

APPENDIX 1 - Detailed changes to ESCC 4009 issue 1 draft B

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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 its 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.

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1) Editorial - Scope

4009 draft 1B is inconsistent, somewhat confusing and in places overly complicated in its 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 1st 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

2nd 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.

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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 2nd sub-para.

4th 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

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

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13) Editorial - para 4.3.1. Lot Failure

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

2nd to 5th 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 in-process 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

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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 2nd sub-para 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 1st 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 1st 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 2nd 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. 3rd para is added to clarify the approval required by the ESCC Executive.

26) Editorial - para 7.2 MAINTENANCE OF QUALIFICATION

The 2nd 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"

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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

3rd 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 3rd sub-para as Lot Validation Testing can apply to both qualified & unqualified components (See point 2) above).

Delete redundant phrase "by the Orderer" in 2nd 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.

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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.

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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 2nd 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 2nd sub-para, 2nd sentence, replace " and cable Generic and Detail Specifications" by "specification".

This clarifies and makes consistent the fact that 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.

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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 6th 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.

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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:

- 1st 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 2nd 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 (1st 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 (2nd 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.

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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

1st 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, 4.1.1, 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.