATT, SEMI-PRECISION BASED ON TYPE RER60

ESA/SCC Detail Specification No. 4003/001

space components
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		P18. Para. 4.8.4	: Second sentence amended to "5(b)"	23574
			: Additional alinea added	23574

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This document has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist.		
'B'	Nov. '96	P1. Cover page		None
		P2A. DCN	: Page added	None
		P14. Para. 4.6.2	: In second sentence, "2.5%" amended to "0.65%	23766
		P19. Table 6	: Table updated	23766
		P20. Table 6	: Table updated	23766

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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, Wirewound, Power-type, Chassis-mounted, based on Type RER 60.

It shall be read in conjunction with ESA/SCC Generic Specification No. 4003, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS AND RANGE OF COMPONENTS

Variants of the basic type resistors and the range of components covered by this specification are given in Figure 2 and Table 1(a) respectively.

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 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.

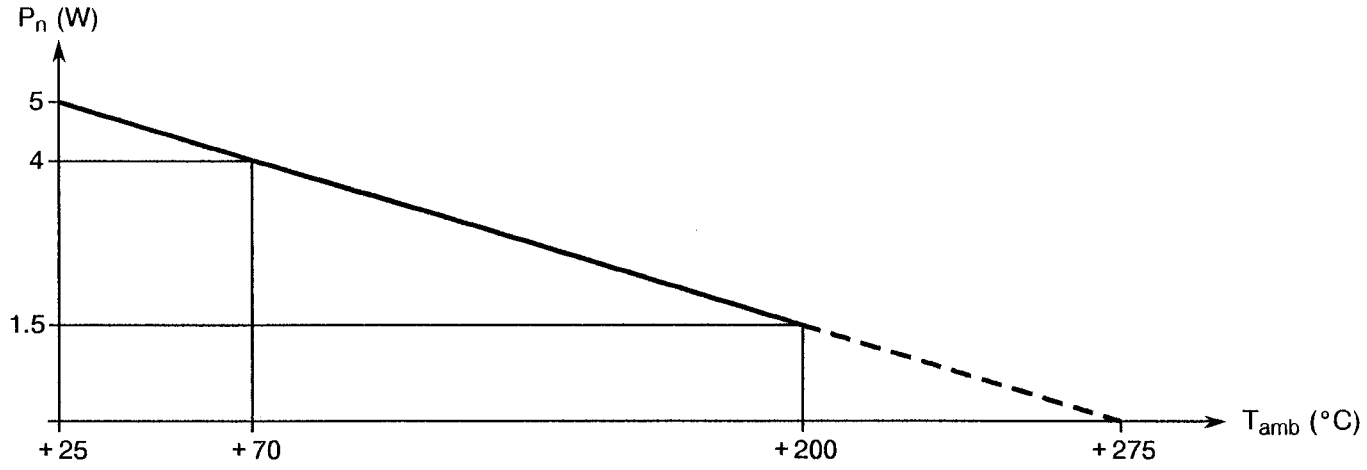
TABLE 1(a) - RANGE OF COMPONENTS (NOTE 1)

Resistance Range (Note 2) R_n (Ω)	Tolerance (±%)	Temperature Characteristic of Resistance (10^{-6}/°C)
0.1 to 0.976	1.0	±100 (Note 3)
1.0 to 19.6	0.5 - 1.0	±50 (Note 3)
20 to 3320	0.5 - 1.0	±30

