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See Appendice	s1&2				
Original wording	<b>j</b> :				
Proposed wordi	ng:				
Specification 4009 rewritten as issue draft 2F (Appendix 3) to incorporate editorial, policy and technical changes as described and detailed in Appendices 1 & 2. . Appendix 1 details all changes and identifies if each change is considered as Editorial, Policy or Technical . . Appendix 2 is a complete mark-up of ESCC 4009 Draft 1B showing all the changes incorporated into draft 2F.					
Attached: . Appendix 1 - Detailed changes to ESCC 4009 issue 1 draft B . Appendix 2 - Mark-up of ESCC 4009 issue 1 draft B . Appendix 3 - ESCC 4009 issue 2 draft F					
Justification:					
All changes have been defined and included to serve the purposes of clarification, accuracy, completeness, simplification and consistency. The aim is to simplify and improve the interpretation of the specification and it's requirements whilst maintaining the same overall structure and technical baseline as per the previous ESCC 4009 issue 1 (ESA/SCC 4009 issue 3B) and ESCC 4009 draft 1B specifications.					

For Policy and Technical changes specific explanations and justifications are provided in Appendix 1.

Attachments:	
Appendix_2_Markup_of_4009_draft_1B_13.10.04.pdf, Appendix_3_4009_draft_2F.pdf, Appendix_1_Details_of_changes_in_4009_draft_2F.pdf, null	
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2004-10-13	



Pages 1 to 26

# **RESISTORS, HEATERS, FLEXIBLE**

**ESCC Generic Specification No. 4009** 

Issue 2 -Draft F	September 2004
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DCR No.	CHANGE DESCRIPTION
TBD	Specification upissued to incorporate editorial and technical changes per DCR.



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## 1. INTRODUCTION

#### 1.1 <u>SCOPE</u>

This specification defines the general requirements for the qualification, qualification maintenance, procurement, and delivery of Resistors, Heaters, flexible for space applications. This specification contains the appropriate inspection and test schedules and also specifies the data documentation requirements.

#### 1.2 <u>APPLICABILITY</u>

This specification is primarily applicable to the granting of qualification approval to a component in accordance with ESCC Basic Specification No. 20100 and the procurement of such components from qualified Manufacturers. It may also be applied for procurement of unqualified components.

#### 2. <u>APPLICABLE DOCUMENTS</u>

The following documents form part of, and shall be read in conjunction with, this specification. The relevant issues shall be those in effect on the date of starting qualification or placing the Purchase Order.

### 2.1 <u>ESCC SPECIFICATIONS</u>

- No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.
- No. 20500, External Visual Inspection.
- No. 20600, Preservation, Packaging and Dispatch of ESCC Electronic Components.
- No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.
- No. 21700, General Requirements for the Marking of ESCC Components.
- No. 22800, ESCC Non-conformance Control System.
- No. 23500, Lead Materials and Finishes for Components for Space Application.
- No. 24600, Minimum Quality System Requirements.
- No. 24800, Resistance to Solvents of Marking, Materials and Finishes.

For qualification and qualification maintenance or procurement of qualified components, with the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800, and 24600, where Manufacturers' specifications are equivalent to, or more stringent than, the ESCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the ESCC Executive.

Such replacements shall be clearly identified in the applicable Process Identification Document (PID).

For procurement of unqualified components, where Manufacturers' specifications are equivalent to or more stringent than the applicable ESCC Basic Specifications listed above, they may be used in place of the latter subject to the approval of the Orderer.

Such replacements may be listed in an appendix to the appropriate Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

Unless otherwise stated herein, references within the text of this specification to "the Detail Specification" shall mean the relevant ESCC Detail Specification.

## OTHER (REFERENCE) DOCUMENTS

- REP005, ESCC Qualified Parts List.
- ECSS-Q-70-02, Thermal Vacuum Test for the Screening of Space Materials.
- IEC Publication No. 68, Basic Environmental Testing Procedures.



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- IEC Publication No. 115, Fixed Resistors for Use in Electronic Equipment.

## 2.3 ORDER OF PRECEDENCE

For the purpose of interpretation and in case of conflict with regard to documentation, the following order of precedence shall apply:

- (a) ESCC Detail Specification.
- (b) ESCC Generic Specification.
- (c) ESCC Basic Specification.
- (d) Other documents, if referenced herein.

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

The terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

## 4. <u>REQUIREMENTS</u>

## 4.1 <u>GENERAL</u>

The test requirements for the component type qualification of a component shall comprise Special In-Process Controls, Screening Tests and Component Type Qualification Testing.

The test requirements for procurement of components shall comprise Special In-Process Controls, Screening Tests, together with Periodic Testing for qualified components and Lot Validation Testing for qualified (if required in the Purchase Order) and unqualified components.

#### 4.1.1 Specifications

For qualification, qualification maintenance, procurement and delivery of components in conformity with this specification, the applicable specifications listed in Section 2 of this document shall apply in total unless otherwise specified herein or in the Detail Specification.

## 4.1.2 Conditions and Methods of Test

The conditions and methods of test shall be in accordance with this specification, the ESCC Basic Specifications referenced herein and the Detail Specification.

#### 4.1.3 Manufacturer's Responsibility for Performance of Tests and Inspections

The Manufacturer shall be responsible for the performance of tests and inspections required by the applicable specifications. These tests and inspections shall be performed at the plant of the Manufacturer of the components unless it is agreed by the ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components), to use an approved external facility.

## 4.1.4 Inspection Rights

The ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components) reserves the right to monitor any of the tests and inspections scheduled in the applicable specifications.



#### 4.2 QUALIFICATION AND QUALIFICATION MAINTENANCE REQUIREMENTS ON A MANUFACTURER

To obtain and maintain the component type qualification of a component, or family of components, a Manufacturer shall satisfy the requirements of ESCC Basic Specification No. 20100.

## 4.3 DELIVERABLE COMPONENTS

Components delivered to this specification shall be processed and inspected in accordance with the relevant Process Identification Document (PID). Each delivered component shall be traceable to its production lot. Components delivered to this specification shall have satisfactorily completed all the required tests.

ESCC qualified components delivered to this specification shall be produced from lots that are capable of passing all applicable tests, and sequences of tests, that are defined in Chart F4. The Manufacturer shall not knowingly supply components that cannot meet this requirement. In the event that, subsequent to delivery and prior to operational use, a component is found to be in a condition such that it could not have passed these tests at the time of manufacture, this shall be grounds for rejection of the delivered lot.

## 4.3.1 Lot Failure

Lot failure may occur during Screening Tests (Chart F3) or Qualification and Periodic Tests (Chart F4).

Should such failure occur during qualification, qualification maintenance or procurement of qualified components the Manufacturer shall initiate the non-conformance procedure in accordance with ESCC Basic Specification No. 22800. The Manufacturer shall notify the Orderer and the ESCC Executive by any appropriate written means, within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing shall be performed on the failed components.

Should such failure occur during procurement of unqualified components the Manufacturer shall notify the Orderer by any appropriate written means within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing shall be performed on the failed components. The Orderer shall inform the Manufacturer within 5 working days of receipt of notification what action shall be taken.

## 4.4 <u>MARKING</u>

All components procured and delivered to this specification shall be marked in accordance with ESCC Basic Specification No. 21700.

## 4.5 <u>MATERIALS AND FINISHES</u>

Specific requirements for materials and finishes are specified in the Detail Specification. Where a definite material or finish is not specified a material or finish shall be used so as to ensure that the component meets the performance requirements of this specification and the Detail Specification. Acceptance or approval of any constituent material or finish does not guarantee acceptance of the finished product.

All non-metallic materials and finishes, of the components specified herein shall meet the outgassing requirements as outlined in ECSS-Q-70-02.

#### 4.5.1 <u>Terminal Leads Requirements</u>

Wires used for terminal leads shall be as specified in the applicable wire ESCC Detail specification as



referenced in the heater ESCC Detail Specification. The wires shall be ESCC Qualified as evidenced by a listing in the current ESCC Qualified Parts List REP005.

## 5. **PRODUCTION CONTROL**

#### 5.1 <u>GENERAL</u>

The minimum requirements for production control are defined in the Process Identification Document (PID).

Unless otherwise specified in the Detail Specification all lots of components used for qualification and qualification maintenance, Lot Validation Testing and for delivery shall be subject to tests and inspections in accordance with Chart F2.

Any components which do not meet these requirements shall be removed from the lot and at no future time be resubmitted to the requirements of this specification.

The applicable test requirements are detailed in the paragraphs referenced in Chart F2.

## 5.2 SPECIAL IN-PROCESS CONTROLS

- 5.2.1 <u>Robustness of Terminations</u> In accordance with Para. 8.6 and the Detail Specification on a 100% basis.
- 5.2.2 <u>Dimension Check</u> In accordance with Para. 8.5 on 3 samples only.

If a failure occurs, the complete lot shall be checked.

#### 5.2.3 Weight

The maximum weight of the components specified in the Detail Specifications shall be guaranteed but not tested.

## 5.2.4 <u>Documentation</u> Documentation of Special In-Process Controls shall be in accordance with Para. 9.5.

#### 6. <u>SCREENING TESTS</u>

#### 6.1 <u>GENERAL</u>

Unless otherwise specified in the Detail Specification, all components used for qualification and qualification maintenance, Lot Validation Testing and for delivery, shall be subjected to tests and inspections in accordance with Chart F3.

Unless otherwise specified in the Detail Specification, the tests shall be performed in the order shown.

Any components which do not meet these requirements shall be removed from the lot and at no future time be resubmitted to the requirements of this specification.

The applicable test methods and conditions are specified in the paragraphs referenced in Chart F3.



#### 6.2 FAILURE CRITERIA

#### 6.2.1 <u>Parameter Limit Failure</u>

A component shall be counted as a limit failure if one or more parameters exceed the limits shown in Electrical Measurements at Room, High and Low Temperatures in the Detail Specification.

Any component which exhibits a limit failure prior to the submission to burn-in shall be rejected and not counted when determining lot rejection.

#### 6.2.2 <u>Other Failures</u>

A component shall be counted as a failure in any of the following cases:

- Visual Inspection failure.
- Mechanical failure.
- Handling failure.
- Lost component.

#### 6.3 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 6.2.

#### 6.4 <u>LOT FAILURE</u> In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.1.

#### 6.4.1 Lot Failure during 100% Testing

If the number of components failed on the basis of the failure criteria specified in Para. 6.2.1 exceeds 5% (rounded upwards to the nearest whole number) of the components submitted to burn-in in Chart F3, the lot shall be considered as failed.

If a lot is composed of groups of components of one family defined in one ESCC Detail Specification, but separately identifiable for any reason, then the lot failure criteria shall apply separately to each identifiable group.

#### 6.4.2 Lot Failure during Sample Testing

A lot shall be considered as failed if the number of allowable failures during sample testing as specified herein or in the Detail Specification, is exceeded.

If a lot failure occurs, a 100% testing may be performed but the cumulative percent defective shall not exceed that given in Para. 6.4.1.

#### 6.5 DOCUMENTATION

Documentation of Screening Tests shall be in accordance with Para. 9.6.

## 7. QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING

Requirements of this paragraph are applicable to the tests performed for component type qualification and qualification maintenance, and also for Lot Validation Testing. All components shall be serialised prior to the tests and inspections.



## 7.1 <u>COMPONENT TYPE QUALIFICATION TESTING</u>

#### 7.1.1 General

Qualification testing shall be in accordance with the requirements given in Chart F4. The tests of Chart F4 shall be performed on the specified sample, chosen at random from components which have successfully passed the tests in Chart F3 (Screening Tests). This sample constitutes the qualification test lot.

The qualification test lot is divided into subgroups of tests and all components assigned to a subgroup shall be subjected to all of the tests in that subgroup, in the sequence shown. The applicable test requirements are detailed in the paragraphs referenced in Chart F4.

The conditions governing component type qualification testing are given in ESCC Basic Specification No. 20100.

#### 7.1.2 Distribution within the Qualification Test Lot

The qualification test lot shall be comprised in accordance with the following provisions:.

- 1/3 of the lot with the maximum resistive density.
- 1/3 of the lot with the average resistive density (10 to 30 Ohms/cm<sup>2</sup>).
- 1/3 of the lot of the double layer type with separate outputs.

The component types may be specified by, but in any case shall be agreed with, the ESCC Executive, prior to the commencement of qualification testing and the justification for the selection shall be declared in the qualification test report.

## 7.2 QUALIFICATION MAINTENANCE (PERIODIC TESTING)

Component type qualification is maintained through periodic testing and the test requirements of Para. 7.1 shall apply. For each subgroup the period between successive subgroup testing shall be as given in Chart F4. The conditions governing qualification maintenance are given in ESCC Basic Specification No. 20100.

## 7.3 LOT VALIDATION TESTING

#### 7.3.1 <u>General</u>

For qualified components, Lot Validation Testing as defined in compliance with Chart F4, Subgroup 2, shall only be performed on the procured lot if required in the Purchase Order.

If unqualified components are procured using this specification then the Orderer shall define in the Purchase Order the required subgroups from Chart F4 to be used for Lot Validation Testing.

## 7.3.2 Distribution within the Sample for Lot Validation Testing

Where a Detail Specification covers a range, or series, of components that are considered similar, then it is only necessary to perform Lot Validation Testing on representative types if a number of different types are procured together. The sample for Lot Validation Testing should be comprised of component types so selected that they adequately represent all of the various mechanical, structural and electrical peculiarities of the components procured from the range or series.

The distribution of component types will vary from procurement to procurement and shall be as required in the Purchase Order.



## 7.4 FAILURE CRITERIA

The following criteria shall apply to qualification, qualification maintenance and Lot Validation Testing.

## 7.4.1 <u>Environmental and Mechanical Test Failures</u> The following shall be counted as component failures:-

Components which fail during tests for which the pass/fail criteria are inherent in the test method, e.g. Robustness of Terminations.

#### 7.4.2 <u>Electrical Failures</u>

The following shall be counted as component failures:

Components which fail one or more of the applicable limits at each of the relevant data points specified for environmental, mechanical and endurance testing in Intermediate and End-point Electrical Measurements in the Detail Specification.

#### 7.4.3 <u>Other Failures</u>

A component shall be counted as a failure in any of the following cases:

- Visual Inspection failure
- Mechanical failure
- Handling failure
- Lost component

## 7.5 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 7.4.

When requested by the ESCC Executive (for qualification, qualification maintenance or procurement of qualified components) or the Orderer (for procurement of qualified or unqualified components), failure analysis of failed components shall be performed by the Manufacturer and the results provided.

Failed components shall be retained at the Manufacturer's plant until the final disposition has been agreed and certified.

## 7.6 LOT FAILURE

For qualification and qualification maintenance, the lot shall be considered as failed if one component in any subgroup of Chart F4 is a failed component based on the criteria given in Para. 7.4.

For procurement, the lot shall be considered as failed if one component in any test specified for Lot Validation Testing is a failed component based on the criteria given in Para. 7.4.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.1.

