DOCUMENT CHANGE REQUEST

DCR number 532	Changes required for: General	Originator: S Jeffery - ESCC
Date: 2009/07/07	Date sent: 2009/07/07	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Title:	Resistors Heaters Flexible Single and Double Layer, Follow-up Specification for ESA/SCC Detail		
Number:	4009/002	Issue:	4

Other documents affected:

Page:

Specification 4009/002 Issue 4 is updated to accompany the updated Generic 4009. Changes are summarised herein (see attached Issue 5 - Draft A).

Paragraph:

Specification 4009/002 Issue 4 is updated to accompany the updated Generic 4009. Changes are summarised herein (see attached Issue 5 - Draft A).

Original wording:

Proposed wording:

To introduce a number of editorial changes (see the attached mark-up) which are required to make this detail spec clear, complete and consistent.

Justification:

Improve the appearance, content and clarity of the spec.

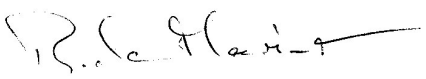
Attachments:

4009002_Issue_5_-_Draft_A.pdf, null

Modifications:

N/A

Approval signature:



Date signed:

2009-07-07

RESISTORS, HEATERS, FLEXIBLE

SINGLE AND DOUBLE LAYER

ESCC Detail Specification No. 4009/002

as applicable

Issue ~~4~~ 5 - Draft A	~~September 2006~~

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

as applicable

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DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
~~280[illegible]232~~ tbd	Specification up issued to incorporate editorial and technical ~~and policy~~ changes per DCR.

TABLE OF CONTENTS

1.	**GENERAL**	**5**
1.1	Scope	5
1.2	Applicable Documents	5
1.3	Terms, Definitions, Abbreviations, Symbols and Units	5
1.4	The ESCC Component Number and Component Type Variants	5
1.4.1	The ESCC Component Number	5
1.4.2	Component Type Variants and Range of Components	5
1.4.3	Manufacturer Specific Heater Identification	7
1.5	Maximum Ratings	7
1.6	Physical Dimensions and Heater Outline	8
1.7	Material and Finishes	9
1.7.1	Heater Resistive Element	9
1.7.2	Protective Coating	9
1.7.3	Terminal Leads	9
2.	**REQUIREMENTS**	**9**
2.1	General	9
2.1.1	Deviations from the Generic Specification	10
2.1.1.1	Deviations from Screening Tests- Chart F3	10
2.2	Marking	10
2.3	Robustness of Terminations	10
2.4	Electrical Measurements at Room, High and Low Temperatures	10
2.4.1	Room Temperature Electrical Measurements	10
2.4.2	High and Low Temperatures Electrical Measurements	11
2.5	Intermediate and End-Point Electrical Measurements	11
2.6	Burn-in Conditions	13
2.7	Operating Life Conditions	13
APPENDIX 'A'		14
1.6.1	Heater Thickness	9

1.4.3 Manufacturer Specific Heater Identification

A Heater Design Drawing shall be produced by the Manufacturer after negotiation with the Orderer and shall be held under configuration control by the Manufacturer who will allocate a unique Manufacturer Specific Heater Identification sequentially when a request for a heater is received.

Each Heater Design Drawing shall include the following information:

(a) The heater outline and dimensions as required by Physical Dimensions herein. This shall include details of the terminal leads configurations and the angle of exit of each terminal lead with respect to the heater body.
(b) The ESCC Component Number for the heater, including the Manufacturer Specific Heater Identification.
(c) The terminal leads' ESCC Detail Specification and Component Number.
(d) The heater electrical information as follows:
- Resistance value Rn and tolerance by circuit at T_{amb}= +22±3°C.
- Maximum rated power in still air at T_{amb}= +25°C.
(e) Track width and spacing with tolerances.
(f) Cover material (if fitted).
(g) Pressure sensitive tape (if fitted).
(h) Dimensions of pre-form, if required.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
Rated Power Density	Pn	0.54	W/cm^2	Note 1, 2 , 3, 4
Operating Temperature Range	T_{op}	-65 to +200	°C	T_{amb} Note 3
Storage Temperature Range	T_{stg}	-65 to +200	°C	-
Rated Voltage	U_R	$\sqrt{Pn.Rn.S}$	V	Note 2, 3, 5

NOTES:

1. With heater suspended in still air at T_{amb}= +25°C.
2. Actual rated power shall be specified in the applicable Heater Design Drawing. It shall be determined from the Heating Area (S) in cm^2.
3. Rated Power Density shall be derated against temperature and Heating Area as follows:
   (a) Pn = $0.54W/cm^2$ for $T_{amb} \leq +25°C$. Derate to $0W/cm^2$ at $0.00308W/cm^2/°C$ for $+25°C < T_{amb} \leq +200°C$.
   (b) Pn = $0.54W/cm^2$ for $1.6cm^2 \leq$ Heating Area (S) $\leq 300cm^2$. Derate to $0.3W/cm^2$ at

$0.00024W/cm^2/cm^2$ for $300cm^2$ < Heating Area (S) ≤ $1300cm^2$.

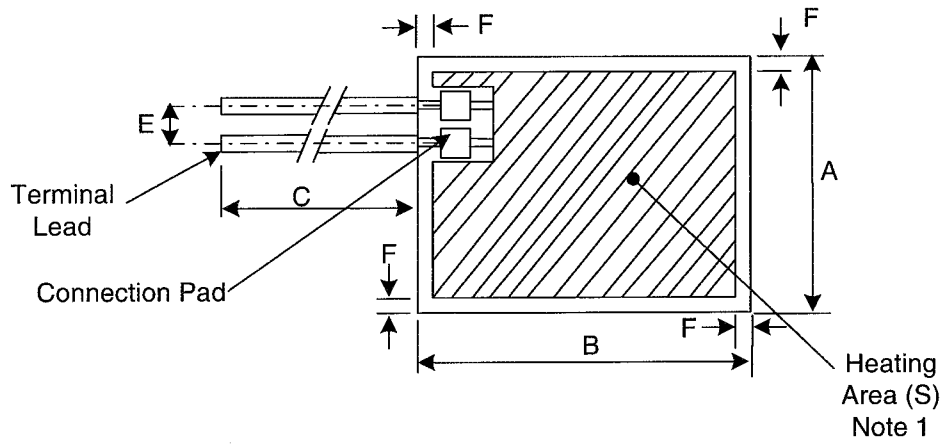
4. The following design rule shall be applied:

$$\frac{\text{Area of Heater Resistive Element}}{\text{Heating Area (S)}} = 50 \pm 10\%$$

5. Rn is the nominal resistance.

1.6 PHYSICAL DIMENSIONS AND HEATER OUTLINE

The general physical dimensions and heater layout shall be as follows. The physical dimensions and heater layout applicable to a specific heater will be specified in the Heater Design Drawing held by the Manufacturer.



Symbol	Dimensions mm		Tolerance ± mm	Remarks
	Min	Max		
A	6	590	0.5	Note 1
B	8	600	0.5	Note 1
C	300	-	Note 2	-
E	2	-	Note 3	Note 4
F	0.4	-	-	Note 5, 6
S				Note 1

NOTES:

1. The Heating Area, is defined as the total area of the heater excluding the peripheral margin and the terminal lead connection area. ~~shall have the following limits:~~ The acceptable limits of S are ~~$1.6cm^2 \leq S \leq 1300cm^2$~~ specified in Component Type Variants and Range of Components.

~~The following design rule shall be applied~~

~~Area of Heater Resistive Element = 50 ± 10%~~
~~Heating Area (S)~~

1.6.1 Heater thickness:
~~0.2mm maximum for single layer heaters.~~
~~0.3mm maximum for double layer heaters.~~
~~except~~ over the terminal lead connection area.
[These maximum limits do not apply

The maximum thicknesses for single layer and double layer heaters are as follows:

2. The tolerance shall be ± 10% on the required dimension.
3. The tolerance shall be ± 0.5mm on the required dimension.
4. Terminal lead spacing shall be measured at the terminal lead connection area. Terminal leads may exit the terminal lead connection area at any angle. The terminal leads may be located on any side of the heater. There may be more than 2 terminal leads (for multiple resistive element and double layer heaters).
5. Peripheral margin dimension.
6. Perforated holes in the peripheral margin are allowed provided that the distance between the edge of the hole and the heater resistive element or connection pad is equal to, or greater than, dimension F.

1.7 MATERIAL AND FINISHES

1.7.1 Heater Resistive Element

The heater resistive element shall be made of flexible nickel/chromium/iron alloy (76/16/8 Inconel).