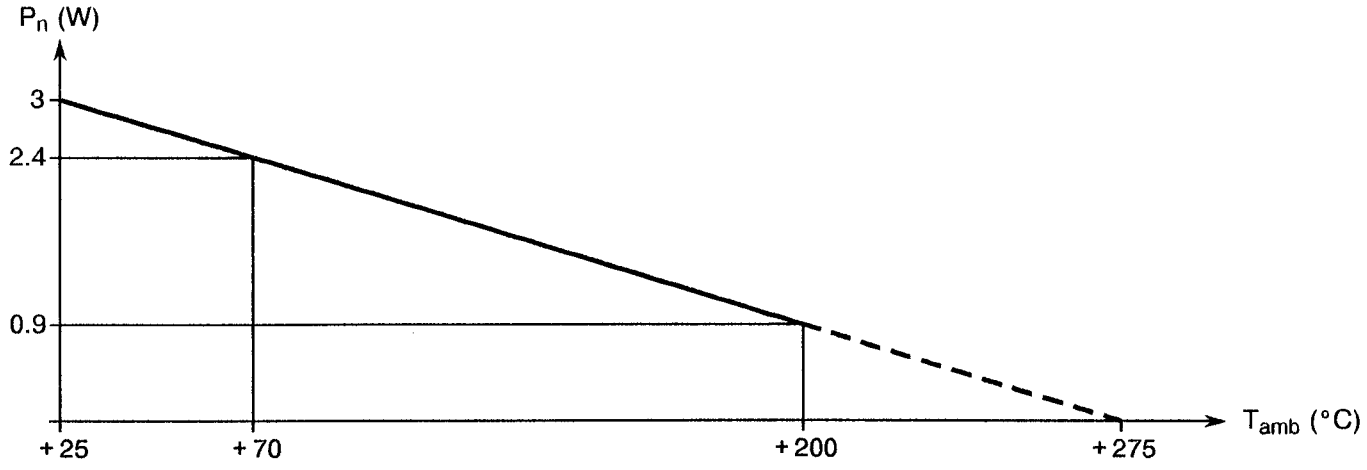
NOTES

1. As specified in Para. 4.4.3 and Figure 2, these ranges are available in 3 variants (see Figure 2).
2. The critical value is outside the resistance range.
3. For information only for values less than 5.0Ω.

FIGURE 1 - PARAMETER DERATING INFORMATION



Power versus Temperature
(For resistors mounted on chassis)



Power versus Temperature
(For resistors not mounted on chassis)

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Limits		Unit	Remarks
			Min.	Max.		
1	Rated Dissipation for Resistors Mounted on Chassis (Note 1)	P_n	-	5.0	W	See Figure 1
2	Rated Dissipation for Unmounted Resistors	P_n	-	3.0	W	See Figure 1
3	Limiting Element Voltage	U_L	-	160	V	
4	Rated Voltage Mounted on Chassis (Note 1)	U_R	-	$\sqrt{5\ R_n}$	V	At T_{amb} = +25°C
5	Overload Voltage and Time Mounted on Chassis (Note 1)	$U_{over\ L}$	-	$\sqrt{25\ R_n}$	Vac	At T_{amb} = +25°C
		t	-	5.0	s	
6	Operating Temperature Range	T_{op}	−55	+200	°C	T_{amb}
7	Storage Temperature Range	T_{stg}	−55	+275	°C	
8	Maximum Soldering Temperature	T_{sol}	-	+260	°C	Soldering time: t < 10 sec

NOTES

1. The approximate dimensions of the aluminium chassis shall be:-

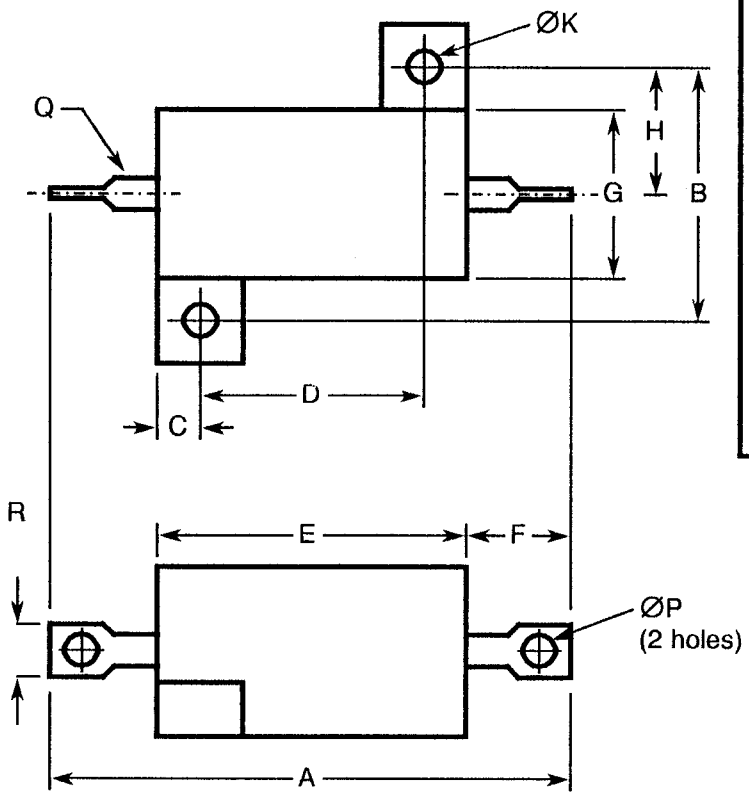
   Length = 153mm
   Width = 102mm
   Height = 51mm
   Thickness = 1.0mm
   Approx. area = 400cm^2.