# 7.7 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING

<u>SAMPLES</u>

The tests of Chart F4 are considered to be destructive and therefore components so tested shall not form part of the delivery lot.



## 7.8 DOCUMENTATION

Documentation of qualification, qualification maintenance and Lot Validation Testing shall be in accordance with Para. 9.7.

## 8. <u>TEST METHODS AND PROCEDURES</u>

If a Manufacturer elects to eliminate or modify a test method or procedure, the Manufacturer is still responsible for delivering components that meet all of the performance, quality and reliability requirements defined in this specification and the Detail Specification.

For a qualifed component, documentation supporting the change shall be approved by the ESCC Executive and retained by the Manufacturer. It shall be copied, when requested, to the ESCC Executive. The change shall be specified in an appendix to the Detail Specification and in the PID.

For an unqualified component the change shall be approved by the Orderer. The change may be specified in an appendix to the Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

## 8.1 <u>ELECTRICAL MEASUREMENTS</u>

#### 8.1.1 General

Electrical measurements and methods shall be as follows.

#### 8.1.1.1 Resistance

Measurements of resistance shall be made by using a direct voltage of small magnitude for as short a time as practicable so that the temperature does not rise appreciably during measurement.

The resistance of terminal leads attached to the heaters shall be calculated and subtracted from the actual measurement. The terminal lead resistance shall be calculated from data found in the applicable wire specification. Additionally, for High and Low temperatures and Temperature Coefficient measurements, the heaters and the whole length of their terminal leads shall be placed inside the temperature chamber. In this case, the terminal lead resistance, adjusted for temperature coefficient resistance, shall be subtracted from the actual measurement.

The resistance limits at +22  $\pm$  3 °C are given in Room Temperature Electrical Measurements in the Detail Specification.

In the event of conflicting results, attributable to test voltages, the voltage specified in the following table shall be used for reference purposes.

Rated Resistance (R <sub>n</sub> ) (Ω)	Measuring Voltage V (+0-10)%
less than 10	0.1 (Note 1)
10 to 99	0.3
100 to 999	1
1000 to 9999	3

#### NOTES:

1. The accuracy of the measuring equipment shall be such that the error does not exceed 10% of the



tolerance. Where the measurement forms part of a test sequence, it shall be possible to measure a change in resistance with an error not exceeding 10% of the maximum change permitted for that test.

#### 8.1.1.2 Insulation Resistance

- Mounting
  - The heaters shall be clamped between 2 conducting plates connected together.
- Test Conditions

The insulation resistance shall be measured with a direct voltage of  $500 \pm 50V$ . The measurement shall be performed between all terminations of the heater connected together as one pole and the mounting device as the other pole; for heaters with more than one resistor, the measurement shall also be performed between each resistor, with each resistor having both terminations connected together to form one pole.

The voltage shall be applied for 1 minute or such shorter time as is necessary to obtain a stable reading. The insulation resistance shall be read at the end of that period and shall not be less than that specified in Room Temperature Electrical Measurements in the Detail Specification. There shall be no evidence of breakdown or flash-over.

#### 8.1.1.3 Voltage Proof

Mounting

The heaters shall be clamped between 2 conducting plates connected together.

Test Conditions

A voltage as specified in Room Temperature Electrical Measurements in the Detail Specification shall be applied for a period of  $60 \pm 5$  seconds between all terminations of the heater connected together as one pole and the mounting device as the other pole; for heaters with more than one resistor, the measurement shall also be performed between each resistor, with each resistor having both terminations connected together to form one pole. The voltage shall be applied gradually at a rate of approximately 100V/second. There shall be no evidence of breakdown or flash-over.

## 8.1.2 High and Low Temperatures Electrical Measurements

High and Low Temperatures Electrical Measurements shall be performed as specified in the Detail Specification. 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.

## 8.1.3 <u>Room Temperature Electrical Measurements</u>

Room Temperature Electrical Measurements shall be performed as specified in the Detail Specification.

#### 8.1.4 Intermediate and End-Point Electrical Measurements

At each of the relevant data points during Qualification and Periodic Tests Intermediate and End-point Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated, if specified.

#### 8.2 RAPID CHANGE OF TEMPERATURE

The heaters shall be subjected to Test 'Na' of IEC Publication No. 68-2-14 with the following details:

Mounting

The heaters shall be suspended by their terminal leads in still air.



#### Test Conditions

The duration of exposure at the maximum and minimum storage temperature ratings as specified in the Detail Specification shall be 15 minutes each. The number of cycles shall be 10.

## Data Points

During the 10 exposures to high temperature, electrical continuity shall be checked. On completion of testing the heaters shall be subjected to standard atmospheric conditions for recovery for not less than 1 hour and not more than 2 hours. Resistance shall be measured as specified in Room Temperature Electrical Measurements in the Detail Specification.

#### 8.3 <u>OVERLOAD</u>

Overload shall be performed during Screening Tests on a sample of 5 components with the following details:

In the event of any failure a 100% inspection shall be performed.

#### Mounting

The heaters shall be suspended by their terminal leads in still air. Heaters shall be positioned such that one heater does not unduly influence the temperature of any other.

Test Conditions

The ambient temperature shall be between +15 and + 35 °C.

The heaters shall be tested with a power of 1.5 times the rated power as specified in the Detail Specification for a period of 1 minute minimum.

Each layer of double layer heaters shall be tested successively for the period specified. Resistors of multiple resistor single layer heaters shall be tested simultaneously.

#### Data Points

On completion of testing the heaters shall be subjected to standard atmospheric conditions for recovery for not less than 1 hour and not more than 2 hours. Resistance shall be measured as specified in Room Temperature Electrical Measurements in the Detail Specification.

#### 8.4 <u>BURN-IN</u>

Burn-in shall be performed in accordance with IEC Publication No. 115.1, Clause 4.25 with the following details:

#### Mounting

The heaters shall be suspended and connected by their terminal leads in still air. Heaters shall be positioned such that one heater does not unduly influence the temperature of any other.

Test Conditions

As specified in Burn-in in the Detail Specification.

The duration of the burn-in shall be 168 (+24-0) hours.

Each layer of double layer heaters shall be tested successively for 84 hours.

Resistors of multiple resistor single layer heaters shall be tested simultaneously.

The voltage (dc or full-wave rectified ac with ripple less than 5%) shall be increased until either rated power density or the maximum rated operating temperature, both as specified in the Detail Specification, are reached.

The voltage shall be in cycles of 1.5 hours "ON" and 0.5 hours "OFF" (The "OFF" cycles are included in the test duration).

Data Points

On completion of testing the heaters shall be subjected to standard atmospheric conditions for recovery for not less than 1 hour and not more than 2 hours. Resistance shall be measured as



### specified in Room Temperature Electrical Measurements in the Detail Specification.

### 8.5 EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK

External visual inspection shall be performed in accordance with ESCC Basic Specification No. 20500.

The heater surface shall be free of cuts or abrasion. The heaters shall not exhibit bubbles or delamination.

Dimension check (during Special In-Process Controls only) shall be performed in accordance with ESCC Basic Specification No. 20500 and the Detail Specification on a sample of 3 components. If a failure occurs the complete lot shall be checked.

#### 8.6 ROBUSTNESS OF TERMINATIONS

The heaters shall be subjected to Test 'Ua 1' of IEC Publication No. 68-2-21 with the following details:

- Test Conditions
   The strength and duration of the pull shall be as specified in the Detail Specification.
- Data Points
  - (a) During Special In-Process Controls: Not applicable.
  - (b) During Qualification and Periodic Tests: Resistance and Change in Resistance shall be measured as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification both before and after the test. Change in Resistance shall be related to the initial measurements.

## 8.7 <u>CLIMATIC SEQUENCE</u>

#### 8.7.1 Initial Measurements

The resistance shall be measured as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification.

#### 8.7.2 Dry Heat

The heaters shall be subjected to Test 'Ba' of IEC Publication No. 68-2-2 at the maximum storage temperature rating as specified in the Detail Specification for 2 hours.

On completion of testing the heaters shall be subjected to standard atmospheric conditions for recovery, for not less than 1 hour before being subjected to Damp Heat (first cycle).

#### 8.7.3 Damp Heat (Accelerated) First Cycle

The heaters, suspended by their terminal leads, shall be subjected to Test Db, Severity a, Variant 2, of IEC Publication No. 68-2-30, for one cycle of 24 hours. On completion of testing after recovery, the heaters shall be immediately subjected to the Cold Test.

#### 8.7.4 <u>Cold Test</u>

The heaters shall be subjected to Test 'Ad' of IEC Publication No. 68-2-1 at the minimum storage temperature rating as specified in the Detail Specification. After 1 hour of stabilisation at this temperature, the heaters shall be tested with rated power as specified in the Detail Specification, for 45 minutes.



Each layer of double layer heaters shall be tested successively for the period specified.

Resistors of multiple resistor single layer heaters shall be tested simultaneously.

On completion of testing the heaters shall be removed from the chamber and subjected to standard atmospheric conditions for recovery for not less than 4 hours before being subjected to Low Air Pressure.

## 8.7.5 Low Air Pressure

The heaters, operated with rated power as specified in the Detail Specification, shall be subjected to Test 'M' of IEC Publication No. 68-2-13, using a pressure of 20±1 mbar.

Each layer of double layer heaters shall be tested successively for the period specified.

Resistors of multiple resistor single layer heaters shall be tested simultaneously.

The test shall be performed at a temperature between +15 and + 35 °C.

The duration of the test shall be 1 hour.

On completion of testing the heaters shall immediately be subjected to Damp Heat (remaining cycles).

#### 8.7.6 Damp Heat (Accelerated) Remaining Cycles

The heaters, suspended by their terminal leads, shall be subjected to Test 'Db', Severity a, Variant 2, of IEC Publication No. 68-2-30 for 5 cycles of 24 hours.

On completion of testing the heaters shall be removed from the chamber and subjected to standard atmospheric conditions for recovery for  $30 \pm 5$  minutes before being subjected to DC Load.

#### 8.7.7 DC Load

The heaters suspended and connected by their terminal leads in still air shall be operated at rated power as specified in the Detail Specification for 1 minute.

Each layer of double layer heaters shall be tested successively for the period specified.

Resistors of multiple resistor single layer heaters shall be tested simultaneously.

On completion of testing the heaters shall be subjected to standard atmospheric conditions for recovery for not less than 1 hour and not more than 2 hours before being subjected to Final Measurements.

## 8.7.8 Final Measurements

Resistance, Change in Resistance, Insulation Resistance and Voltage Proof, shall be measured as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification. Change in Resistance shall be related to the initial measurements

#### 8.8 <u>OPERATING LIFE</u>

Operating Life shall be performed in accordance with the following details:

#### Mounting

The heaters shall be suspended and connected by their terminal leads in still air. Heaters shall be positioned such that one heater does not unduly influence the temperature of any other.

Test Conditions
 As specified in Operating Life in the Detail Specification
 The duration of Operating Life shall be 2000 ± 48 hours.



Each layer of double layer heaters shall be tested successively for  $1000 \pm 48$  ( $2000 \pm 48$  hours total). Resistors of multiple resistor single layer heaters shall be tested simultaneously.

The voltage (dc or full-wave rectified ac with ripple less than 5%) shall be increased until either rated power density or the maximum rated operating temperature, both as specified in the Detail Specification, are reached.

The voltage shall be in cycles of 1.5 hours "ON" and 0.5 hours "OFF" (The "OFF" cycles are included in the test duration).

## Data Points

As specified in Intermediate and End-Point Electrical Measurements in the Detail Specification at 0 hours, 1000±48 hours and 2000±48 hours.

If drift values are specified, the drift shall always be related to the 0-hour measurement.

At each data point the heaters shall be subjected to standard atmospheric conditions for recovery for not less than 1 hour and not more than 2 hours prior to electrical measurements.

After the 1000 hour measurement the heaters shall be returned to the test conditions. The interval between removal from and return to the test conditions for any heater shall not exceed 12 hours.

## 8.9 PERMANENCE OF MARKING

Permanence of Marking shall be performed in accordance with ESCC Basic Specification No. 24800

## 9. DATA DOCUMENTATION

#### 9.1 <u>GENERAL</u>

For the qualification, qualification maintenance and procurement for each lot a data documentation package shall exist in a printed or electronic form.

This package shall be compiled from:

- (a) Cover sheet (or sheets).
- (b) List of equipment (testing and measuring).
- (c) List of test references.
- (d) Special In-Process Controls data (Chart F2).
- (e) Screening Tests data (Chart F3).
- (f) Qualification and Periodic Tests data including Lot Validation Testing data (when applicable) (Chart F4)
- (g) Failed components list and failure analysis report (when applicable).
- (h) Certificate of Conformity.

Items (a) to (h) inclusive shall be grouped, preferably as subpackages and, for identification purposes, each page shall include the following information:

- ESCC Component Number.
- Manufacturer's name.
- Lot identification.
- Date of establishment of the document.
- Page number.

Whenever possible, documentation should preferably be supplied in electronic format suitable for reading using a compatible PC. The format supplied shall be legible, durable and indexed. The preferred storage media are 3 1/2 inch diskettes or CD-ROMs and the preferred file formats are ASCII or PDF.



#### 9.1.1 Qualification and Qualification Maintenance

In the case of qualification or qualification maintenance, the items listed in Para. 9.1(a) to (h) are required.

## 9.1.2 <u>Component Procurement and Delivery</u>

For all deliveries of components procured to this specification, the following documentation shall be supplied:

- (a) Cover sheet (if all of the information is not included on the Certificate of Conformity).
- (b) Certificate of Conformity.

## 9.1.3 Additional Documentation

The Manufacturer shall deliver additional documentation containing data and reports to the Orderer, if required in the Purchase Order.

## 9.1.4 Data Retention/Data Access

If not delivered, all data shall be retained by the Manufacturer for a minimum of 5 years during which time it shall be available for review, if requested, by the Orderer or the ESCC Executive (for qualified components).

## 9.2 <u>COVER SHEET(S)</u>

The cover sheet(s) of the data documentation package shall include as a minimum:

- (a) Reference to the Detail Specification, including issue and date.
- (b) Reference to the applicable ESCC Generic Specification, including issue and date.
- (c) ESCC Component Number and the Manufacturer's part type number.
- (d) Lot identification.
- (e) Number of the Purchase Order.
- (f) Information relative to any additions to this specification and/or the Detail Specification.
- (g) Manufacturer's name and address.
- (h) Location of the manufacturing plant.
- (i) Signature on behalf of Manufacturer.
- (j) Total number of pages of the data package.

## 9.3 LIST OF EQUIPMENT USED

A list of equipment used for tests and measurements shall be prepared, if not in accordance with the data given in the PID. Where applicable, this list shall contain inventory number, Manufacturer's type number, serial number, etc. This list shall indicate for which tests such equipment was used.

## 9.4 LIST OF TEST REFERENCES

This list shall include all Manufacturer's references or codes which are necessary to correlate the test data provided with the applicable tests specified in the tables of the Detail Specification.