1.7.2 Protective Coating

Heater resistive elements and terminal lead connections shall be completely coated with Polyimide Polymer/FEP in accordance with MIL-P-46112 (as superseded by ASTM-D5213).

1.7.3 Terminal Leads

Terminal leads shall be made of multi-strand silver-plated copper in accordance with ESCC Generic Specification No. 3901. The applicable Heater Design Drawing shall specify the wire ESCC Detail Specification and the wire ESCC Component Number. The wire gauge shall be as specified in Component Type Variants and Range of Components herein. Terminal leads shall be electrically welded to the heater resistive element.

2. REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

2.1.1.1 Deviations from Screening Tests- Chart F3

(a) For heaters where the ~~Heater~~ Design Drawing requires the application of cover material or pressure sensitive tape the following additional steps shall be performed during Screening Tests:
   (i) An additional 100% External Visual Inspection shall be performed after successful completion of High and Low Temperatures Electrical Measurements.
   (ii) After successful completion of the additional External Visual Inspection the cover material and/or pressure sensitive tape shall be applied.
   Note:
   For heaters which already have a backing foil applied the additional External Visual Inspection shall not be performed.

(b) For heaters where the Heater Design Drawing requires pre-forming this shall be performed on successful completion of Screening Tests. The pre-forming operation shall be performed at a temperature not exceeding the maximum storage temperature. An additional External Visual Inspection shall be performed after the pre-forming operation to check for any damage.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

(a) The ESCC qualified components symbol (for ESCC qualified components only).
(b) The ESCC Component Number.
(c) Traceability information.

2.3 ROBUSTNESS OF TERMINATIONS

The test conditions for robustness of terminations, tested as specified in the ESCC Generic Specification, shall be as follows and apply to a single terminal lead at a time.

Wire Gauge (AWG)	20	22	24	26	28	30
Pull Strength (N)	45	36	22	13	9	4.5
Duration (s) Minimum	5	5	5	5	5	5

2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

The measurements shall be performed at room, high and low temperatures.

2.4.1 Room Temperature Electrical Measurements

The measurements shall be performed at T_{amb}=+22 ±3°C.

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Resistance	R_A	ESCC No. 4009 ±2% Tolerance ±3% Tolerance ±5% Tolerance ±10% Tolerance	 0.98 Rn 0.97 Rn 0.95 Rn 0.9 Rn	 1.02 Rn 1.03 Rn 1.05 Rn 1.1 Rn	Ω
Insulation Resistance	R_I	ESCC No. 4009	1000	-	MΩ
Voltage Proof Leakage Current	I_L	ESCC No. 4009 Test Voltage = 500Vrms	-	2 or (1) 4	mA $\mu A/cm^2$

NOTES:
1. Whichever is greater based on the Heating Area.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Resistance change between -65(+3 -0)°C and +22 ±3°C	$\Delta R_A/R_A(L)$	ESCC No. 4009	0	-1.57	%
Resistance change between +200(+0 -3)°C and +22 ±3°C	$\Delta R_A/R_A(H)$	ESCC No. 4009	0	+3.17	%

NOTES:
1. Measurements shall be performed during Screening Tests on a sample of 3 components. In the event of any failure a 100% inspection shall be performed.

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb}=+22 ±3°C.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic where specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

APPENDIX 'A'

AGREED DEVIATIONS FOR RICA (I)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Deviations from Screening Tests - Chart F3	Heaters with cover material applied: Where cover material has been applied during the heater lamination process, the deviations specified in Para. 2.1.1.1(a) of this specification are not applicable. Rapid Change of Temperature: Mounting: Heaters may be mounted using any suitable method. Data Points: Electrical measurements during and after testing are optional at the Manufacturer's discretion. Overload: Data Points: Electrical measurements after testing are optional at the Manufacturer's discretion. ~~Serialisation:~~ ~~Serialisation prior to Screening Tests, with subsequent read and record Electrical measurements during Screening Tests, is optional at the Manufacturer's discretion.~~

Para. 8.2,

Para. 8.3,

Paras. 8.1.2 and 8.1.3, Electrical Measurements at Room, High and Low Temperatures:
Electrical measurements at room, high and low temperatures may be performed read and record (a 100% serialisation ~~shall be~~ carried out prior to the commencement of Screening Tests) at the manufacturer's discretion.