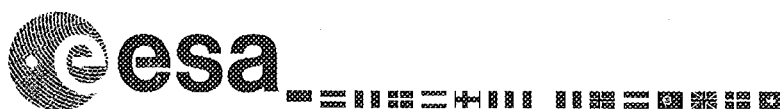





Pages 1 to 16

**THERMISTORS**  
**(THERMALLY SENSITIVE RESISTORS),**  
**NTC, 4000 OHMS AT +25°C**  
**WITH A TEMPERATURE RANGE OF -55 TO +115°C**  
**BASED ON TYPE 4K3A356**  
**ESCC Detail Specification No. 4006/002**

**ISSUE 2**  
**February 2003**



Document Custodian: European Space Agency - see <https://escies.org>

	ESCC Detail Specification No. 4006/002		PAGE i ISSUE 2
--	---	--	-------------------

### LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2003. 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.

**DOCUMENTATION CHANGE NOTICE**

(Refer to <https://escies.org> for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
9	Specification upissued to incorporate editorial and technical changes per DCR.


**TABLE OF CONTENTS**

		<u>Page</u>
1.	<b><u>GENERAL</u></b>	<b>5</b>
1.1	Scope	5
1.2	Type Variants	5
1.3	Maximum Ratings	5
1.4	Parameter Derating Information	5
1.5	Physical Dimensions	5
1.6	Functional Diagram	5
2.	<b><u>APPLICABLE DOCUMENTS</u></b>	<b>5</b>
3.	<b><u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u></b>	<b>5</b>
4.	<b><u>REQUIREMENTS</u></b>	<b>9</b>
4.1	General	9
4.2	Deviations from Generic Specification	9
4.2.1	Deviations from Special In-process Controls	9
4.2.2	Deviations from Final Production Tests	9
4.2.3	Deviations from Burn-in and Electrical Measurements	9
4.2.4	Deviations from Qualification Tests	9
4.2.5	Deviations from Lot Acceptance Tests	9
4.3	Mechanical Requirements	9
4.3.1	Dimension Check	9
4.3.2	Weight	9
4.3.3	Terminal Strength	10
4.4	Materials and Finishes	10
4.4.1	Case	10
4.4.2	Lead Material and Finish	10
4.5	Marking	10
4.5.1	General	10
4.5.2	The ESCC Component Number	10
4.5.3	Traceability Information	10
4.6	Electrical Measurements	11
4.6.1	Electrical Measurements at Room Temperature	11
4.6.2	Electrical Measurements at High and Low Temperatures	11
4.6.3	Circuits for Electrical Measurements	11
4.7	Burn-in Tests	11
4.7.1	Parameter Drift Values	11
4.7.2	Conditions for Burn-in	11
4.7.3	Electrical Circuits for Burn-in	11
4.8	Environmental and Endurance Tests	14
4.8.1	Measurements and Inspections on Completion of Environmental Tests	14
4.8.2	Measurements and Inspections at Intermediate Points during Endurance Tests	14
4.8.3	Measurements and Inspections on Completion of Endurance Tests	14
4.8.4	Conditions for Operating Life Tests	14
4.8.5	Electrical Circuits for Operating Life Tests	14

<u>TABLES</u>	<u>Page</u>
1(a) R/T Characteristics, Variant 01	6
1(b) Maximum Ratings	7
2 Electrical Measurements at Room Temperature - DC Parameters	12
3 Electrical Measurements at High and Low Temperatures	12
4 Parameter Drift Values	13
5 Conditions for Burn-in and Operating Life Tests	13
6 Measurements and Inspections on Completion of Environmental Tests and at Intermediate Points and on Completion of Endurance Testing	15

<u>FIGURES</u>	
1 Parameter Derating Information	7
2 Physical Dimensions	8
3 Functional Diagram	8
4 Circuits for Electrical Measurements	13
5 Electrical Circuit for Burn-in and Operating Life Tests	13

APPENDICES (Applicable to specific Manufacturers only)  
None.