#### 9.5 SPECIAL IN-PROCESS CONTROLS DATA (CHART F2)

A test result summary shall be compiled, showing the total number of components submitted to, and the total number rejected after each of the tests.



## 9.6 SCREENING TESTS DATA (CHART F3)

A test result summary shall be compiled showing the total number of components submitted to and the total number rejected after each of the tests.

## 9.7 QUALIFICATION AND PERIODIC TESTS DATA (CHART F4)

## 9.7.1 <u>Qualification Tests</u>

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

#### 9.7.2 Periodic Testing for Qualification Maintenance

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

In addition to the full test data a report shall be compiled for each subgroup of Chart F4 to act as the most recent Periodic Testing summary. These reports shall include a list of all tests performed in each subgroup, the ESCC Component Numbers and quantities of components tested, a statement confirming all the results were satisfactory, the date the tests were performed and a reference to the full test data.

#### 9.7.3 Lot Validation Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup (as applicable). Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

#### 9.8 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

The failed components list and failure analysis report, shall provide full details of:

- (a) The reference and description of the test or measurement performed as defined in this specification and/or the Detail Specification during Special In-Process Controls, Screening Tests and Qualification and Periodic Tests.
- (b) The serial number (if applicable) of the failed component.
- (c) The failed parameter and the failure mode of the component.
- (d) Detailed failure analysis (If requested by the ESCC Executive or Orderer).

## 9.9 <u>CERTIFICATE OF CONFORMITY</u>

A Certificate of Conformity shall be established as defined in ESCC Basic Specification No. 20100.

## 10. <u>DELIVERY</u>

For procurement, for each order, the items forming the delivery are:



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- (a) The delivery lot.
- (b) The components used for Lot Validation Testing (when applicable), but not forming part of the delivery lot.
- (c) The relevant documentation in accordance with the requirements of Section 9.

In the case of a component for which a valid qualification is in force, all data of all components submitted to Lot Validation Testing shall also be copied, when requested, to the ESCC Executive.

For qualification or qualification maintenance, the disposition of the test lot and its related documentation shall be as specified in ESCC Basic Specification No. 20100 and the relevant paragraphs of Section 9 of this specification.

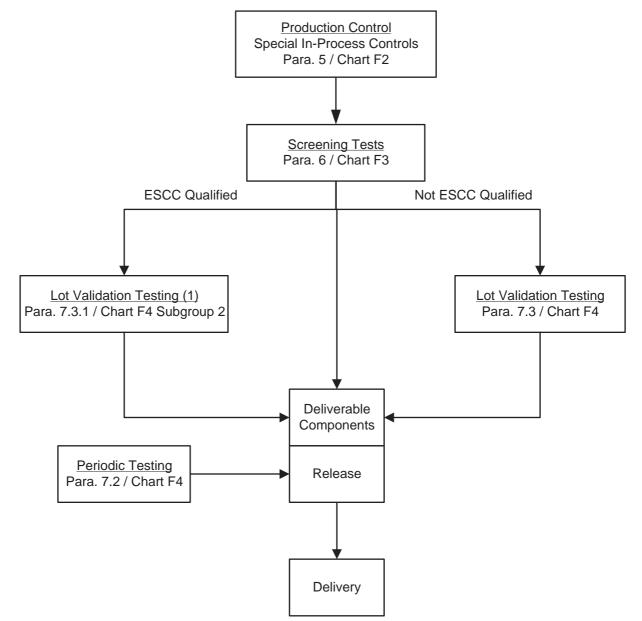
## 11. PACKAGING AND DISPATCH

The packaging and dispatch of components to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 20600.



## 12. <u>CHARTS</u>

## 12.1 CHART F1 - GENERAL FLOW FOR PROCUREMENT

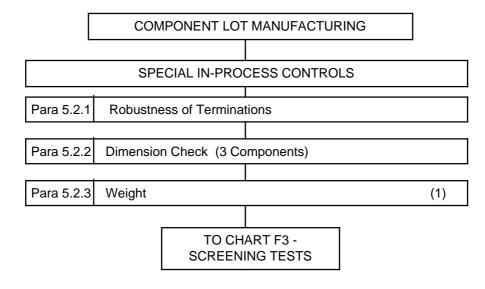


## NOTES:

1. Lot Validation Testing is optional for qualified components and shall only be performed if required in the Purchase Order.



## 12.2 CHART F2 - PRODUCTION CONTROL



## NOTES:

1. Guaranteed but not tested.



## 12.3 CHART F3 - SCREENING TESTS

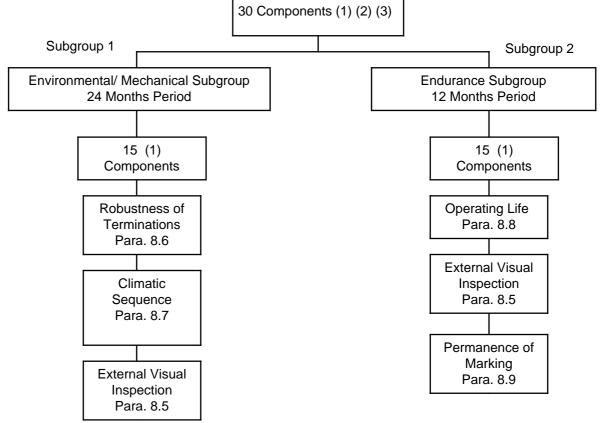
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Rapid Change of Temperature	2	
•		
Overload (5 Components)		
Burn-in		(2)
-		
High and Low Temperatures E	Electrical Measurements (3 Components)	(2)
•		
Room Temperatures Electrica	I Measurements	(2)
•		
Check for Lot Failure		(3)
External Visual Inspection		
TO CHART F4 WH	IEN APPLICABLE	
	Room Temperature Electrical Rapid Change of Temperature Overload (5 Components) Burn-in High and Low Temperatures E Room Temperatures Electrica Check for Lot Failure External Visual Inspection	Burn-in High and Low Temperatures Electrical Measurements (3 Components) Room Temperatures Electrical Measurements Check for Lot Failure

## NOTES:

- 1. Optional at the manufacturer's discretion.
- 2. The lot failure criteria of Para. 6.4.1 apply to this test.
- 3. Check for Lot Failure shall take into account all electrical parameter failures that may occur during Screening Tests in accordance with Para. 8.4, 8.1.2 and 8.1.3 following completion of burn-in testing.



## 12.4 CHART F4 - QUALIFICATION AND PERIODIC TESTS



## NOTES:

- 1. For distribution within the subgroups, see Para. 7.1.2.
- 2. No failures are permitted.
- 3. All components shall be serialised prior to testing.

APPENDIX 2

ARK-UP Showing all changes

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Pages 1 to 28

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# RESISTORS, HEATERS, FLEXIBLE

ESCC Generic Specification No. 4009 2 ISSUE X, DRAFT 'B', <del>JANUARY 2002</del>



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ESCC Generic Specification No. 4009



PAGE 2

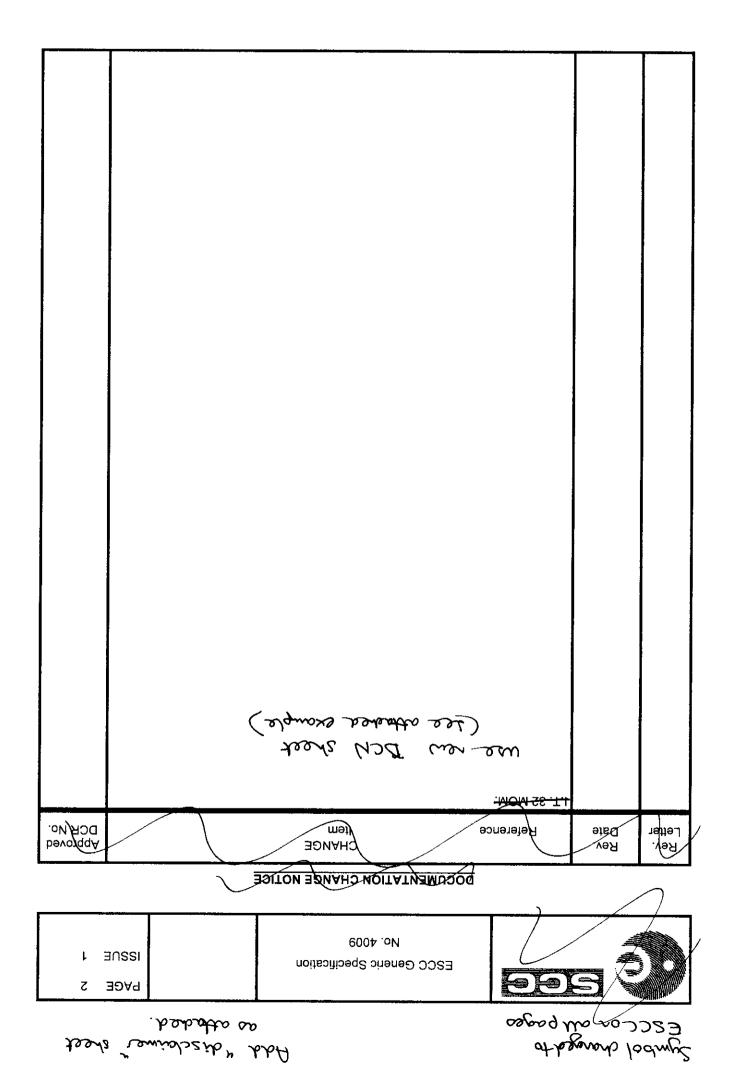
LEGAL DISCLAIMER AND COPYRIGHT

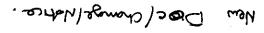
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ESCC Generic Specification No. 4009



ISSUE 2 - DRAFT C

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## DOCUMENTATION CHANGE NOTICE

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

Specification upissued to incorports editorial and technical changes por Del	<b>J</b> BT
CHANGE DESCRIPTION	DCK Nº

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## 1. INTRODUCTION

## 11 SCOPE

This specification defines the general requirements for the qualification approval, qualification maintenance, procurement, <del>def-validation</del> and delivery of Resistors, Heaters, Flexible for space applications.

This specification contains the appropriate inspection and test schedules and also specifies the data documentation requirements.

#### 1.2 APPLICABILITY

This specification is primarily applicable to the granting of qualification approval to a component in accordance with ESCC Basic Specification No. 20100 and the procurement of such components from qualified Manufacturers. It way also be applied for procurement of such a component in components.

## 2. APPLICABLE DOCUMENTS

The following documents form part of, and shall be read in conjunction with, this specification. The relevant issues shall be those in effect on the date of starting the qualification or placing the Burchase Order.

## 2.1 ESCC SPECIFICATIONS

No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.

No. 20500, External Visual Inspection.

No. 20600, Preservation, Packaging and Despatch of ESCC Electronic Components.

No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.

No. 21700, General Requirements for the Marking of ESCC Components.

No. 22800, ESCC Non-conformance Control System.

No. 23500, Lead Materials and Finishes for Components for Space Application.

No. 24600, Minimum Quality System Requirements.

No. 24800, Resistance to Solvents of Marking, Materials and Finishes.

For qualification and qualification of ESCC Basic Specifications Nos. 20100, 21700, 22800 and 24600, where Waith the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800 and 24600, where Manufacturers' specifications are equivalent to, or more stringent than, the ESCC Basic Specifications

Manufacturers' specifications are equivalent to, or more stringent than, the ESCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the ESCC Executive. (910)

Such replacements shall be clearly identified in the applicable Process Identification Document (P.I.D.) and listed in an appondix to the appropriate Detail Specification.

Unless otherwise stated herein, references within the text of this specification to "the Detail Specification.

2.2 OTHER (REFERENCE) DOCUMENTS REPOS, ESCC Qualified Parts List

ECSS-Q-70-02, X Thermal Vacuum Test for the Screening of Space Materials.

IEC Publication No. 68, Basic Environmental Testing Procedures.

IEC Publication No. 115, Fixed Resistors for Use in Electronic Equipment.

-HEC Publication No. 419, Sampling Plans and Procedures for Inspection by Attributos.

For procurement of unqualified components, where Manufacturers' specifications are equivalent to or more stringent than the applicable ESCC Basic Specifications listed above, they may be used in place of the latter subject to the approval of the Orderer.

Such replacements may be listed in an appendix to the appropriate Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

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The ESCC Executive <del>(for qualification approval or for a procuroment)</del> reserves the right of the tests and inspections scheduled in the applicable specifications.	
4.1.4 Inspection Rights	
The Manufacturer shall be responsible for the performance of tests and inspections r manufacturer of the components unless it is agreed by the ESCC Executive prior the Manufacturer of the components unless it is agreed by the ESCC Executive prior to the manufacturer of the components unless it is agreed by the test.	
4.1.3 Manufacturer's Responsibility for Performance of Tests and Inspections	
The conditions and methods of test shall be in accordance with this specification, th Specifications referenced herein and the Detail Specification.	
4.1.2 Conditions and Methods of Test	
ארינו <u>בארטאוטטוי</u> אראנאלע אראטאל אין אינא דעראלי אראטאל אינאעראין איז איז אינא געראאין איז איז ארינאטע אראטא איז א דסר קטאנא אונא לאיג געפאעאל, ארטטטרופשפת <del>(ארטעאל)</del> אראעאלאסא נסלאן unless otherwise specification, the specifications listed in Section 2 of this documen total unless otherwise specified herein or in the Detail Specification.	
4.1.1 Specifications and an	
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The test requirements for procurement of components shall comprise Screening Tests ( ديم ر test et all components ( ديم ر test of the with the vertice to the sting for unqualified components ( ديم ر	
The test requirements for component type qualification approved of a component Creening lests (coe Chart F2) and Qualification Testing (coe Chart F3), 2 (co control for the	
4.1 GENERAL Component Type Special In-Process	
4. REQUIREMENTS	
The terms, definitions, abbreviations, symbols and units specified in ESCC Basi No. 21300 shall apply.	
3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS	
<ul><li>(a) Other documents, if referenced herein.</li></ul>	
(c) ESCC Basic Specification.	
(b) ESCC Generic Specification.	
(a) ESCC Detail Specification.	
order of precedence shall apply:-	
For the purpose of interpretation and in case of conflict with regard to documentation	

ESCC Generic Specification

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4.4 MARKING

All components procured and delivered to this specification from a source qualified according to EGC Basic Specification No. 20100 shall be marked in accordance with ESCC Basic Specification No. 21700, and the Detail Specification. Thus, they ahall bear the ESC Basic Specification eonformance to this specification and the Detail Specification.

hotify the ESCC Executive who will define a course of action to be followed. No further testing that be

Components produced from sources which are not ESCC qualified, provided that they fully comply with the procurement requirements of this specification and the Detail Specification, may bear the ESCC harking with the exception of the ESA symbol.

Replacement for Para 4.3.1 2nd to 5th 2mb-para's:

Should such failure occur during qualification, qualification maintenance or procurement of qualified components the manufacturer shall initiate the non-conformance procedure in accordance with ESCC Basic Specification N. 22800. The manufacturer shall notify the Orderer and the ESCC Executive by any appropriate written means, within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing shall be performed on the failed components.