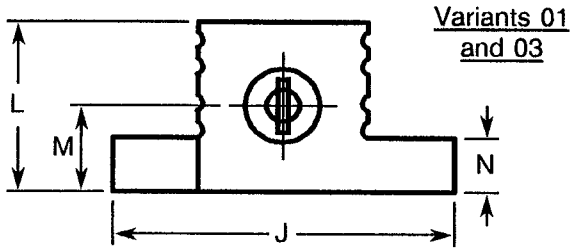
FIGURE 2 - PHYSICAL DIMENSIONS

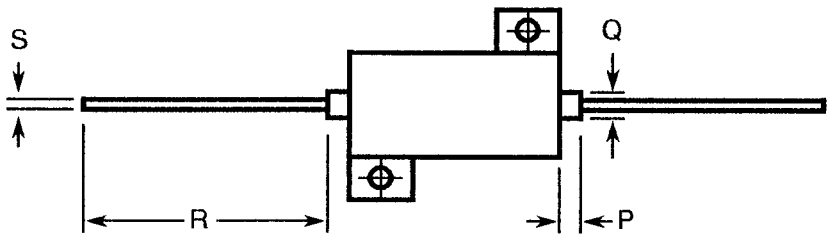
Variant 03 identical to Variant 01, except:

SYMBOL	MILLIMETRES VARIANT 03	
	MIN.	MAX.
P	2.03	2.29
Q	1.95	2.15
R	3.56	-

SYMBOL	MILLIMETRES			
	VARIANT 01		VARIANT 02	
	MIN.	MAX.	MIN.	MAX.
A	27.10	30.15	-	-
B	12.20	12.70	12.20	12.70
C	1.19	2.77	1.19	2.77
D	11.03	11.23	11.03	11.23
E	13.67	16.81	13.67	16.81
F	5.19	8.33	5.19	8.33
G	6.91	10.05	6.91	10.05
H	5.43	7.01	5.43	7.01
J	15.62	17.20	15.62	17.20
ØK	2.23	2.49	2.23	2.49
L	7.34	8.92	7.34	8.92
M	1.81	4.95	1.81	4.95
N	0.86	2.44	0.86	2.44
ØP	1.14	1.40	2.00	3.00
Q	1.20	1.40	1.95	2.15
R	2.16	-	36.00	40.00
S	-	-	0.75	0.85

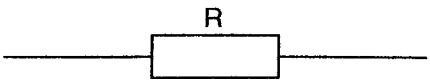






Variant 02

FIGURE 3 - FUNCTIONAL DIAGRAM



2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:-

(a) ESA/SCC Generic Specification No. 4003, Resistors, Fixed, Wirewound, Power-type, Chassis-mounted.

(b) ESA/SCC Basic Specification No. 23500, Requirements for Lead Materials and Finishes for Components for Space Application.

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 room ambient temperature ($+22 \pm 3°C$).
TCR = Temperature Characteristic of Resistance.

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. 4003 for Resistors, Fixed, Wirewound, Power-type, Chassis-mounted. 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. 9.18, Maximum Time Constant: Not applicable.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.18, Maximum Time Constant: Not applicable.

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. 9.3 of ESA/SCC Generic Specification No. 4003 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 3.0 grammes.

4.3.3 Robustness of Terminations

The requirements for robustness of terminations are specified in Para. 9.10 of ESA/SCC Generic Specification No. 4003. The test conditions shall be as follows:-

Variant 01

Test Condition: Ua.
Applied Force: 20 N.

Variant 02

Test Conditions: Ua, Ub and Uc.
Applied Force for test condition Ua: 10 N.

Variant 03

Test Condition: Ua.
Applied Force: 40 N.

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 Housing

The housing shall be made from an aluminium alloy and shall be protected against corrosion. All fasteners shall be suitably plated.

4.4.2 Terminals

Variants 01 and 03

The terminals shall be Type 'C4' of ESA/SCC Basic Specification No. 23500.

Variant 02

The terminals shall be Type 'B3' 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, except at the end terminals. In no case shall the nominal diameter be less than 25µm. For wires with a nominal diameter of less than 60µm, no abrasion, with the view of achieving the required resistance tolerance, is allowed. For diameters equal to or greater than that above, the abrasion, if performed, must be evenly distributed around the resistor body. The remaining cross-sectional area of the wire after the abrading operation shall be at least 90% of the original cross-sectional area.

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. 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:-

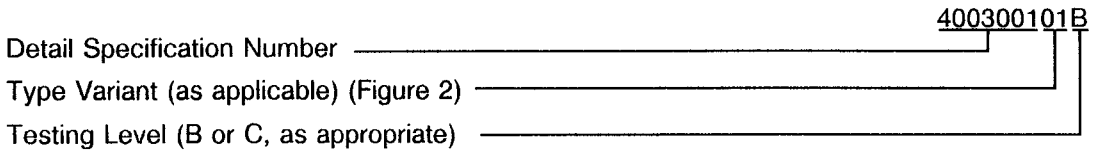
(a) The SCC Component Number.