	<p style="text-align: center;">ESCC Detail Specification No. 4006/002</p>	<p>PAGE 5 ISSUE 2</p>
---	---	---------------------------

**1. GENERAL**

**1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Thermistors (Thermally Sensitive Resistors), NTC, 4000 Ohms at +25°C with a Temperature Range of -55 to +115°C, based on Type 4K3A356. It shall be read in conjunction with ESCC Generic Specification No. 4006, the requirements of which are supplemented herein.

**1.2 TYPE VARIANTS**

Variants of the basic type thermistors specified herein, which are also covered by this specification, are 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 thermistors specified herein, are as scheduled in Table 1(b).

**1.4 PARAMETER DERATING INFORMATION (FIGURE 1)**

Not applicable.

**1.5 PHYSICAL DIMENSIONS**

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

**1.6 FUNCTIONAL DIAGRAM**

The functional diagram for the thermistors 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) ESCC Generic Specification No. 4006, Thermistors (Resistors, Thermally Sensitive).
- (b) IEC 60410, Sampling Procedures and Tables for Inspections by Attributes.
- (c) MIL-STD-202, Test Methods for Electronic and Electrical Component Parts.

**3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS**

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply. In addition, the following symbols are used:-

- NTC = Negative Temperature Coefficient.
- Rz = Zero Power Resistance



ESA/SCC Detail Specification  
No. 4006/002

PAGE 6  
ISSUE 2

**TABLE 1(a) - TYPE VARIANTS**

(1) VARIANT	(2) BASED ON TYPE	(3) R <sub>Z</sub> (Note 1)	RESISTANCE/TEMPERATURE CHARACTERISTICS (Note 2)								(4)
			-55°C	-40°C	-25°C	0°C	+25°C	+50°C	+70°C	+100°C	
01	4K3A358	NOM. (Ω)	408340	140400	53740	13240	1428.4	688.5	263.20	172.00	
		TOL. (±%)	3.30	2.50	2.00	1.00	0.84	0.74	0.65	0.57	1.50

**NOTES**

- For test purposes, when zero power is dissipated and the ambient temperature is held as specified, the value is referred to as R<sub>Z</sub> (Zero Power Resistance).
- The reference resistance is specified at +25°C.

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

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Power Dissipation	$P_D$	2.0	mW	Note 1
2	Operating Temperature Range	$T_{op}$	Note 2	°C	
3	Storage Temperature Range	$T_{stg}$	Note 3	°C	
4	Soldering Temperature	$T_{sol}$	+245	°C	Note 4

**NOTES**

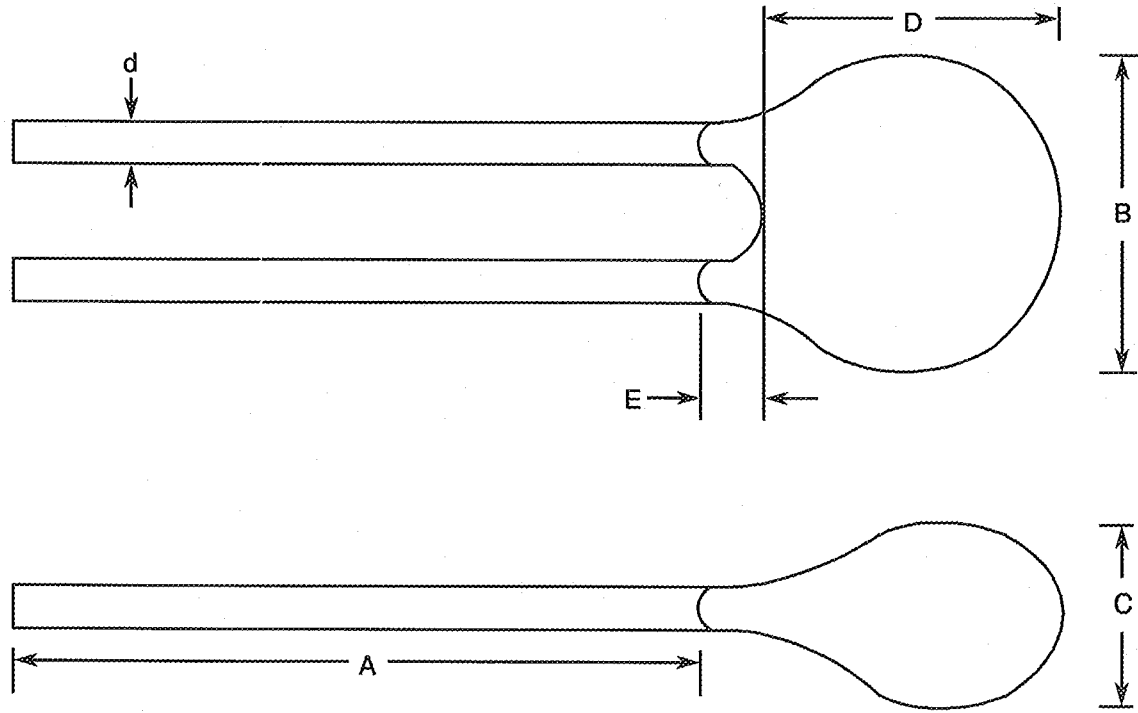
1. Never to be exceeded in the temperature measurement mode. The thermistors specified herein shall not be used in the self-heat mode.
2. See Column 4 of Table 1(a).
3. -55°C to the Maximum Operating Temperature in Column 4 of Table 1(a).
4. Duration 10 seconds maximum at a distance of not less than 10mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