Should such failure occur during procurement of unqualified components the manufacturer shall notify the orderer by any appropriate written means within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing days of receipt of notification what action shall be taken. The Orderer shall inform the manufacturer within 5 working days of receipt of notification what action shall be taken.

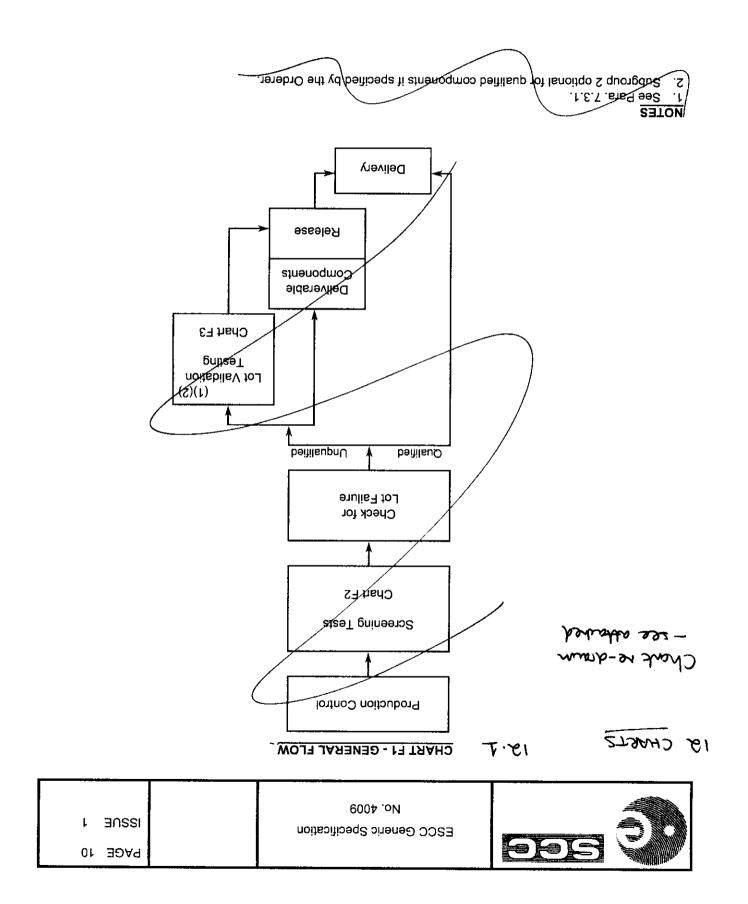
Para 4.5.1 replaces Para 4.1.60:

Tenning Leads Requirements

Wine weed for terninal leads shall be an specified in the applicable une ESCC Detail Specification as referenced in the Reater ESCC Detail Specification. The unnes shall be ESCC Bunkified as avidenced by a hethod in the current ESCC Qualified Ponto List REPOOS.

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	-SSDE ni beniltuo se str	components specified herein shall meet the outgassing requiremen	
		Specific requirements for materials and finishes are specified in the	"
		GENERAL	2°1 2'1
tnemusoa no	the Process Identificatio	רעבועקב. The minimum requirements for production control are defined in t (אינים.): בענש)	
			5.2
<del>ui peiliseq</del>	ectiped pelow shall be	Where <u>applicable</u> , <u>additional special in-process controls to those d</u> the <u>Detail Specification</u> .	
		Robustness of Terminations	5.2.1
		-All flexible heaters may be subjected to Test 'Uat' of IEC Publics -duration of the pull forces are given in the Detail Specification.	
		In accordance with Park 8.6 and the Detail 5 peci Dimension Check With Park. 8.5	5.2.2
<del>pounonoq o</del> (	erak specification. Tot	In accordance <del>with ESCC Basic Specification No. 20500 and the D</del> on 3 samples only.	
		It a failure occurs, the complete lot shall be checked.	
tud haatneis	un ad liede noiteoitioog	<u>Weight</u> The maximum weight of the components specified in the Detail S	5.2.3
100 000000		not tested.	
оf Рага. 9.5	e with the requirements	Documentation Documentation of Special In-Brocess Controls shall be in accordanc of this specification and shall be supplied if specified in the Purchas	5.2.4
	.10510-0		
<u> </u>			
ient Por	anetreocA noiteoitioec	l or finish is not specified a material or finish shall be used so as to the performance requirements of this specification and the Detail St of any constituent material or finish does not guarantee acceptance	
	sed for qualification and to tests and inspections	erwise specified in the Detail Specification all lots of components us on maintenance, Lot Validation Testing and for delivery shall be subject ince with Chart F2, The applicable test requirements are detailed in the 2.	Unless oth qualificatio in accorda
			······
		oonents which do not meet these requirements shall be removed fron submitted to the requirements of this specification	I WUX COMI

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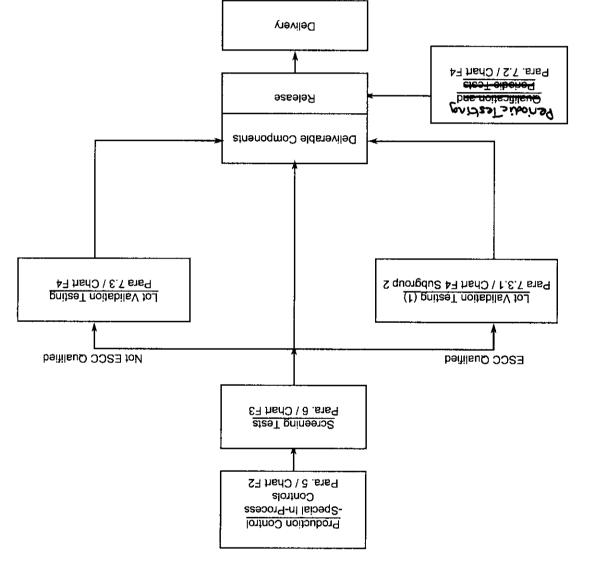
ESCC Generic Specification No. 4009

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## 12. CHARTS

## 12.1 CHARTEN - GENERAL FLOW FOR PROCINCEMENT



:S3TON

 Lot Validation Testing is optional for qualified components and shall only be performed if required in the Purchase Order.

PAGE 11	ESCC Generic Specification No. 4009	ĐĐS	Î
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#### 6. SCREENING TESTS

#### 6.1 GENERAL

## and guarification maint gromes

Unless otherwise specified in the Detail Specification, all components used for qualification teeping, by Validation Testing and for delivery, shall be subjected to tests and inspections in accordance with Chart MS F3

#### 

Unless otherwise specified in the Detail Specification, the tests shall be performed in the order shown.

Any components that do not meet these requirements shall be removed from the lot and at no future time be re-submitted to the requirements of this specification.

The applicable test methods and conditions are specified in the paragraphs referenced in Chart 😿 FS

#### 6.2 FAILURE CRITERIA

#### 6.2.1 Parameter Limit Failure

A component shall be counted as a limit failure if one or more parameters exceed the limits shown in Electrical Measurements at Room, High and Low Temperatures in the Detail Specification.

Any component which exhibits a limit failure prior to submission to burn-in shall be rejected and not counted when determining lot rejection.

#### 6.2.2 Other Failures

A component shall be counted as a failure in any of the following cases:

- Mechanical failure. ~ Visnor inspection foilme
- Handling failure.
- Lost component.

#### 6.3 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 6.2 <del>af this specification</del>.

#### 6.4 LOT FAILURE

In the case of lot failure, the Manufacturer shall act in accordance with the requirements of Para. 4.3.1 of this specification.

#### EnitseT %001 purine during 100% Testing

ال the number of components failed on the basis of the failure criteria described in Para. 6.2.1 exceeds 5% (rounded upwards to the nearest whole number) of the number of components submitted to the 5% (rounded upwards to the nearest whole number) of the number of components submitted to the basis of the number of components submitted to the basis of the number of components submitted to the failure criteria described in Para. 6.2.1 exceeds 5% (rounded upwards to the nearest whole number) of the number of components submitted to the basis of the number of components submitted to the failure criteria described in Para. 6.2.1 exceeds 5% (rounded upwards to the nearest whole number) of the number of components submitted to the the basis of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of components submitted to the text of the number of text of the number of the number of text of the number of the number of text of t

It a lot is composed of groups of components of one tamily defined in one ESCC Detail Specification, but separately identifiable for any reason, then the lot failure criteria shall apply separately to each identifiable group.

	in the qualification test report.
testing and the justification for the selection shall be declared	brior to the commencement of qualification
v, but in any case shall be agreed with, the ESCC Executive,	The component types may be specified by
Diversion then the Present the Present the Manual Contents the	shall be performed on the procured lot in the procured iot in the procured iot in
odic testing and the test requirements of Para. 7.1 shall apply.	Compower the conditions is maintained through perion n For each subgroup, test periodisity is given n The conditions governing qualitication n
(Shitzsterdie 7552) 32 Annu (Shitzstudie)	VOITADIALA OUALIFICATION
·	
	The acleated distribution shall be agreed
e with seperate outputs.	- 1/3 of the lot of the double layer typ
tive density (10 to 30 Ohms/cm²).	following provisions:
	10t Swall as composed - 1/3 of the lot with the maximum resi
	Le ·
	The gradit frattion test the distribution the catton for the second seco
	2.1.2 Distribution within motivatives 2.1.7
عد esting are given in ESCC Basic Specification No. 20100.	on conditions governingjqualification فرمهمهم کلم کرکتان
	ni staat of the subjected to all of the paragra requirements are detailed in the paragra
איאל ואזף לאטאא דע דע אחרפ שולה להפרור פרגי סל Chart F3. The tests of Chart F3 (Screening Tests). This sample constitutes the qualification F2 (Screening Tests). This sample constitutes the qualification	shall be performed on the specified
senoused phorto the tests	
TESTING TESTING	7.1 COMPONENT TYPE QUALIFICATION
applicable to the tests performed for <del>dovice</del> qualification and ot validation <del>of non-qualified components</del> .	Requirements of this paragraph are a qualification maintenance and also for l
ION TEETE TESTING COMPONENTE TIPE	مهداج، معدي معدي معدي معدي معدي معدي معدي معدي
	. <del>this specification</del> .
of tear strail be in accordance with Para. 9.6 of	Adda bocumentation of burnentation of burnentation
27257.0	6.5 DOCUMENTATION
if the number of allowable failures during sample testing <del>in.</del> avel th of IEC Publication No. 410 and the applicable AQ4 as perceded. may be performed but the cumulative <del>P.D.A</del> . shall not exceed	<del>عددوراعمده سنام General Arspection Line وماهدها المجهودية العا</del> مرابع المحمد محر
	2.4.3 Lot Failure during Sample 2.4.9
6007 °N	
eneric Specification	FROM FROM FROM FROM FROM FROM FROM FROM
PAGE 12	

PAGE 13 ESCC Generic Specification No. 4009	
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Distribution within the Sample for Lot Validation Testing S.S.7

arities of the procured range or series. selected that they adequately represent all of the various mechanical, structural and electrical peculiare procured together. The sample for lot validation festing shall be comprised of component types so then it is only necessary to perform lot Validation on representative types if a number of different types Where a Detail Specification covers a range, of series, of components that are considered similar,

ROWARD be as appointed by the Presurer in the Purchase Order. The distribution of the component types will normally vary from procurement to procurement and shall

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not form part of the delivery lot. The tests termination are considered to be destructive and therefore components so tested shall

, guartification mainterance

FAILURE CRITERIA

The following criteria shall apply to usinification reating and to validation festing.

- Environmental and Mechanical Test Failures 172
- The following shall be counted as component failures:

+= + Charle F-

- robustness of terminations, etc. Components which fail, tests for which the pass/fail criteria are inherent in the test method, e.g.
- Electrical Failures 2.4.7

#### -testinwing shall be counted as component failures:-

- tests, in accordance with either Electrical Measurements at Room Temperature or Measurements. (a) Companents which, when subjected to electrical measurementation of environmental
- Specification, fail opte or more of the applicable limits. during lendurance testing, in accordance with Measurements and Inspections in the Detail (b) Compohents which, when subjected to electrical measurements at intermediate and endpoints
- tsimi/eldspilde ef the applicable/jimits. with Electrical Measurements at Room, Migh and Low Temperatures in the Detail Specification, (c) Compdnents which, when subjected to measurement of electrical pharacteristics, in accordance

Components failing to comply with the requirements of ESCC Basic/Specification Nd. 20500.

Other Failures

## FAILED COMPONENTS

Jeest comportents

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in

Para. 7.4 <del>at this apecification</del> (for gradification, gradification mainternate of anguate the mainternate of anguation (for gradification), gradification and the Creter failure analysis of tailed components shall be performed by the Manufacturer and the results provided. (for procreation of any the Manufacturer and the results provided. (for procreation of any the Manufacturer and the results provided. (for procreation of any the Manufacturer and the results provided. (for procreation of any the Manufacturer and the results provided. (for procreation of any the Manufacturer and the results provided. (for procreation of any the Manufacturer and the results provided.

qualification or procurement lot has been agreed and certified. Failed components lenit litru ting a stute the Manutacturer's plant until lenit strenges the

- £.4.7
- (q) The following additional failures may also occur during qualification testing or lot validation testing

¥.7

**6**.7

Replacement Rans 7.4.2, 7.4.3

#### Electrical Failures S.4.7

The following shall be counted as component failures:

Measurements and Inspections in the Detail Specification. for environmental, mechanical and endurance testing in Intermediate and End-point Electrical Components which tail one or more of the applicable limits at each of the relevant data points specified

#### <u>Other Failures</u> 243

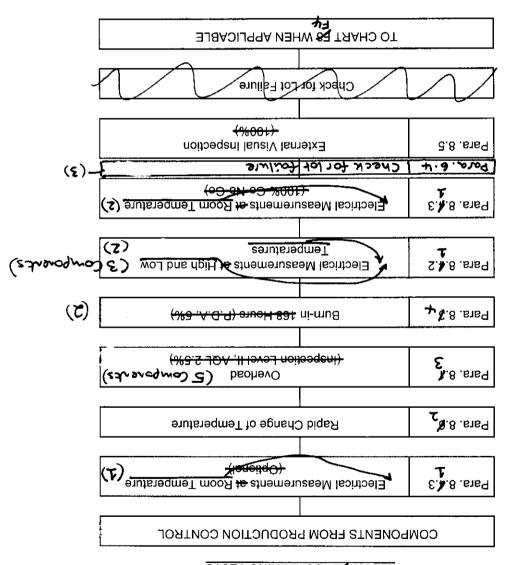
. A component shall be counted as a failure in any of the following cases:

- Visual Inspection failure -
- Mechanical failure \_
- enuliet gnilbneH
- Lost component

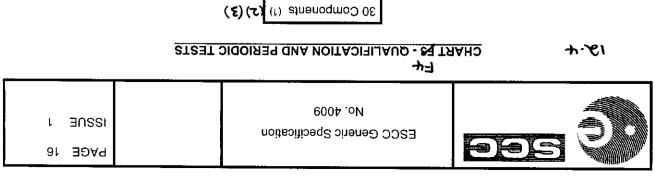
re and hat bet dation to a share to share	tota	attor of Quality. ance whe Pan of lishs signation	ing, the accord i ای محدمدم ing, the pagificati	OCUMENTATION	
ne component in bed on the criteria	i balist as tailed if o sed fnanoqmoo balis	افدوط هد الافريسيده افتاق عند الما المالي المالية المالية بالما المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية المالية الم مالية المالية المالية مالية مالية مالي مالية مالية ماليية مالية مالية مالية مالية مالية مالية مالية مالية ماليية	based on the crite <del>riqualified compon</del> t <del>he Ordere</del> r for <b>l</b> ot	or qualification the I a failed component or procurement <del>of ur</del> ny test specified <del>by t</del> iven in Para. 7.4.	ai Si Si Si Si Si Si Si Si Si Si Si Si Si
PAGE 14		eneric Specification No. 4009		ðes	

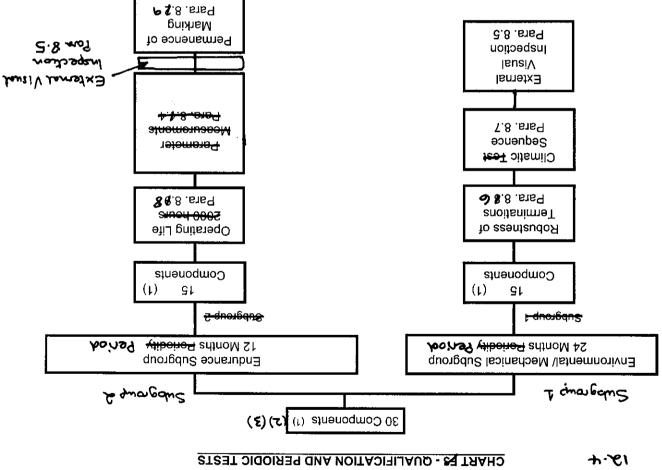
7.7.2 Periodic and Lot Validation Testing, the data shall be documented in accordance with the requiremented in accordance with the requirements of Para. 9.8 of this specification.

