



**RESISTORS, FIXED, WIREWOUND, POWER-TYPE,
CHASSIS-MOUNTED, 30 WATT, SEMI-PRECISION
BASED ON TYPE RER 75**

ESCC Detail Specification No. 4003/008

**ISSUE 1
October 2002**



	ESCC Detail Specification		PAGE ii ISSUE 1
---	---------------------------	--	--------------------

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2002. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole in any medium without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.



europaean space agency
agence spatiale européenne

Pages 1 to 20

**RESISTORS, FIXED, WIREWOUND, POWER-TYPE,
CHASSIS-MOUNTED, 30 WATT, SEMI-PRECISION**

BASED ON TYPE RER75

ESA/SCC Detail Specification No. 4003/008



**space components
coordination group**

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 2	April 1979	-	-
Revision 'A'	May 1993	<i>Pommes</i>	<i>F. Leub</i>
Revision 'B'	November 1996	<i>Sam Hill</i>	<i>A. Room</i>



DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue incorporates all modifications agreed on the basis of Policy DCR 21016 for adaptation to new qualification requirements.		
'A'	May '93	P1. Cover page P2. DCN P4. Table of Contents P5. Para. 2 P10. Para. 4.1 P11. Para. 4.4.3 P17. Para. 4.7.2 P18. Table 5 Table 5(b) Figure 5 P20. Para. 4.8.4 Para. 4.8.5 Table 7	: Table 5 entry amended : Table 5(b) entry added : Table 7 entry deleted : Appendices entry added : Entry "(b)" deleted : Para. rewritten : Text changed to permit abrasion technique : Second sentence amended to "5(a)" : Renumbered to "5(a)" and Title amended : No. 1, Characteristic amended : No. 2, Characteristic and Condition amended : Table added : Input Voltage amended to "U _T " : Second sentence amended to "5(b)" : Paragraph amended : Deleted in toto	None None 23574 23574 23574 21019 21025 21019 22860 23574 23574 23574 23574 23574 23574 23574 23574 23574
		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 P2. DCN P19. Table 6 P19A. Table 6	: Title amended and Table updated : Page added	None None 23766 23766



TABLE OF CONTENTS

	<u>Page</u>
1. <u>GENERAL</u>	5
1.1 Scope	5
1.2 Range of Components	5
1.3 Maximum Ratings	5
1.4 Parameter Derating Information	5
1.5 Physical Dimensions	5
1.6 Functional Diagram	5
2. <u>APPLICABLE DOCUMENTS</u>	5
3. <u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u>	10
4. <u>REQUIREMENTS</u>	10
4.1 General	10
4.2 Deviations from Generic Specification	10
4.2.1 Deviations from Special In-process Controls	10
4.2.2 Deviations from Final Production Tests (Chart II)	10
4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)	10
4.2.4 Deviations from Qualification Tests (Chart IV)	10
4.2.5 Deviations from Lot Acceptance Tests (Chart V)	10
4.3 Mechanical Requirements	10
4.3.1 Dimension Check	10
4.3.2 Weight	11
4.3.3 Robustness of Terminations	11
4.4 Materials and Finishes	11
4.4.1 Housing	11
4.4.2 Terminals	11
4.4.3 Wire	11
4.5 Marking	12
4.5.1 General	12
4.5.2 The SCC Component Number	12
4.5.3 Electrical Characteristics and Ratings	12
4.5.4 Traceability Information	14
4.5.5 Marking of Small Components	14



	<u>Page</u>
4.6 Electrical Measurements	14
4.6.1 Electrical Measurements at Room Temperature	14
4.6.2 Electrical Measurements at High and Low Temperatures	14
4.6.3 Circuits for Electrical Measurements	14
4.7 Burn-in Tests	17
4.7.1 Parameter Drift Values	17
4.7.2 Conditions for Burn-in	17
4.7.3 Electrical Circuits for Burn-in	17
4.8 Environmental and Endurance Tests	17
4.8.1 Electrical Measurements on Completion of Environmental Tests	17
4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests	17
4.8.3 Electrical Measurements on Completion of Endurance Tests	20
4.8.4 Conditions for Operating Life Tests (Part of Endurance Testing)	20
4.8.5 Electrical Circuits for Operating Life Tests	20
4.8.6 Conditions for High Temperature Storage Test (Part of Endurance Testing)	20