**FIGURE 1 - PARAMETER DERATING INFORMATION**

Not applicable.



**FIGURE 2 - PHYSICAL DIMENSIONS**

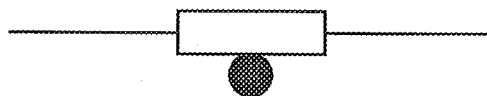


SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	50.8	-
B	-	2.29
C	-	2.29
D	-	3.50
d	0.23	0.28
E	-	1.60

**NOTES**

1. The leads shall not be bent, or the means of fastening them cause bending in any direction within a distance of 15mm from the centre of the thermistor.
2. All dimensions are in millimetres.

**FIGURE 3 - FUNCTIONAL DIAGRAM**





4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the thermistors specified herein are stated in this specification and ESCC Generic Specification No. 4006 for Thermistors (Resistors, Thermally Sensitive). 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 ESCC 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) Thermal Shock: Test Condition 'C' except that the maximum temperature shall be the maximum operating temperature specified in Column 4 of Table 1(a) of this specification.

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

None

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Thermal Shock: Test Condition 'C' except that the maximum temperature shall be the maximum operating temperature specified in Column 4 of Table 1(a) of this specification.

(b) Para. 9.3.1.2, Dissipation Constant: Not Applicable.

(c) Para. 9.15, Short Time Overload: Not Applicable.

(d) Para. 9.17, High Temperature Storage: Not Applicable.

(e) Para. 9.20, Permanence of Marking: Not Applicable.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Thermal Shock: Test Condition 'C' except that the maximum temperature shall be the maximum operating temperature specified in Column 4 of Table 1(a) of this specification.

(b) Para. 9.20, Permanence of Marking: Not Applicable.

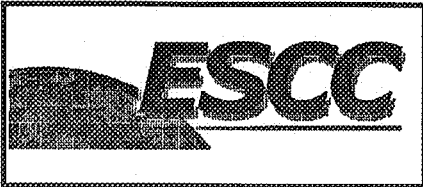
4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the thermistors specified herein shall be verified in accordance with the requirements set out in Para. 9.4 of ESCC Generic Specification No. 4006 and they shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the thermistors specified herein shall be 0.1 grammes.



4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Para. 9.13 of ESCC Generic Specification No. 4006. The test conditions shall be as follows:-

Applied Force: 4.45 (+ 1.1 -0)N.  
Duration: 5 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 thermistors 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 thermistor shall be covered with an epoxy encapsulant.

4.4.2 Lead Material and Finish

The lead material shall be Type 'A' with Type '3' finish in accordance with the requirements of ESCC Basic Specification No. 23500.