8 4	ОМРОИЕИТS FROM PRODUCTION CONTROL	co
	F3 CHART B2 - SCREENING TESTS	ह.क्ष
⊧ ∃∩ssi	ESCC Generic Specification No. 4009	
PAGE 15		



1. The lot the manufastives discretion 3. The lot tailine enterior of Gas. 6.4.1 applig to this took 3. Check for Lot Failure shall take into account all clectrical Barmater for that may occur during Earening Tests in accordance mill Park. 8.1.2, 19.1000 and completion of Bum-in Testing.





NOTES

1. For distribution within the subgroups, see Para. 7.1.2.

2. No failure ane permitted

3. All components shall be serialised prior to tooking.

	)	า	
		For components undergoing a total burn-in of 168 hours, the data point for po measurements shall be 168 (+24-0).	In-in electrical
smos		The conditions for burn-in shall be as specified in Burn-in in the Detail Specification	
hatto 296	eq	single layer heaters shall be tested similtaneously.	
lana ketan		The test shall be conducted in accordance with IEC Publication No. 115-1, Claus of double layer heaters shall be tested successfully for 84 hours. Resistors	25. Each layer 25. Each layer
		The method for mounting heaters and the test set-up shall be <del>as specified in Pare</del>	. <del>(ə) bna (d) (</del>
	£.8	An accordance with ESCC Basic Specification No. 24800. حکومی می می از ای کاری کاری کاری کاری کاری کاری کاری ک	
	S.8	PERMANENCE OF MARKING	
		After a recovery period not leas than 1 hour and not more than 2 hours the measured. <del>The change in resistance compared to the value measured in exceed the value prescribed in Electrical Measurements at Room Tempe Opeolification.</del>	ten libre svedt
	8	(c) Recovery and Final Measurements	
		The <del>flexible</del> heaters shall be tested with a power of 1.5 times the rated pow minute minim	r a period of 1
		(b) Test Conditions	
		. <mark>1,1,1,8 .≘re</mark> 9 ni beilioeqa as borussem od llarla censision od∓	
		- <del>stnomeruscoM-lcitint- (c)</del>	
		The following requirements shall apply:-	
chendrome Jaelendrani	2.1.8	Procedure	
Some		Resistors of multiple resistor heaters shall be tested simultaneously, <del>unless off</del> <del>the Orderer</del> .	<del>(q poijisods es</del>
Reformated beread		The ambient temperature shall be between +15 and +35 °C. Each layer of double layer heaters shall be tested <del>separately</del> , <del>each</del> for t hereunder.	pəyicəds <del>səmi</del>
low		The flexible heaters shall be suspended by their terminal leads in still air <del>with. than that caused by the heat of the flexible heaters being operated</del> .	i <del>shto noitoluoti</del>
	r.r.8	pritruoM	
	۲.8		
		ر <del>جابع دامها وه دامها ان جابه Deficed instead off ni boñiceds ad lists epaces of t</del>	
	*	Peermentation supporting the change shall be approved by the ESCC Excentive.	<del>fq pəujeter pur</del>
		If a Manufacturer elects to eliminate or modify a test method or procedure, the responsible for delivering components that meet all of the performance, q requirements defined in this specification and the Detail Specification.	ر and reliabilit
	.8	TEST METHODS AND PROCEDURES	
		6007 °N	I BURSI
ituoex31	ле: Ас	ESCC Generic Specification	
puədde	C ert of xi	it beithers be group of the construction of the Manufacturer or Orderer. The change may be specified in the component of the specification of the specificat	
		Detail Specification and in the PID."	
pλ (μe	utostunsM Wanufactu	omponent, documentation supporting the change shall be approved by the ESCC Executive. uren it shall be copied, when requested, to the ESCC Executive. The change shall be specifi	90 ergiued
	ee beitilen	T 0.001 - 44 - 44 is strate of llode seconds of the theory is notice the muscle intervention	

# S.1.8, 1.1.8, I.8 mag behand and betamod of

#### £.8 <u>OVERLOAD</u>

:slisteb Overload shall be performed during Screening Tests on a sample of 5 components with the following

In the event of any failure a 100% inspection shall be performed.

- 6ujjunoM \_
- that one heater does not unduly influence the temperature of any other. The heaters shall be suspended by their terminal leads in still air. Heaters shall be positioned such
- **Test Conditions**

The ambient temperature shall be between +15 and + 35 °C.

Specification for a period of 1 minute minimum. The heaters shall be tested with a power of 1.5 times the rated power as specified in the Detail

multiple resistor single layer heaters shall be tested simultaneously. Each layer of double layer heaters shall be tested successively for the period specified. Resistors of

specified in Room Temperature Electrical Measurements in the Detail Specification. recovery for not less than 1 hour and not more than 2 hours. Resistance shall be measured as On completion of testing the heaters shall be subjected to standard atmospheric conditions for strio9 steQ

# Reformated and amended Pare 8.3

#### BURN-IN

4.8

:slietep Burn-in shall be performed in accordance with IEC Publication No. 115.1, Clause 4.25 with the following

- 6ununoM
- positioned such that one heater does not unduly influence the temperature of any other. The heaters shall be suspended and connected by their terminal leads in still air. Heaters shall be
- **Rest Conditions**

The duration of the burn-in shall be 168 (+24-0) hours. As specified in Burn-in in the Detail Specification.

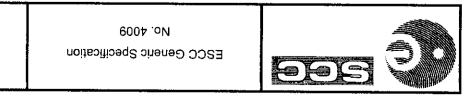
Each layer of double layer heaters shall be tested successively for 84 hours.

power density or the maximum rated operating temperature, both as specified in the Detail The voltage (dc or full-wave rectified ac with ripple less than 5%) shall be increased until either rated Resistors of multiple resistor single layer heaters shall be tested simultaneously.

in the test duration). The voltage shall be in cycles of 1.5 hours "NO" and 0.5 hours "OFF" cycles are included Specification, are reached.

striio**9** steO

specified in Room Temperature Electrical Measurements in the Detail Specification. recovery for not less than 1 hour and not more than 2 hours. Resistance shall be measured as On completion of testing the heaters shall be subjected to standard atmospheric conditions for



## 8.#1 ELECTRICAL MEASUREMENTS

#### 1.4.8 1.4.8 1.4.8

Electrical measurements and methods shall be as follows.

## 8.4.1.1 Resistance

Measurement of resistance shall be made by using a direct voltage of small magnitude for as short a time as practicable so that the temperature does not rise appreciably during measurement.

**JUSSI** 

PAGE 18

The resistance of terminal leads attached to the flexible heaters shall be calculated and subjitracted from the actual measurement. The terminal lead resistance shall be calculated from data found in the applicable wire and cable Generic and Detail Generic and from data found in the applicable wire and cable Generica and the flexible from the actual measurements, the flexible heaters and the whole length of their terminal leads shall be placed inside the temperature chamber. In this case, the terminal lead resistance, adjusted for temperature coefficient resistance, shall be subjitracted from the actual adjusted for temperature coefficient resistance, shall be subjitracted from the actual measurement.

In the event of conflicting results, attributable to even test voltages, the voltage specified in the following table shall be used for reference purposes.

£	6666	ot	1000
ŀ	666	ot	001
6.0	66	oţ	01
(1 etoV) 1.0	01 0	redt a	səj
egstring Voltage V((01-0+)√ ▲	Rated Resistance (R <sub>n</sub> ) (Ω)		

NOTES

1. The accuracy of the measuring equipment shall be such that the error does not exceed 10% of the tolerance. Where the measurement forms part of a test sequence, it shall be possible to measure a change in resistance with an error not exceeding 10% of the maximum change permitted for that test. The resistance exceeding 10% of the maximum change permitted for that test. The resistance firmits at +22 ±3 °C are given in Electrical Measurements at Room Temperature in the Detail Specification.

5.1.2 Insulation Resistance

pnitnuoM - <del>P.S.1.P.8</del>

The flexible heaters shall be clamped between 2 conducting plates connected together.

-:1.1.4.8.5.15 ni beniced as specificade se benezem ed liede considered ed.T-	٦	some chraniteration
Puiner Measurements	<del>- 1.3.8</del>	200 attached
APID CHANGE OF TEMPERATURE	7,58)	kstemofel
In accordance with ESCC Basic Specification No. 20500. The heater surfaces shall be free of cuts or eater surfaces shall be tree of cuts or exhibit bubbles or delamination.	٨ı	- see atter
At each of the relevant data points specified for environmental, mechanical and ondurance testing, messurements shall be made of all parameters listed in Messurements and Inspections in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated, if required. Specification and Recorded against serial numbers and the standard for the feelower and specificate feelower an specificat	<u>7.8</u>	
Parameter Measurements Intremediate and End. Point Electrical Measurements	<b>₽.1</b> .8	
Electrical measurements of toom Temperature shall be made in accordance with Electrical Electrical measurements of teat		
Electrical measurements at trigh and low Temperatures shall be made in accordance with Electrical performent of High and Low Temperatures in the Detail Specification. Measure were shark be performed. It also that he event of any be to made in accordance with Electrical performent of the event of any be a sample of a sector of a sample of a	£. <b>₽</b> .8	
Electrical Measurements et High and Low Temperatures	<b>₹</b> . 1.8	
A voltage as specified in Electrical Measurements at Room Temperature in the Detail Specification shall be applied for a period of 60 ± 5 seconds between all terminations of the heater connected together as one pole and the mounting device as the other pole; for heater connected together as one pole and the mounting device as the other pole; for heater connected together as one pole and the measurement shall also be performed to be the pole; for heater connected together as one pole and the mounting device as the other pole; for heater connected together as one pole and the mounting device as the other pole; for heater connected together as one pole and the mounting device as the other pole; for heater connected together as one pole and the mounting device as the other pole; for the measurement shall also be performed together as one pole and the mounting device as the other pole; for the measurement of a performed together as a non-pole. The voltage shall be applied gradually at a rate of approximately to form one pole. The voltage shall be applied gradually at a rate of approximately to form one pole.		
The <del>floxible</del> heaters shall be clamped between 2 conducting plates connected together.		
The voltage shall be applied for 1 minute or such shorter time as is necessary to obtain a stable reading. The insulation resistance shall be read at the end of that period and shall not be less than that prescribed in the Detail Specification.		
8.4.1.2.2 - Procedure Test Condictions The insulation resistance shall be measured with a direct voltage of 500 ± 50V. The measurement shall be performed between all terminations of the heater connected together as one pole and the mounting device as the other pole; for heaters with more than one resistor, the measurement shall also be performed between each resistor, with each resistor having both terminations connected together to form one pole.		
ESCC Generic Specification ISSUE 19 No. 4009		

Inchuked

Rewritten Par 8.5:

#### EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK

External visual inspection shall be performed in accordance with ESCC Basic Specification No. 20500. The heater surface shall be free of cuts or abrasion. The heaters shall not exhibit bubbles or

delamination.

Dimension check (during Special In-Process Controls only) shall be performed in accordance with ESCC Basic Specification No. 20500 and the Detail Specification on a sample of 3 components. If a failure occurs the complete lot shall be checked.