TABLES

1(a) Range of Components	6
1(b) Maximum Ratings	7
2 Electrical Measurements at Room Temperature	15
3 Electrical Measurements at High and Low Temperatures	16
4 Parameter Drift Values	18
5(a) Conditions for Burn-in Tests	18
5(b) Conditions for Operating Life Tests	18
6 Electrical Measurements on Completion of Environmental Tests and at Intermediate Points and on Completion of Endurance Testing	19

FIGURES

1 Rated Dissipation versus Temperature	8
2 Physical Dimensions	9
3 Functional Diagram	9
4 Circuit for Electrical Measurements	18
5 Circuit for Burn-in and Operating Life Tests	18

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, 30 Watt, Semi-Precision, based on Type RER 75.

It shall be read in conjunction with ESA/SCC Generic Specification No. 4003, 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 applicable derating information for 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. 4003, Resistors, Fixed, Wirewound, Power-type, Chassis-mounted.



TABLE 1(a) - RANGE OF COMPONENTS

Tolerance (%)	Resistance Range (Note 1) R_n (Ω)	Temperature Characteristic of Resistance (ppm/ $^{\circ}$ C)	Resistance Range (Note 1) R_n (Ω)
± 0.5	0.15 to 64k	± 30	$R_n > 2000$
± 1.0	0.06 to 64k	± 50	$0.1 < R_n < 2000$
± 2.0	0.03 to 64k	± 100	$R_n < 0.1$
± 5.0	0.015 to 64k		
± 10	0.0075 to 64k		

NOTES

1. The critical value is outside the resistance range.

**SCC**ESA/SCC Detail Specification
No. 4003/008

PAGE 7

ISSUE 2

TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Maximum Rating	Unit	Remarks
1	Rated Dissipation for Resistors Mounted on Chassis (Note 1)	P_n	30	W	Up to $T_{amb} = +25^\circ\text{C}$
			24		At $T_{amb} = +70^\circ\text{C}$
2	Rated Dissipation for Unmounted Resistors	P_n	10	W	Up to $T_{amb} = +25^\circ\text{C}$
			8.0		At $T_{amb} = +70^\circ\text{C}$
3(a)	Lower Category Temperature	T_{amb}	-55	$^\circ\text{C}$	+275° at zero wattage. It is the maximum storage temperature
3(b)	Upper Category Temperature		+275		
4	Limiting Element Voltage	U_L	1285	V	
5	Rated Voltage	U_R	$\sqrt{30 R_n}$	V	At $T_{amb} = +25^\circ\text{C}$
6	Voltage Proof	U_{proof}	2500	Vrms	At atmospheric pressure
7	Voltage Proof	U_{proof}	500	Vrms	At reduced barometric pressure
8	Overload Voltage and Time Mounted on Chassis	$U_{over L}$	$\sqrt{150 R_n}$	Vac	At $T_{amb} = +25^\circ\text{C}$
		t	5.0	s	

NOTES

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

Length = 178mm

Width = 127mm

Height = 51mm

Thickness = 1.0mm

Approx. area = 500cm².

See ESA/SCC Generic Specification No. 4003, Para. 9.1.1, for the mounting procedure.