4.5 MARKING

4.5.1 General

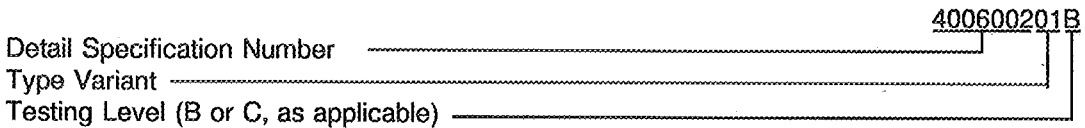
The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

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

- (a) The ESA Symbol, for qualified components only.
- (b) The ESCC Component Number.
- (c) Traceability Information.


4.5.2 The ESCC Component Number

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



4.5.3 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

	<p style="text-align: center;">ESCC Detail Specification No. 4006/002</p>	<p style="text-align: right;">PAGE 11 ISSUE 2</p>
---	---	---

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  $T_{amb} = +25 \pm 0.01$  °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. The temperature tolerance shall be  $\pm 0.01$ °C.

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  $T_{amb} = +25 \pm 0.01$ °C. The parameter drift values ( $\Delta$ ) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESCC Generic Specification No. 4006. The conditions for burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuits for Burn-in (Figure 5)

Not applicable.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - DC. PARAMETERS**

No.	CHARACTERISTICS	SYMBOL	ESCC 4006 TEST METHOD AND CONDITIONS	LIMITS		UNIT
				MIN.	MAX.	
1	Zero Power Resistance	R <sub>Z</sub>	Para. 9.3.1.1	Note 1		Ω
2	Insulation Resistance	R <sub>i</sub>	Para. 9.3.1.4 T <sub>amb</sub> = +25 ± 1°C Note 2	100	-	MΩ
3	Thermal Time Constant	K <sub>H</sub>	Para. 9.3.1.3 T <sub>amb</sub> = +25 ± 1°C In Still Air Note 3	-	25	Sec.

**NOTES**

1. See Column 4 of Table 1(a) for resistance values.
2. If more than 20 devices have to be measured, the test shall be performed on a sample basis in accordance with Level II, Single Sampling Plan for Normal Inspection, AQL = 1.0 of IEC 60410.
3. Test to be performed on 10 samples during Chart II only.

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

No.	CHARACTERISTICS	SYMBOL	ESCC 4006 TEST METHOD AND CONDITIONS	LIMITS		UNIT
				MIN.	MAX.	
1	Zero Power Resistance	R <sub>Z</sub>	Para. 9.3.1.1 At each specified temperature, over operating range	Note 1		Ω

**NOTES**

1. See Column 4 of Table 1(a) for resistance values.

**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

Not applicable.

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	CHARACTERISTICS	SYMBOL	TEST METHOD AND CONDITIONS	CHANGE LIMITS ( $\Delta$ )	UNIT
1	Zero Power Resistance Change	$\frac{\Delta R_z}{R_z}$	As per Table 2	$\pm 0.2$	%

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


No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	$T_{amb}$	Note 1 Note 2	°C
2	Power Dissipation	$P_D$	2.0	mW

**NOTES**

1. Maximum Operating Temperature specified in Column 4 of Table 1(a).
2. The Temperature Tolerance = (+0 -3°C).

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

Not applicable.

	ESCC Detail Specification No. 4006/002	PAGE 14 ISSUE 2
---	---	--------------------

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 4006)

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 2. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +25 \pm 0.01$  °C.

4.8.2 Measurements and Inspections at Intermediate Points during Endurance Tests

The parameters to be measured and inspections to be performed at intermediate points during endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +25 \pm 0.01$  °C.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +25 \pm 0.01$  °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 ESCC Generic Specification No. 4006. The conditions for operating life testing shall be as specified in Table 5 for the burn-in test.

4.8.5 Electrical Circuits for Operating Life Tests

Not applicable.