Reformates and amandes Para 8.6, 8.6.1, 8.6.2,8.6.3

## **EXPLID CHANGE OF TEMPERATURE**

The heaters shall be subjected to Test 'Na' of IEC Publication No. 68-2-14 with the following details:

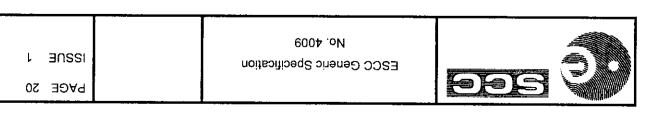
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- **Test Conditions** ----The heaters shall be suspended by their terminal leads in still air.
- the Detail Specification shall be 15 minutes each. The number of cycles shall be 10. The duration of exposure at the maximum and minimum storage temperature ratings as specified in
- During the 10 exposures to high temperature, electrical continuity shall be checked. On completion strio9 steO

Temperature Electrical Measurements in the Detail Specification. than 1 hour and not more than 2 hours. Resistance shall be measured as specified in Room of testing the heaters shall be subjected to standard atmospheric conditions for recovery for not less

2.8



Procedure and Recevery **S.**6.8

Specification shall be 15 minutes. at each of the storage temperature extremes given in Maximum Ratings in the Detail Publication No. 68-2-14 for the number of cycles specified hereunder. The duration of exposure The flexible flexible flexible to Test to Their terminal leads and submitted to Test 'Na' of IEC

less than't hour and not frore than 2 hours. The flexible heaters shall then remain under standard atmospheric conditions for recovery for not

contivuity shall be checked. The number of sycles shall be 10. During the 10 exposures to high temperature, electrical

SINAMOUNSESM IGNIT 5.9.8

Specification. and Inspections in the Detail The resistance shall be measured.[T<del>he eherge in n</del> العنيه. 3.6.1 shall not exceed the الطنية preserved in prinseem enjer ett et polodmos eeustoiset ui eg

**CLIMATIC SEQUENCE** Τ.8

S.7.8

1.7.8

in the Detail Specification. The resistance shall be measured as specified in <del>Pare. 8.4.1.1</del>. Internedi ate and Erd. Point Electrical Measurements Initial Measurements

The flexible heaters shall be subjected to Test 'Ba' of IEC Publication No. 68-2-2 at the upper Specification Freder + 1 hold is a porter entre of the report munitary at Dry Heat

conditions for recovery, for not less than I hour. Datans sawy subjected to Dame Heek (first wele). estegory temperature for 2 hours, taking into account the following deviation:-الم دوس ولولايم مود دوم الم الموالموسورات عالي الموداد والمسابل والمسابل والمالي المالي ومالفانواند. الم المعلمان المعلمين مود دومة المسابل والمسابل والمسابل والمسابل والمسابل ومالمونون

Damp Heat (Accelerated) First Cycle £.7.8

heaters shall be immediately subjected to the Cold Test. a, Variant 2, of IEC Publication No. 68-2-30, for one cycle of 24 hours. After recovery, the flexible The flexible heaters, suspended by their terminal leads, shall be subjected to Test 'Db', Severity

natheritized tonge to porture return of specifical inter Detail Specification <u>Cold Test</u> 4.7.8

tested power for 45 minutes. א אס שאבע גיע אים שבלהע לאבע גיבשה estegory temperature. After 1 hour of stabilisation at this temperature, the flexible heaters shall be The flexible heaters shall be subjected to Test 'Ad' of IEC Publication No. 68-2-1 at the lewer

دهديد اهيه of Double layer heaters shall be tested one layer atter the other successively for the parat speci fier.

single lange

the Urderer. Resistors of multiple resistor heaters shall be tested simultaneously, unless otherwise specified by

.sweesing atmospheric conditions for not less than 4 hours. معدرهم عسافردوا به فحس Air The flowble heaters shall there be removed from the chamber and expessed to standard The flowble and expessed to standard

ni baruzeam eulevent et bare	The resistance shall be measured. The change in resistance comp Para. 8.8 1 shall not exceed the value prescribed in Measurements Specification.	)
	Final Measurements	<del>6.8.8</del>
	5 have be as specified	
noite	The strength and duration of the pull are given in the Detail Specific	
	Procedure	<del>2.8.8</del>
	.↑.↑ <del>.⊅.8 .snsণ ni belitoeqe ee berussem ed llade eonsteiser ed l</del>	-200 attached
		rewiller /
	<u>stnemetuseeM leitinl</u>	<del>1.8.8</del>
itS-S-86 .oN not	The flexible heaters shall be subjected to Test 'Us 1' of IEC Publica	
		0.40
	SUOITANIMAET TO SEENTSUBOR	9\$ <sup>8</sup>
on ed lisits ereit bas 6.1.4.8	A voltage proof test shall be performed in accordance with Para. e <del>vidence of</del> breakdown or flash-over.	
etail Specification.	less than that prescribed in Measurements and Inspections of the D	outerined
sulation resistance shall not be	Measurements and Inspections in the Detail Specification. The In	- 766
	compared to the value measured in Para. 8.7.1 shall not ex	Merrillen
red. The change in resistance	$\Gamma$ the resistance and the insulation resistance shall then be measu	
	Final Measurements	8.7.8
manage in the second second		
sebuelic conditions for recovery	The <del>fiexbl</del> besters shall <b>then</b> be subjected to the standard atmo tor not less than 1 hour and not more than 2 hours. المعراصح العدار ع	
	entist to remain on	
A <del>a powoads osmaawo ecowa</del> 'A		
	Resistors of multiple resistor heaters shall be tested simultaneously	
or double tayer neaters shall be	heaters shall be teeted at rated power for 1 minute. Each layer of tested separately for the series successive second	
	t dwep-sette setter etter towers the chamber setter setter	JAN STATE
	some contest on specified in the De	nicoth and batasmas 11/18 ni channat
y <del>ns ni bris sidieeoq as feird as</del>	atmospheric conditions for recovery: The time of transfer shall be	Ensperded and
	At the end of the conditioning period, the flexible heaters shall	
Erres rated annum CIDE LOL	B.G. Load structure atmospheric conditions for recovery	7.7.8
of here draw and realized at may here here	hows by way betage of any 27 to return with	
	The flexible heaters, suspended by their terminal leads, shall be su Variant 2, of IEC Publication No. 68-2-30 for 5 cycles of 24 hours.	
A	Damp Heat (Accelerated) Remaining Cycles	9.7.8
( energed to Damp Heat ( remaining costs)	. Bu completion of the parters show immediately be	9.7.8
(viras to Damp Heak (Runinum coch )	The duration of the test shall be 1 hour. On completion of the test shall be 1 hour. Damp Heat (Accelerated) Remaining Cycles	9.7.8
	. Bu completion of the parters show immediately be	9.7.8
	The duration of the test shall be 1 hour. On completism of the fight a heaters show immediately be :	9.7.8
.°C.	Kesistors of multiple resistor heaters shall be tested simultaneousl the Orderer. The test shall be performed at a temperature between +15 and +35 The duration of the test shall be 1 hour. Øد دصيولدائعه م <del>ذ לلعاديم بانم المدادي</del> دا <i>لمبلا اسمد :</i>	9.7.8
۵.۵ ۸' <del>העופגפ-סנµסנאוניס באפכונופק א</del>	Resistors of multiple resistor heaters shall be tested simultaneousi the Orderer. The duration of the test shall be 1 hour. (On completizer of the tight of hour.) (On completizer of the tight of hour.)	9.7.8
۵.۵ ۸' <del>העופגפ-סנµסנאוניס באפכונופק א</del>	Each layer of double layer heaters shall be tested separately. عرده درموله لمبول Resistors of multiple resistor heaters shall be tested simultaneousl the Orderer. The duration of the test shall be 1 hour. On completism of the test shall be 1 hour.	9.7.8
erectuety for the period by and the the period by o.	<ul> <li>Ine <del>destine</del> neaters, <del>tooled</del> with rated power, shall be subjected to to be subjected to to be subjected to the same start and the subject of and to be subjected simultaneousl the Orderer.</li> <li>The duration of the test shall be 1 hour.</li> <li>The duration of the test shall be 1 hour.</li> </ul>	9.7.8
test 'M' of IEC Publication No. <del>همذياطنع قد البه تحدما يودن <b>إ</b>ديا</del> y, <del>unlece ethomice epocified b</del> y o.	The flexible heaters, tested with rated power, shall be subjected to be the flexible heaters, tested with rated power, shall be subjected to 68-2-13, using a pressure of 20±1 mbar. Each layer of double layer heaters shall be tested separately. Succeed to flexible resistor heaters shall be tested separately. Succeed the Orderer. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour.	
test 'M' of IEC Publication No. <del>همذياطنع قد البه تحدما يودن <b>إ</b>ديا</del> y, <del>unlece ethomice epocified b</del> y o.	<ul> <li>Ine <del>destine</del> neaters, <del>tooled</del> with rated power, shall be subjected to to be subjected to to be subjected to the same start and the subject of and to be subjected simultaneousl the Orderer.</li> <li>The duration of the test shall be 1 hour.</li> <li>The duration of the test shall be 1 hour.</li> </ul>	č.7.8 ∂.7.8
test 'M' of IEC Publication No. <del>همذياطنع قد البه تحدما يودن <b>إ</b>ديا</del> y, <del>unlece ethomice epocified b</del> y o.	The flexible heaters, tested with rated power, shall be subjected to be the flexible heaters, tested with rated power, shall be subjected to 68-2-13, using a pressure of 20±1 mbar. Each layer of double layer heaters shall be tested separately. Succeed to flexible resistor heaters shall be tested separately. Succeed the Orderer. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour.	
test 'M' of IEC Publication No. <del>همذياطنع قد البه تحدما يودن <b>إ</b>ديا</del> y, <del>unlece ethomice epocified b</del> y o.	<u>Low Air Pressure</u> The flexible heaters, tooled with rated power, shall be subjected to Beschaps, tooled a stepse of 20±1 mbar. Each layer of double layer heaters shall be tested separately. عسر Resistors of multiple resistor heaters shall be tested separately. عسر the Orderer. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour.	
test 'M' of IEC Publication No. <del>همذياطنع قد البه تحدما يودن <b>إ</b>ديا</del> y, <del>unlece ethomice epocified b</del> y o.	No. 4009 <u>Low Air Pressure</u> The flexible heaters, tecked with rated power, shall be subjected to Besch layer of double layer heaters shall be tested separately. عسور Each layer of double layer heaters shall be tested separately. عسور Resistors of multiple resistor heaters shall be tested separately. عسور the Orderer. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour.	
را Spearfication No. Test 'M' of IEC Publication No. همدر مولس for the تحدمه specified by y, <del>unless othorwise specified b</del> y s <sup>o</sup> C.	<u>Low Air Pressure</u> The flexible heaters, tooled with rated power, shall be subjected to Beschaps, tooled a stepse of 20±1 mbar. Each layer of double layer heaters shall be tested separately. عسر Resistors of multiple resistor heaters shall be tested separately. عسر the Orderer. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour. The duration of the test shall be 1 hour.	

Convittee Par 8.7.8.

#### sinemenuseeM leni - 8.7.8

Resistance, Change in Resistance, Insulation Resistance and Voltage Proof, shall be measured as specified in Intermediate and End-Point Electrical Measurements **extraction**. Change in Resistance shall be related to the initial measurements

## ROBUSTNESS OF TERMINATIONS

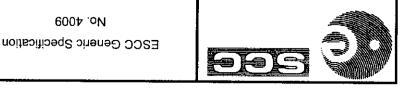
The heaters shall be subjected to Test 'Us 1' of IEC Publication No. 68-2-21 with the following details:

- Test Conditions

The strength and duration of the pull shall be as specified in the Detail Specification.

- atnio9 ets0 -
- (a) During Special In-Process Controls: Not applicable.
   (b) During Qualification and Periodic Tests: Resistance and Change in Resistance shall be
- measured as specification both before and End-Point Electrical Measurements and inspecification both before and siter the test. Change in Resistance shall be related to the initial measurements.

<del>3</del>.8



8.9 OPERATING LIFE

-:viga following requirements shall apply:-

(a) Duration: 2000 hours.

Each layer of double layer heaters shall be tested successively for 1 000 hours.

#### (b) Method of Mounting

The flexible heaters shall be freely suspended and connected by their terminal leads. They shall be positioned in such a way that the heat from one heater does not unduly influence the temperature of any other heater. There exists the network from the exists the method from the exists the teater does not unduly influence the temperature of any other heater.

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PAGE 22

#### (c) Test Conditions

As specified in Operating Life in the Detail Specification.

The voltage (d.c. or full-wave rectified a.c. with ripple less than 5%) shall be increased until the following occurs:

- The rated power density is reached, or
- The temperature of the heaters reaches the maximum operating temperature.

The voltage shall then be applied in cycles of /.5 hours 'ON' and 0.5 hours 'OFF' throughout the test. The 0.5 hour 'OFF' periods are included in the total test duration.

Resistors of multiple resistor single layer heaters shall be tested simultaneously.

For intermediate and end-point data/measurements, the flexible heaters shall be allowed to cool at room temperature for not less than 1 hour and not more than 2 hours. The measuremente abail take place at the end of the 0.6 hour "off" period.

After intermediate measurements, the flexible heaters shall be returned to the test conditions. The interval between the removal of any heater from the load and its return to the conditions of the test shall not exceed 12 hours.

#### (d) Intermediate Data Points

Detail Specification at 0 and 1000 ±48 hours.

In the case where Measurements and Inspections specify "changes", the drift shall always be

#### eta Data Points (e)

Measurements at end-points in accordance with Measurements and Inspections in the Detail Specification at 0 and 2000 ± 46 hours.

In the case where Measurements and Inspections specify "changes", the drift shall always be related to the 0-hour measurement.

#### **OPERATING LIFE**

Operating Life shall be performed in accordance with the following details:

**Buitnuo**M

positioned such that one heater does not unduly influence the temperature of any other. The heaters shall be suspended and connected by their terminal leads in still air. Heaters shall be

**Test Conditions** 

As specified in Operating Life in the Detail Specification

power density or the maximum rated operating temperature, both as specified in the Detail The voltage (dc or full-wave rectified ac with ripple less than 5%) shall be increased until either rated Resistors of multiple resistor single layer heaters shall be tested simultaneously. Each layer of double layer heaters shall be tested successively for  $1000 \pm 48$  (2000  $\pm 48$  hours total). The duration of Operating Life shall be 2000 ± 48 hours.

in the test duration). The voltage shall be in cycles of 1.5 hours "NO" and 0.0 hours "OFF" cycles are included Specification, are reached.

#### 8h I &ર્મ∓ strio9 eteO

As specification at 0 hours, 1000 hours and 2000 hours.

If drift values are specified, the drift shall always be related to the 0-hour measurement.

for not less than 1 hour and not more than 2 hours prior to electrical measurements. At each data point the heaters shall be subjected to standard atmospheric conditions for recovery

between removal from and return to the test conditions for any heater shall not exceed 12 hours. After the 1000 hour measurement the heaters shall be returned to the test conditions. The interval

8.8



#### DATA DOCUMENTATION '6

#### guarification mainterence must proceedent tor each tot GENERAL 1.6

package shall exist in a printed or electronic form. For the qualification approval records and with each component delivery, a data documentation

-:mont backage shall be compiled from:-

- (a) Cover sheet (or sheets).
- (b) List of equipment (testing and measuring).
- (c) List of test references.
- (d) Special In-Brocess Control test data (if specified in the Purchase Order). ( Chart F2)
   (e) Screening Tests test data (Chart F2), F3
   (f) Qualification Tests test (Chart F3). ( mu Perodu c

## (g) - Poriodio or Let Validation tost data (when applicable).

- A (K) الا الما الما الما الما الما الما (<del>3.7 منه 2.3 منه 1.5) (1.4 منه العا</del>بات الما الما الما الما (<del>3.5 منه 2.4 (1.4 )) (1.4 ) (1.4 ) (1.4 )</del> (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1.4 ) (1. (atterilger ratu)
- N (i) Certificate of Conformity.

each page shall include the following information: Items (a) to (b) inclusive shall be grouped, preferably as subpackages and, for identification purposes,

- ESCC Component Number.
- .emen s'herutetheme.
- Lot identification.
- Date of establishment of the document.
- Page number.

ASCII or PDF. preferred storage media are 3 1/2 inch diskettes or CD-ROMs and the preferred file formats are reading using a compatible PC. The format supplied shall be legible, durable and indexed. The Whenever possible, documentation should preferably be supplied in electronic format suitable for

## 1.1.9

Qualification Approval and Qualification Approval, the items listed in Para. 9.1 (a) to (if) less item (g) are required.

#### Component Delivery 2.1.2

-:peyddns For all deliveries of components procured to this specification, the following documentation shall be

- (a) Cover sheet (if all of the information is not included on the Certificate of Conformity).
- (b) Certificate of Conformity.