(b) Electrical Characteristics and Ratings.

(c) Traceability Information.

4.5.2 The SCC Component Number

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



4.5.3 Electrical Characteristics and Ratings

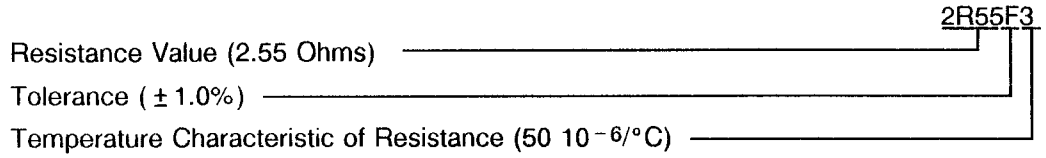
The electrical characteristics and ratings to be marked in the following order of precedence are:-

(a) Resistance Value.

(b) Tolerance.

(c) Temperature Coefficient.

The information shall be constituted and marked as follows:



4.5.3.1 Resistance Values

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

Resistance Value	Code
0.XXX	RXXX
X.XX	XRXX
XX.X	XXRX
XXX	XXX0
XXX10^1	XXX1

For values of 100 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 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 (%)	Code Letter
± 0.5	D
± 1.0	F

4.5.3.3 Temperature Characteristic of Resistance

The temperature characteristic of resistance shall be indicated by the numerical codes specified hereafter:-

Temperature Characteristic of Resistance ($\pm 10^{-6}$/°C)	Digit
30	9
50	3
100	4

4.5.4 Traceability Information

Traceability information shall be marked in accordance with the requirements of ESA/SCC 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 at room temperature are scheduled in Table 2. The measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured 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. 4003. The conditions for burn-in shall be as specified in Table 5(a) of this specification.

The resistors shall be tested with a d.c. voltage with a ripple that does not exceed 5.0%.

A voltage as specified in Figure 5 shall be applied in cycles of 90 minutes "on" and 30 minutes "off" throughout the test.

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 draught over the resistors. After the period specified in the Detail Specification, the resistors shall be allowed to cool under normal atmospheric conditions for a minimum of 4 hours.

4.7.3 Electrical Circuits for Burn-in

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

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Tolerance (%)	Limits		Unit
						Min.	Max.	
1	Resistance	R_A	ESA/SCC Gen. Spec. No. 4003	Para. 9.5.1.1	±0.5	0.995 R_n	1.005 R_n	Ω
					±1.0	0.990 R_n	1.010 R_n	
2	Insulation Resistance (Note 1)	R_i	ESA/SCC Gen. Spec. No. 4003	Para. 9.5.1.2	-	10 000	-	MΩ
3	Voltage Proof (Note 1)	V_P	ESA/SCC Gen. Spec. No. 4003	Para. 9.5.1.3	-	1000	-	Vrms

NOTES

1. Measurements on a sample basis; sample size as specified in Para. 4.6.2.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions (Note 1)	Resistance Range (Ω)	Limits		Unit
						Min.	Max.	
1	Resistance Change between −55(+3−0)°C and +22±3°C	$\frac{\Delta R}{R}$	ESA/SCC Gen. Spec. No. 4003	Para. 9.5.1.1	<1.0	−0.8	+0.8	%
					1.0 to 19.6	−0.4	+0.4	
					≥20	−0.25	+0.25	
2	Resistance Change between +175(+0−3)°C and +22±3°C	$\frac{\Delta R}{R}$	ESA/SCC Gen. Spec. No. 4003	Para. 9.5.1.1	<1.0	−1.5	+1.5	%
					1.0 to 19.6	−0.75	+0.75	
					≥20	−0.45	+0.45	

NOTES

1. Sampling Level II, AQL = 0.65%.

TABLE 4 - PARAMETER DRIFT VALUES

Characteristics	Symbol	Specification	Test Conditions	Change Limits (Δ)	Unit
Resistance	$\frac{\Delta R}{R}$	ESA/SCC Gen. Spec. No. 4003	Para. 9.5.1.1	± 0.3 (Note 1)	%