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

No.	ESCC GENERIC SPEC. No. 4006		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Thermal Shock	Para. 9.2 (2)	-	-	-	-	-	-
02	Thermal Time Constant	Para. 9.3.1.3 in Still Air	Initial Measurements Zero Power Resistance	9.3.1.3(c)	R <sub>Z</sub>	Record Values		Ω
			Final Measurements Thermal Time Constant	9.3.1.3(f)	K <sub>H</sub>	-	25	Sec.
03	External Visual Inspection	Para. 9.5	ESCC 20500	-	-	-	-	-
04	Shock (Specified Pulse)	Para. 9.7	Initial Measurements Zero Power Resistance	Table 2 Item 1	R <sub>Z</sub>	Table 2 Item 1		Ω
			During Shock Intermittent Contact	Open or Short Circuiting	-	-	-	-
			After Shock Zero Power Resistance Change	Table 2 Item 1	ΔR <sub>Z</sub> /R <sub>Z</sub>	-2.0	+2.0	%
			Visual Examination	Evidence of damage	-	-	-	-
05	Vibration	Para. 9.8	Initial Measurements Zero Power Resistance	Table 2 Item 1	R <sub>Z</sub>	Table 2 Item 1		Ω
			During Vibration Intermittent Contact	Open or Short Circuiting	-	-	-	-
			After Vibration Zero Power Resistance Change	Table 2 Item 1	ΔR <sub>Z</sub> /R <sub>Z</sub>	-2.0	+2.0	%
			Visual Examination	Evidence of damage	-	-	-	-
06	Immersion	Para. 9.9	Visual Examination	Evidence of damage	-	-	-	-
07	Dielectric Withstanding Voltage	Para. 9.10	During Test Visual Examination	Evidence of breakdown or flashover	-	-	-	-
			After Test Visual Examination	Evidence of damage, arcing or breakdown	-	-	-	-
08	Resistance to Soldering Heat	Para. 9.11	After Test Zero Power Resistance Visual Examination	After a recovery period of 24 ± 4 hrs Table 2 Item 1 Evidence of damage	R <sub>Z</sub>	Table 2 Item 1		Ω

**NOTES**

1. The tests in this Table refer to either Chart IV or V and shall be used as applicable.
2. Thermal Shock Test Method and Conditions shall use the deviation of this specification 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.	ESCC GENERIC SPEC. No. 4006		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT				
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.					
09	Moisture Resistance	Para. 9.12	<b>Initial Measurements</b>	Not less than 1.5 hrs after removal from drying oven Table 2 Item 1 Within 24 hrs of removal from 1.5 to 3.5 hr conditioning Table 2 Item 1	R <sub>Z</sub>	Table 2 Item 1		Ω				
			<b>Final Measurements</b>									
			Zero Power Resistance Change						ΔR <sub>Z</sub> /R <sub>Z</sub>	-2.0	+2.0	%
			Insulation Resistance	Table 2 Item 2	R <sub>i</sub>	100	-	MΩ				
10	Terminal Strength	Para. 9.13	<b>Initial Measurements</b>	Table 2 Item 1	R <sub>Z</sub>	Table 2 Item 1		Ω				
			<b>Final Measurements</b>									
			Zero Power Resistance Change						ΔR <sub>Z</sub> /R <sub>Z</sub>	-2.0	+2.0	%
			Visual Examination	Evidence of damage	-	-	-	-				
11	Operating Life	Para. 9.14	<b>Initial Measurements</b>	Table 2 Item 1	R <sub>Z</sub>	Table 2 Item 1		Ω				
			Zero Power Resistance									
			<b>Intermediate Measurements</b>									
			Zero Power Resistance Change						ΔR <sub>Z</sub> /R <sub>Z</sub>	-0.5	+0.5	%
			Insulation Resistance						Table 2 Item 2	R <sub>i</sub>	100	-
			<b>Final Measurements</b>	Table 2 Item 1	ΔR <sub>Z</sub> /R <sub>Z</sub>	-0.5	+0.5	%				
Zero Power Resistance Change												
Insulation Resistance	Table 2 Item 2	R <sub>i</sub>	100						-	MΩ		
12	Low Temperature Storage	Para. 9.16	<b>Initial Measurements</b>	Table 2 Item 1	R <sub>Z</sub>	Table 2 Item 1		Ω				
			<b>Final Measurements</b>									
			Zero Power Resistance Change						ΔR <sub>Z</sub> /R <sub>Z</sub>	-2.0	+2.0	%
			Visual Examination	Evidence of damage	-	-	-	-				
13	Solderability	Para. 9.18	-	-	-	-	-	-				

**NOTES**

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