FIGURE 1 - RATED DISSIPATION VERSUS TEMPERATURE

(For resistors mounted on chassis)

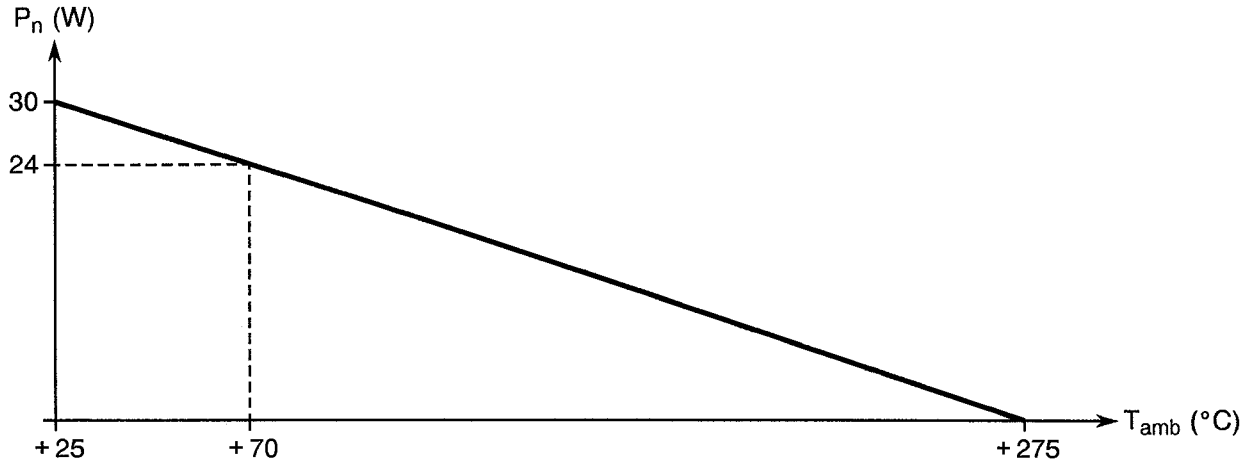
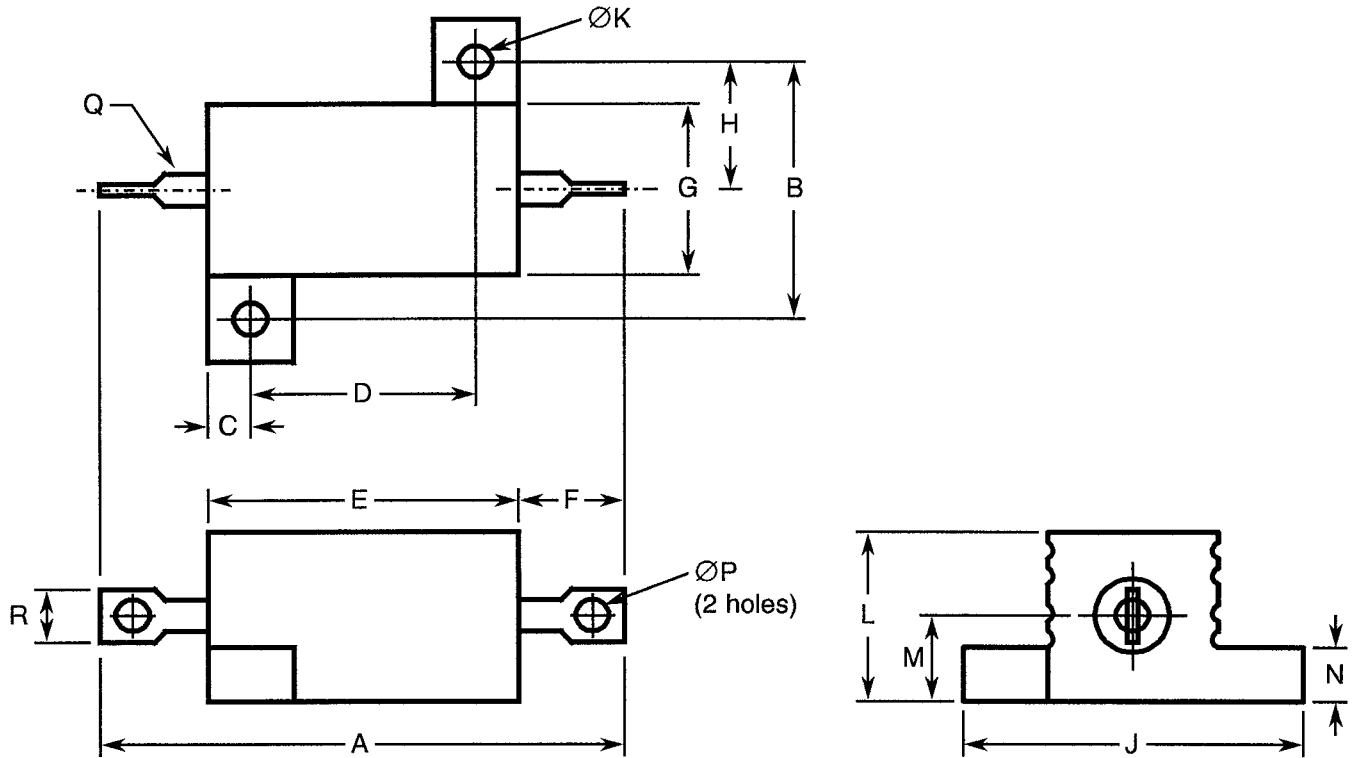