#### Additional Documentation 5.1.9

required by the Purchase Order. The Manufacturer shall deliver additional documentation containing data and reports to the Orderer, if

#### Data Retention/Data Access 116

time it shall be available to the ESCC Executive and the Orderer, if requested, for review. for verve If not delivered, all data shall be retained by the Manufacturer for a minimum of 5 years during which

## · l'equested, by the Orderer or the ESCC Executive (for quertified composity).

PAGE 24	ESCC Generic Specification No. 4009	
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#### COVER SHEET(S) 2.6

- The cover sheet(s) of the data documentation package shall include as a minimum:-
- (a) Reference to the Detail Specification, including issue and date.
- (b) Reference to the applicable ESCC Generic Specification, including issue and date.
- Edmen sapi E2CC Component Number and the Monufactures po (c) component-type and number.
- (d) Lot identification.
   (e) Number of purchase Brder.
- (f) Information relative to any additions to this specification and/or the Detail Specification.
- (9) Manufacturer's name and address.
- Include the manufacturing plant.
- Signature on behalf of Manufacturer. - (i)
- Total number of pages of the data package.
- LIST OF EQUIPMENT USED 6'3

tests such equipment was used. inventory number, Manufacturer's type number, serial number, etc. This list shall indicate for which data given in the Process-Identification Document (P.I.D.). Where applicable, this list shall contain A list of equipment used for tests and medsurements shall be prepared, if not in accordance with the

61P

LIST OF TEST REFERENCES **7**.6

data provided with the applicable tests specified in the tables of the Detail Specification. This list shall include all Manufacturer's references or codes which are necessary to correlate the test

SPECIAL IN-PROCESS CONTROLS TEST DATA (CHARK F2) 9.6

the total number rejected after each of the tests. A test result summary shall be compiled, showing the total number of components submitted to, and

SCREENING TESTS DATA (CHART F2) 9.6

the total number rejected after each of the tests. <del>The P.D.A. shall be recorded</del>. A test result summary shall be completed, showing the total number of components submitted to, and

OUALIFICATION TEST DATA (CHART F3) 7.6 もし

hered

bounder ablauted

Inspections in the Betail Specification, as and where applicable. stant be provided of all electrical measurements made in accordance with Measurements and components submitted to each test in each of the subgroups and of those rejected. Detailed data All data shall be referenced to the relevant serial numbers. Detailed records shall be provided of the

- 2.7.10 PERIODIC AND LOT VALIDATION TEST DATA (CHART F3) 8.6 1.t.b
- Periodic Tests for Maintenance of Qualification らもし 1.8.9

anall be prepared. For each group of periodic tests in Chart F3, the summary shall include a list of the tests performed, when they were last performed, the number of components tested a statement that the results were satisficatory and a reference identifying the location of the full lest data. Summary data for the most recent performance of periodic tests for the maintenance of qualification

(2.8.6'1.8.6'2.0't.0) 2. t. to 2.t. o 1.t. b 1.t. b sized withough

## CHARTER OUPLIFICATION AND PERIODIC TESTS DATA (CHARTER)

#### P.F.P. Qualification Tests

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Component serial numbers for each subgroup shall be identified. For each test in each subgroup, component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

#### Gui

## A.T.2 Periodic Tests for Qualification Maintenance

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

In addition to the full test data a report shall be compiled for each subgroup of Chart F4 to act as the most recent periodic testing summary. These reports shall include a list of all tests performed in each subgroup, the ESCC Component Numbers and quantities of components tested, a statement confirming all the results were satisfactory, the date the tests were performed and a reference to the full test data.

## P.T.A Lot Validation Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup (as applicable). Component serial numbers for each subgroup shall be recorded against identified. For each test requiring electrical measurements the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against recorded against component serial number.

e relevant paragraphs of Section 9 -	<ul> <li>10. <u>DELIVERY</u></li> <li>۲۰ میساید استان میهای از این ماه میشده</li> <li>۲۰ میساید استان میهای از این ماه منابع میسنده</li> <li>۲۰ منابع specification معها (the disposition of the quelification and the states)</li> <li>۲۰ منابع specification.</li> <li>۲۰ procurement, for each order, the items forming the delivery are:</li> <li>(a) The delivery for.</li> <li>(b) The components used for lot Validation festing, (when applic delivery lot.</li> </ul>			
Basic Specification No. 20100.	A Certificate of Contornity shall be established as defined in ESCC			
· marging vanst	ه (د) Detailed failure analysis, intequested. (b) The series (if requested by the ESCEExecuture or Ordune). 9.10 CERTIFICATE OF CONFORMITY			
- ות אסנפגם לבת אימו ג, גר נפנאי יות דבואה מתא שעתי ויניביננים מתי וברשיינים דבולי				
The failed component list and failure analysis report shall provide full details of:-				
Ē	9.9 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT			
Pediate Periodic Tests used for Lot Validation Detailed records shall be provided of all electrical measurements made in accordance with and the results obtained. Detailed data shall be provided of all electrical measurements made in accordance with Measurements and inspections in the Detail Specification, as and where applicable.				
ISSUE 1 PAGE 25	ESCC Generic Specification No. 4009			

(c) The relevant documentation in accordance with the requirements of Section 9 of this aposition.

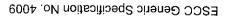
to lot Validation Testing shall also be copied, when requested, to the ESCC Executive.

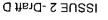
PACKAGING AND DESPATCH

11

The packaging and despatch of components to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 20600.

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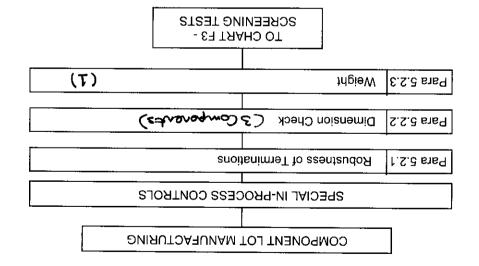


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12.2

CHART F2 - PRODUCTION CONTROL



:SETON

1. Guaranteed but not tested.

This document details all changes proposed by the ESCC Executive Secretariat to specification:

RESISTORS, HEATERS, FLEXIBLE
 ESCC Generic Specification No. 4009 ISSUE 1, DRAFT 'B', JANUARY 2002.

The proposed changes have been incorporated into the revised specification 4009 issue 2 draft F (See Appendix 3).

Due to the extensive editorial changes made between draft 1B & 2F, only a general description has been given herein by reference to the paragraph affected in 4009 draft 1B and a summary of the extent of the change.

A detailed Mark-up of ESCC 4009 draft 1B (See Appendix 2) shows the details of all changes incorporated into 4009 draft 2F.

The majority of changes detailed herein are considered by the Secretariat to be of an **Editorial** nature. They have been defined and included to serve the purposes of clarification, accuracy, completeness, simplification and consistency. The aim is to simplify and improve the interpretation of the specification and it's requirements whilst maintaining the same overall structure and technical baseline as per the previous ESA/SCC 4009 issue 3B and ESCC 4009 draft 1B specifications. In addition ESCC 4009 draft 2F has been written to closely follow the structure and content of the recently reviewed and accepted ESCC Generic Specification 9000 issue 2 (and recently approved DCR138).

There are some **Technical & Policy** changes included in the revised specification draft 2F for which specific explanations and justifications are also provided herein.

#### 1) Editorial - Scope

4009 draft 1B is inconsistent, somewhat confusing and in places overly complicated in it's references to:

- Qualification and qualification approval
- Component Type Qualification
- Qualification maintenance & Periodic Testing
- Procurement of qualified components
- Procurement of unqualified components

The Secretariat has tried to simplify, clarify and make consistent the use of these terms throughout 4009 draft 2F.

The terminology related to all these subjects has been changed in the following paragraphs to clarify, simplify and make consistent the specification on this subject.

Para's in 4009 draft 1B affected due to this point: **2.1**, **4.1**, **4.1.1**, **4.1.3**, **4.1.4**, **4.2**, **4.3.1**, **5.**, **6.1**, **7.**, **7.2**, **7.3.1**, **7.3.3**, **7.6**, **7.7.1**, **7.7.2**, **9.1**, **9.1.1**, **9.1.4**,

9.8, 9.8.1, 10.

#### 2) Editorial - Unqualified Components

The Specification has been made applicable and fully usable for procurement of unqualified components as well as for Qualified components. Draft 1B did include some references to procurement of unqualified components but this was generally inconsistent and incomplete.

Para's in 4009 draft 1B affected: 1.2, 2.1, 4.1, 4.1.3, 4.1.4, 4.3.1, Chart F1, 7.3.1, 7.6

## 3) Editorial - Para 1. Applicability

Delete "lot validation" as a redundant reference from 1<sup>st</sup> sentence. "Lot Validation Testing" is part of procurement and does not always apply. Therefore it is best not referenced in the Scope para.

## 4) Editorial - Para 2. Applicability

2<sup>nd</sup> sentence added to clarify the specification can be used for unqualified components. (See point 2) above).

# 5) Policy & Editorial - Para 2.1. Definition of Applicable documents replacements & Clarification of the applicable documents for unqualified components.

Delete in the 2nd main sub-para "listed in an appendix to the Detail Specification"

For qualified components, as the Manufacturers' PID will define all applicable documents it is considered unnecessary to list any replacements in the appendix of the Detail Spec. A statement of the requirement of equivalency is considered as sufficient.

For non-qualified Manufacturers and procurements it should be the responsibility of the Orderer to ensure that the Manufacturer meets the quality requirements of the programme prior to procurement including applicable documentation. Sub-para has been added accordingly to cover unqualified components (See point 2) above).

The content of approved DCR138 to ESCC Generic Specification 9000 issue 2 has also been incorporated into this para.

## 6a) Editorial - Para 2.2. Other (Reference) Documents

Add REP005, ESCC Qualified Parts List.

#### 6b) Technical - para 2.2 & 6.4.2. Sampling Standard

Delete references to the sampling reference document (IEC Pub. No.410) and the inspection level/AQL.

The given IEC document is only referred to in the generic specification para 6.4.2 (Lot failure during sample testing - during Screening); The only sample test included during screening is Overload with sampling requirements as follows:

• GI level II AQL 2.5%; in the event of a failure a 100% test shall be performed.

Per IEC Publication No. 410 (now designated as IEC Pub. No. 60410) this sample is equal to 5 samples with 0 failures permitted (independent of lot size).

For the purposes of simplification the secretariat proposes to replace the AQL sampling by the equivalent fixed sampling. Reference to the IEC document is thereby not necessary.

If any detail specification did have a requirement for an additional sample test during screening defined by an AQL and sample plan the relevant sampling specification would be included as a reference document in the Detail Specification.

#### 7) Editorial - para 4.1. General

First 3 sub-para's have been amended in order to be complete, accurate, clear and consistent with the actual requirements applicable to component type qualification approval and procurement.

3rd sub-para is deleted due to being covered by the 2<sup>nd</sup> sub-para.

4<sup>th</sup> sub-para deleted, as in-process controls may not be eliminated/substituted unless specifically deviated to in the Detail Specification. This sub-para is therefore redundant.

#### 8) Editorial - para 4.1.1. Specifications

Redundant phrase "(including lot validation testing)" deleted

#### 9) Editorial - para 4.1.3. Manufacturer's Responsibility for Performance of Tests and Inspections

Phrase "prior to commencing qualification testing, or procurement" is deleted. This statement is implicit with the word "agreed" and hence redundant in this sentence.

#### 10) Editorial - para 4.1.5. Pre-encapsulation Inspection witnessing

Para is deleted as precap is not applicable to Heaters.

#### 11) Editorial - para 4.1.6. Wires for Terminal Leads

(para 4.5.1 under Materials And Finishes in 4009 draft 2F) For the purpose of clarification the para is amended to include references to the applicable wire ESCC Detail Specification and the ESCC Qualified Parts List REP005.

#### 12) Editorial - para 4.3. Deliverable components

1<sup>st</sup> sub-para. Correction - reference to purchase order is deleted. The PO does not specify all the tests, the generic Specification does.

#### 13) Editorial - para 4.3.1. Lot Failure

1<sup>st</sup> sub-para. Delete reference to "special in-process controls", as there is no lot failure criteria associated with any of the tests.

2<sup>nd</sup> to 5<sup>th</sup> sub-paras rewritten to clarify and make consistent the requirements for both qualified and unqualified components.

ESCC No. 22800 should only apply to qualified manufacturers.

The written notification deadline to the ESCC Executive for qualified manufacturers, though the non-

conformance process, is 5 working days as stated (not immediate as implied by the last sub-para of para 4.3.1).

#### 14) Editorial - para 4.4. Marking

Para rewritten to remove the duplicated information already fully specified in ESCC basic Specification 21700.

#### 15) Editorial - para 4.5. Materials & Finishes

Para expanded to include generic information taken out of the Detail Specifications. The Secretariat intends that the generic statements on materials and finishes will be removed from all Detail Specifications during the software conversion process in order to simplify the Detail Specifications.

#### 16) Editorial - para 5. Production Control

Para's rewritten for accuracy, clarification & consistency with the presentation of para 6.1 & 7.1.1. and the actual applicable requirements.

The text in para 5.2 is deleted as a redundant statement.

The generic spec defines the baseline requirements for special in-process controls. Any additional special inprocess controls are by definition unique to the detail spec and therefore should not be referenced in the generic spec.

All test methods & procedures have been moved to section 8 (para's 8.5 & 8.6 in 4009 draft 2F)

Para's in 4009 draft 1B affected: 5., 5.1, 5.2, 5.2.1, 5.2.2

#### 17) Editorial - para 5.2.4. Documentation (S.I-P.C.)

Statement "and shall be supplied if specified in the purchase order." is deleted - as this requirement is already covered by para 9.1.3 - Additional documentation.

#### 18) Editorial - CHART F1 - GENERAL FLOW FOR PROCUREMENT

Chart redrawn to clarify the requirements and to reflect the actual procurement flow of components as defined by the specification.

The chart in 4009 draft 1B was unclear and incomplete e.g.

- Lot validation was identified against unqualified components when it can also be applied as an option for qualified components
- Periodic testing was not referenced

#### 19) Editorial - New chart F2 Production control

New chart F2 was added in 4009 draft 2F to be consistent with the format applied to all other tests within the generic specification.

Both Screening tests and Qualification and Periodic Tests each have a chart that outlines and clarifies as a diagram the test sequence and requirements. This format has been followed for the Production Control section of the generic spec (including Special In-Process Controls). In addition to consistency within the specification it also serves to clarify the requirements and focus the importance of Production controls to the overall requirements, in the same way as charts F3 & F4 do for Screening Tests & Qualification and Periodic Tests.

#### 20) Editorial - para 6.1, 7., Chart F3. Serialisation

The requirement to serialise any qualification or Lot Validation Testing components is deleted from the 2<sup>nd</sup> subpara of para 6.1 and moved to para 7. A note about serialisation is added to chart F3 (F4 in 4009 draft 2F). The samples for qualification, qual maintenance and Lot Validation Testing should only be selected after completion of Screening Tests (as there may be failures during screening of any nominated parts).

#### 21) Editorial - para 6.2.2. Other Failures

"Visual Inspection Failure" added for consistency and completeness as the definition had been omitted from 4009 draft 1B.