NOTES

1. Or $\Delta R = \pm 0.05\Omega$, whichever is greater.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

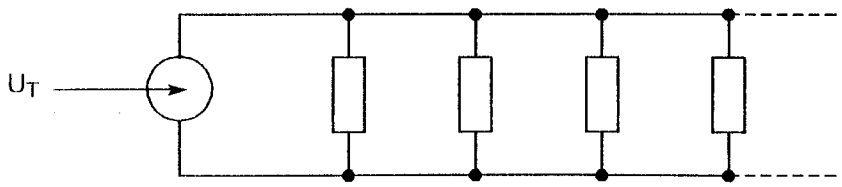
TABLE 5(a) - CONDITIONS FOR BURN-IN TESTS

No.	Characteristics	Symbol	Condition	Unit
1	Temperature for Initial Measurement	T_{amb}	+ 22 ± 3	°C
2	Temperature for Burn-in Tests	T_{amb}	+ 25 ± 10	°C
3	Voltage Applied	U_T	$\sqrt{3\ R_n}$	Vdc or Vrms
4	Temperature for Final Measurement	T_{amb}	+ 22 ± 3	°C

TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTS

No.	Characteristics	Symbol	Condition	Unit
1	Temperature for Initial Measurement	T_{amb}	+ 22 ± 3	°C
2	Temperature for Operating Life Tests	T_{amb}	+ 25 ± 10	°C
3	Voltage Applied	U_T	$\sqrt{5\ R_n}$	Vdc or Vrms
4	Temperature for Final Measurement	T_{amb}	+ 22 ± 3	°C

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



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION No. 4003)

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 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 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. 4003. The conditions for operating life testing shall be as specified in Table 5(b) of this specification.

Resistors shall be centrally mounted by normal mounting means on an aluminium chassis of thickness 1.0mm, length 153mm, width 102mm and height 51mm. The longitudinal axis of the resistor shall be parallel with the longitudinal axis of the chassis.

4.8.5 Electrical Circuits for Operating Life Tests

The electrical circuit for use in performing the operating life tests is shown in Figure 5.

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. 4003. The temperature to be applied shall be the maximum storage temperature specified in Table 1(b) of this specification.

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. 4003		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 Table 1(b) 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 - $\Delta R_A/R_A$	 Table 2 Item 1 - $\pm(0.3\% + 0.05\Omega)$	 - -	 - Ω
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. 4003	TCR	Table 1(a)		$10^{-6}/°C$
04	Voltage Proof (Altitude)	Para. 9.8 500Vrms	**Initial Measurements** Resistance **During Test** Visual Examination **Final Measurements** Resistance Change	 Table 2 Item 1 At Reduced Pressure 8mm Mercury No Breakdown or Flashover Table 2 Item 1	 R_A - $\Delta R_A/R_A$	 Table 2 Item 1 - $\pm(0.2\% + 0.05\Omega)$	 - -	 - Ω
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 - $\Delta R_A/R_A$	 Table 2 Item 1 - $\pm(0.2\% + 0.05\Omega)$	 - -	 - 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 - $\Delta R_A/R_A$	 Table 2 Item 1 - $\pm(0.3\% + 0.05\Omega)$	 - -	 - 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 - $\Delta R_A/R_A$	 Table 2 Item 1 - $\pm(0.5\% + 0.05\Omega)$	 - -	 - 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 - $\Delta R_A/R_A$	 Table 2 Item 1 - $\pm(0.2\% + 0.05\Omega)$	 - -	 - 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. 4003		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** Resistance Change Insulation Resistance	After Drying Table 2 Item 1 After 1 to 2 hrs recovery Table 2 Item 1 Table 2 Item 2	 R_A $\Delta R_A/R_A$ R_i	 Table 2 Item 1 $\pm(1.0\% + 0.01\Omega)$ 1000	 -	 Ω MΩ
11	Operating Life	Para. 9.15 Chart IV	**Initial Measurements** Resistance **Intermediate Measurements** Resistance Change **Final Measurements** Resistance Change	 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	 R_A $\Delta R_A/R_A$ $\Delta R_A/R_A$	 Table 2 Item 1 $\pm(0.8\% + 0.05\Omega)$ $\pm(1.0\% + 0.05\Omega)$	 	 Ω Ω
		Para. 9.15 Chart V	**Initial Measurements** Resistance **Final Measurements** Resistance Change	 Table 2 Item 1 1000 ± 48 hrs After 1 to 2 hrs recovery Table 2 Item 1	 R_A $\Delta R_A/R_A$	 Table 2 Item 1 $\pm(0.8\% + 0.05\Omega)$	 	 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 $\pm(0.8\% + 0.05\Omega)$ $\pm(1.0\% + 0.05\Omega)$	 	 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 and Paras 4.2.4 and 4.2.5 of this spec.	Not applicable					

NOTES: See Page 19.