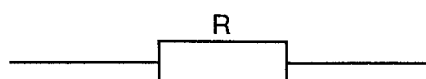


FIGURE 2 - PHYSICAL DIMENSIONS



SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	69.07	72.21
B	21.19	21.69
C	3.99	5.51
D	39.42	39.92
E	47.26	50.80
F	9.56	12.70
G	13.52	16.66
H	9.93	11.51
J	28.57	30.15
ØK	3.05	3.31
L	15.09	16.67
M	6.36	9.49
N	1.60	3.18
ØP	2.03	2.29
Q	1.95	2.15
R	3.56	-

FIGURE 3 - FUNCTIONAL DIAGRAM



**SCC**ESA/SCC Detail Specification
No. 4003/008

Rev. 'A'

PAGE 10

ISSUE 2

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 ($+22 \pm 3^\circ\text{C}$).
 R_i = Insulation resistance.
 U_T = Test voltage.
 U_{proof} = d.c. or r.m.s. voltage proof.
 $U_{\text{over L}}$ = Overload voltage.

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 checked. They 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 35 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. 4003. The test conditions shall be as follows:-

Applied Force: 40 N.

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 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

Connection of the resistor windings to terminals shall result in a joint that is electrically stable and mechanically strong. Terminals shall be suitably treated to facilitate soldering. When a coating containing tin is used, the tin content shall range between 40 and 70%. The terminals shall be firmly secured and shall not be solely dependent on the protective coating or enclosure for mechanical anchorage.

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 25 μ m. For wires with a nominal diameter of less than 60 μ m, 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.

Each component shall be marked in respect of:-

- (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:

Detail Specification Number _____ 4003008B
Testing Level (B or C, as appropriate) _____

4.5.3 Electrical Characteristics and Ratings

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

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

The information shall be constituted and marked as follows:

Value (25.50 Ohms) _____ 25R50D3
Tolerance _____
Temperature Coefficient _____



4.5.3.1 Numerical Values

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

Resistance Value	Code
0.0XXX	R0XXX
0.XXXX	RXXXX
X.XXX	XRXXX
XX.XX	XXRXX
XXX.X	XXXRX
XXXX	XXXX0
XXXX10 ¹	XXXX1

For values of 1000 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 1000 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 numerical values shall be indicated by the letter codes specified hereafter:-

Tolerance (%)	Code Letter
± 0.5	D
± 1.0	F
± 2.0	G
± 5.0	J
± 10	K



4.5.3.3 Temperature Coefficient

The temperature coefficients shall be indicated by the numerical codes specified hereafter:-

Digit	Temperature Coefficient (\pm ppm/ $^{\circ}$ C)
9	30
3	50
4	100

4.5.4 Traceability Information

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

4.5.5 Marking of Small Components

Where it is considered that a component is too small to accommodate the marking as specified above, as much as space permits shall be marked. The order of precedence shall be as specified in Para. 4.5.1. The marking information in full shall accompany each component in its primary package.

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 $T_{amb} = +22 \pm 3$ $^{\circ}$ 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 2.5% 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.