#### 22) Editorial - para 6.4.1. Lot failure Criteria

Correct and clarify in the 1<sup>st</sup> sub-para that the reference point for PDA calculation is the "Burn-in" (delete "and electrical measurements section").

#### 23) Editorial - para 6.4.2. Lot Failure during Sample Testing

Add reference "herein" to 1<sup>st</sup> sentence for number of allowable failures to refer to the generic spec as it does define some sampling requirements.

Correct the incorrectly used term "P.D.A." to be "percent defective" in 2<sup>nd</sup> sub-para.

#### 24) Editorial - para 6.5. Documentation (Screening)

Delete redundant word "Data" from beginning of sentence.

Correct the reference to be "Screening Tests" (was "burn-in and electrical measurements").

#### 25) Editorial - para 7.1.2. Distribution within the Qualification Test Lot

Para reworded to follow the same wording used in ESCC 9000 issue 2 for consistency. 3<sup>rd</sup> para is added to clarify the approval required by the ESCC Executive.

#### 26) Editorial - para 7.2 MAINTENANCE OF QUALIFICATION

The 2<sup>nd</sup> sentence including the word "periodicity" is rewritten for grammar and clarification purposes to be: "For each subgroup the period between successive subgroup testing shall be as given in chart F4"

#### 27) Editorial - para 7.3.1 & 7.3.2. - General (Lot validation Testing)

For the purpose of clarification the para is amended with regard to the purchase order requirements for lot validation testing for both qualified and unqualified components.

#### 28) Editorial - para 7.3.3. Lot validation Samples

For the purpose of clarification and consistency the para is rewritten to also include the samples used for Qualification & Qualification maintenance (para 7.7 in 4009 draft 2F).

#### 29) Editorial - para 7.4.2. Electrical Failures

Para rewritten and corrected to simplify the presentation and to be consistent with chart F3 (F4 in 4009 draft 2F) and the detail specifications. Note: The old Table 6 in the detail specifications will be renamed to be "Intermediate and End-Point Electrical Measurements".

#### 30) Editorial - para 7.4.3. Other Failures

Para amended to include all applicable failures and to be consistent with para 6.2.2 (mechanical & handling failures had been omitted from 4009 draft 1B).

#### 31) Editorial - para 7.5. FAILED COMPONENTS

3<sup>rd</sup> sub-para amended to remove redundant comments "lots" & "of the qualification or procurement lot".

#### 32) Editorial - para 7.6. Lot failure

Delete "of unqualified components" in 3<sup>rd</sup> sub-para as Lot Validation Testing can apply to both qualified & unqualified components (See point 2) above).

Delete redundant phrase "by the Orderer" in 2<sup>nd</sup> sub-para.

#### 33) Editorial - para 7.7 Documentation (Qual)

Sub-para's **7.7.1**, **7.7.2** reduced to a single statement to cover all Qualification and Periodic tests documentation.

Section 9 already specifies the various requirements to cover the documentation for Qualification and Periodic tests and Lot Validation Testing.

## **34) Technical & Editorial - CHART F2 - SCREENING TESTS**

(F3 in 4009 draft 2F)

Add note to clarify that the initial Room Temperature electrical is optional at the Manufacturer's discretion.

Add note to check for lot failure after Burn-in at each post-burn-in electrical test to clarify that lot failure can occur after each of the noted tests and hence testing can then be stopped rather than have to wait until the final "check for lot failure" test.

The "check for lot failure" point is moved to be after final electrical as visual failures do not count towards PDA. A note is added to clarify that "check for lot failure" takes into account all post Burn-in electrical parameter failures.

Delete "(100% Go-No-Go)" & "(100%)" from the chart, as these comments are redundant.

# **35) Technical & Editorial - CHART F3 - QUALIFICATION AND PERIODIC TESTS** (F4 in 4009 draft 2F)

Delete "Parameter Measurements" after Operating Life as final electrical testing is already included as part of Operating Life.

Add External visual inspection after Operating Life to check that no degradation has occurred during the life test. Previously no post life test visual inspection was required.

Amend test titles to be consistent with the tests in the specification.

Correct the word "periodicity" to be " period"

Add note specifying no failures are permitted (as is specified in para 7.6 but omitted from chart F3 in 4009 draft 1B) for the purpose of clarification.

Add note about serialisation for the purposes of clarification (See point 20) above).

#### 36) Editorial - para 8. TEST METHODS AND PROCEDURES

Some general changes applicable to various paras in section 8 are as follows:

All the test methods in para 5 are transferred to para 8 resulting in new/amended para's **8.5** (dimension check) & **8.6** in 4009 draft 2F. Some editorial changes are included in the wording of the new para's. This amendment has been incorporated for simplification and clarification purposes. All the various test methods and procedures, called up throughout the generic specification, are consolidated within the single para 8.

The redundant word "flexible" has been deleted from the phrase "flexible heater" throughout the spec.

Any ratings referenced in the various tests are related to "rating as specified in the Detail Specification" for clarification purposes.

The mounting conditions for the various test are made consistent & simplified in Para's 8.1, 8.3, 8.6, 8.7, 8.9

The content of approved DCR138 to ESCC Generic Specification 9000 issue 2 has also been incorporated into this para.

#### 37) Editorial - Testing of Resistors of multiple resistor heaters

Delete references to" Unless otherwise specified" & "the orderer" plus add "single layer" to be accurate.

The Detail Spec, not the Orderer, will specify any different test conditions

Para's in 4009 draft 1B affected: 8.1.1, 8.3, 8.7.4, 8.7.5, 8.7.7, 8.9

#### 38) Technical & Editorial - para 8.1 & Chart F2. Overload

This para is rewritten to simplify the para layout including deleting sub-para 8.1.1, 8.1.2 & 8.1.3.

Specific changes to the paras include:

Clarification and simplification on the sampling applied to this test is added (See **6b**) above). The original sampling:

• General Inspection level II AQL 2.5%

- Is rewritten as a fixed, equivalent sample quantity:
- 5 parts with 0 failures allowed, otherwise a 100% inspection applies.

In Para 8.1.1, 3rd sub-para "times" is amended to "period".

In Para **8.1.2**, references to initial measurements & change in resistance are deleted as without serialisation drift parameter electrical measurements is not applicable. Only resistance after the test will be measured. As serialisation is not required during screening it is not applicable or possible to measure any drift of parameters during screening. Drift measurements will only apply to the serialised parts during Qualification and Periodic Testing (Chart F4 in 4009 draft 2F)

#### 39) Editorial - para 8.3 BURN-IN

This para is rewritten to simplify the para layout

Specific changes to the paras include:

Detail the mounting and test set-up requirements (same as Operating life)

Clarify the Burn-in period as 168 (+24 -0) hours

Correct "successfully" in 2<sup>nd</sup> sub-para to be "successively"

Added para clarifying that resistance at room temperature is measured between 1 & 2 hours after completion of burn-in. 4009 draft 1B was unspecific in defining which tests should be performed immediately after burn-in.

#### 40) Editorial - para 8.4.1.1 Resistance Measurement

In  $2^{nd}$  sub-para,  $2^{nd}$  sentence, replace " and cable Generic and Detail Specifications" by "specification". This clarifies and makes consistent the fact that the terminal lead resistance is actually found in the applicable wire specification (see point 11) above).

Move last sentence of note 1 to be part of the main sub-para as this sentence refers to the para as a whole not just the measurement of Rn @ 0.1V.

# 41) Technical & Editorial - para 8.4.1.2.2 & 8.4.1.3.2 Insulation Resistance - Procedure & Voltage Proof - Procedure

Add the requirement " There shall be no evidence of breakdown or flashover" this test which is considered necessary for any high voltage testing. It is included as a requirement for final electrical after Climatic sequence testing.

#### 42) Editorial - para 8.4. ELECTRICAL MEASUREMENTS

Para's amended to simplify the content and to make terminology consistent.

Para's in 4009 draft 1B affected: **8.4.2, 8.4.3, 8.4.4** 

#### 43) Editorial - para 8.4.2. Electrical Measurements at high & low Temperatures

Clarification on the sampling acceptance criterion applied to this test is added. i.e. "In the event of any failure a 100% inspection shall be performed".

The acceptance criterion was unclear in 4009 draft 1B.

#### 44) Technical - para 8.6. Rapid Change of Temperature

Initial measurements per para 8.6.1 are deleted. As drift measurements for this test are not possible without serialisation there is no need to perform initial measurements.

Final measurements per para 8.6.3 are amended to define that only resistance is measured on completion of Rapid Change of Temperature; no drift measurements will be performed.

As serialisation is not required during Screening Tests it is not applicable or possible to measure any drift of parameters during Screening Tests. Drift measurements will only apply to the serialised parts during Qualification and Periodic Testing (Chart F4 in 4009 draft 2F)

#### 45) Editorial - para 8.7 CLIMATIC SEQUENCE

Reference to "upper category" & "lower category" temperatures are replaced by "maximum storage" & "minimum storage" temperatures to reflect the definition in the Detail Specification in para 8.7.2 & 8.7.4

Use "operated with rated power" not "tested with rated power" in para 8.7.7

Some minor editorial changes have been made for clarification and consistency purposes.

#### 46) Editorial - para 8.8 Robustness of Terminations

Para rewritten to define the different requirement for the Special In-Process Controls test & the Qualification and Periodic Tests test. Pre & post electrical test do not apply to the Special In-Process Controls test.

#### 47) Technical & Editorial - para 8.9. Operating Life

Duration clarified as "2000 +/-48 hours" & "1000+/-48 hours" each layer for double layer heaters.

"intermediate measurement" is replaced by "the 1000 hour measurement" in the 6<sup>th</sup> sub-para of 8.9(c).

The requirement that measurement take place "at the end of the 0.5 hour "OFF" period" is deleted as there is already a recovery period of 1 to 2 hours specified.

#### 48) Editorial - para 9.1. Documentation - General

Para amended to make the each data item consistent with the content of the specification.

Specific amendments are:

- 1<sup>st</sup> sentence amended; reference to "each component delivery" is replaced by "each lot"
- (d) Reference to the Purchase Order is deleted, as Special In-Process Controls are mandatory.
- (f) & (g) amended to be "Qualification and Periodic Tests data" & "Lot Validation Testing data (when applicable)" for consistency and incorporated in to a single bullet (f).
- (h) "(when applicable )" added for clarification.

#### 49) Editorial - para 9.1.2. Component Delivery

Title amended to be "Component Procurement and Delivery" to be more accurate.

#### 50) Editorial - para 9.1.4. Data Retention/Data Access

Para amended to clarify it applies to the ESCC Executive only for qualified components.

#### 51) Technical & Editorial - para 9.2c. Cover Sheet

For the purposes of clarification and consistency with the ESCC marking requirements, in sub-para (c) replace "Component type and number" with "ESCC Component Number and the Manufacturer's part type number".

In 4009 draft 1B this requirement (c) was unclear. The changed para now clearly defines that the two different identification numbers are required on the cover sheet.

#### 52) Editorial - para 9.6. Screening Test Data

Delete 2<sup>nd</sup> sentence "The PDA shall be recorded".

The PDA is already defined in the generic spec para 6.4.1 (5%) and therefore does not need to be repeated in the data. The actual percent defective (PD) will be evident from the required screening test result summary.

# 53) Editorial - para 9.7 & 9.8. QUALIFICATION TEST DATA & PERIODIC AND LOT VALIDATION TEST DATA

Para's incorporated into a single para with title "Qualification and Periodic Tests Data" to cover the data for Qualification Tests, Periodic Tests, and Lot validation Testing each as a sub-para 9.7.1, 9.7.2, 9.7.3 respectively in 4009 draft 2F.

Para **9.8** QUALIFICATION TEST DATA (para 9.8.1 in 4009 draft 2F) is rewritten for clarification purposes to be consistent with the actual tests performed, including the requirement of a test summary and drift calculation.

Para **9.10.1** Periodic Testing for Maintenance of Qualification (1<sup>st</sup> sub-para of 9.8.2 in 4009 draft 2F) is rewritten for clarification purposes to be consistent with the actual tests performed during qualification maintenance, including the requirement of a test summary and drift calculation.

The periodic summary report (2<sup>nd</sup> sub-para in 4009 draft 2F) is clarified as being independent from and additional to the full qualification maintenance summary data.

Para **9.10.2** Periodic Tests used for Lot Validation (para 9.8.2 in 4009 draft 2F) is amended to correct the title to be "Lot Validation Testing". Lot Validation Testing is not periodic. Para is also amended for clarification purposes to be consistent with the actual tests performed, including the requirement of a test summary and drift calculation.

#### 54) Editorial - para 9.9. FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

Para amended to clarify who defines the need for a detailed failure analysis (i.e. ESCC Executive or the Orderer) and during which tests the failures should be identified. 4009 draft 1B was unclear on these points.

#### 55) Editorial - para 10. DELIVERY

1<sup>st</sup> sub-para is moved to the bottom to the para for the purposes of presentation & clarification.

#### 56) Editorial - New chart F2 Production control

New chart F2 was added in 4009 draft 2F to be consistent with the format applied to all other tests within the generic specification.

Both Screening and Qualification/Periodic tests each have a chart that outlines and clarifies as a diagram the test sequence and requirements. This format has been followed for the Production Control section of the generic spec (including Special in-process controls). In addition to consistency within the specification it also serves to clarify the requirements and focus the importance of Production controls to the overall requirements, in the same way as charts F3 & F4 do for Screening tests & Qualification and Periodic Tests.

#### 57) Editorial - Other Minor Editorial Changes

Other minor editorial changes have been made throughout the specification to correct grammatical errors and for the purposes of clarification, consistency and removal of redundant phrasing.

For example:

Capitalisation of specific references e.g.

• Purchase Order ; Manufacturer ; Orderer ; etc

Maintain consistency in the use of references e.g.

 "Screening Tests"; "Lot validation Testing"; "qualification"; "qualification maintenance"; "Qualification Tests"; "component type qualification"; "required in the Purchase Order"; "Room Temperature Electrical Measurements"; "High and Low Temperatures Electrical Measurements"; "Intermediate and End-Point Electrical Measurements".

Maintain consistency in use of terminology/phraseology e.g.

• PID (not "P.I.D."); etc

Removal of redundant phrasing e.g.

• "of this specification"; "the requirements of"; etc

Para's in 4009 draft 1B affected: 2., 2.1, 4.1, 4.1, 4.2, 4.3, 4.3.1, 5.1, 5.2.4, 6.1, 6.2.1, 6.3, 6.4, 6.5, 7.1.1, 7.2, 7.3.1, 7.3.2, 7.4, 7.5, 7.6,

Chart F2, Chart F3, 8., 8.2, 8.4.1.1, 8.4.1.2.2, 8.4.1.3.2, 8.4.2, 8.4.3, 8.4.4, 9.1, 9.1.1, 9.1.3, 9.2, 9.3, 9.5,

9.6, 10.

#### 58) Editorial - Internal References

All internal paragraph and Chart references have been amended to be consistent as necessitated by the various changes.