**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	0.5	0.995 R_n	1.005 R_n	Ω
					1.0	0.99 R_n	1.01 R_n	
					2.0	0.98 R_n	1.02 R_n	
					5.0	0.95 R_n	1.05 R_n	
					10	0.90 R_n	1.10 R_n	
2	Insulation Resistance	R_i	ESA/SCC Gen. Spec. No. 4003	Para. 9.6 Note 1	All	1 000	-	$M\Omega$
3(a)	Voltage Proof	U_{proof}	ESA/SCC Gen. Spec. No. 4003	Para. 9.8 for atm. pressure	All	2 500	-	V_{rms}
3(b)				Para. 9.8 for reduced pressure Notes 1 & 2	All	500	-	

NOTES

- Measurements on a sample basis; sample size as specified in Para. 4.6.2.
- The pressure shall be 8.0mm of mercury (equivalent to an altitude of 30480 metres).



TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Resistance Range (Ω)	Limits		Unit
						Min.	Max.	
1	Resistance Change between $-55(+3-0)^{\circ}\text{C}$ and $+22\pm 3^{\circ}\text{C}$	$\frac{\Delta R}{R}$	ESA/SCC Gen. Spec. No. 4003	Para. 9.5	$R_n \leq 0.1$	-0.8	+0.8	%
					$0.1 < R_n < 2000$	-0.4	+0.4	
					$R_n > 2000$	-0.25	+0.25	
2	Resistance Change between $+175(+0-3)^{\circ}\text{C}$ and $+22\pm 3^{\circ}\text{C}$	$\frac{\Delta R}{R}$	ESA/SCC Gen. Spec. No. 4003	Para. 9.5	$R_n \leq 0.1$	-1.5	+1.5	%
					$0.1 < R_n < 2000$	-0.75	+0.75	
					$R_n > 2000$	-0.4	+0.4	



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 (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 less than 5.0%.

A voltage of $\sim\sqrt{10} R_n$ (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 draught 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 Circuits for Burn-in

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

4.8 ENVIRONMENTAL AND ENDURANCE TESTS

4.8.1 Electrical Measurements on Completion of Environmental Tests

The parameters to be measured on completion of environmental tests are scheduled in Table 6. The measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests

The parameters to be measured at intermediate points during endurance tests are as scheduled in Table 6 of this specification.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

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.

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

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

TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTS

No.	Characteristics	Symbol	Condition	Unit
1	Temperature for Initial Measurement	T_{amb}	$+22 \pm 3$	$^{\circ}C$
2	Temperature for Operating Life Tests	T_{amb}	$+25 \pm 10$	$^{\circ}C$
3	Voltage Applied	U_T	$\sqrt{30 R_n}$	Vdc or Vrms
4	Temperature for Final Measurement	T_{amb}	$+22 \pm 3$	$^{\circ}C$

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

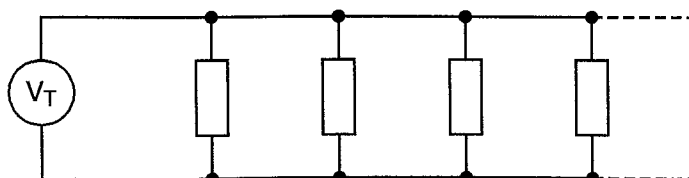


TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING

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)	ppm/°C	
04	Voltage Proof (Altitude)	Para. 9.8 and Table 1(b) of this spec. 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 $M\Omega$
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.

**4.8.3 Electrical Measurements on Completion of Endurance Tests**

The parameters to be measured on completion of endurance testing are as scheduled in Table 6 of this specification. The measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

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

Resistors shall be centrally mounted by normal mounting means on an aluminium chassis of thickness 1.0mm, length 178mm, width 127mm and height 51mm. The longitudinal axis of the resistor shall be parallel to 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 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. 4003. The conditions for high temperature storage shall be $T_{amb} = +275(+0-5)^{\circ}\text{C}$.