# DOCUMENT CHANGE REQUEST

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|---|---|---|---|
| DCR number 570 | Changes required for: General | Originator: S Jeffery |
| Date: 2011/06/17 | Date sent: 2010/01/19 | Organisation: ESA/ESTEC |
| Status: IMPLEMENTED | | |

| | | | |
|---|---|---|---|
| Title: | Generic Specification for Surface Acoustic Wave (SAW) Devices (Filters) | | |
| Number: | 3502 | Issue: | 1 |

Other documents affected:

Page:

Total re-write. See attached for proposed Issue 2.

Paragraph:

Total re-write. See attached for proposed Issue 2.

Original wording:

Proposed wording:

Specification ESCC 3502 Issue 1, dated October 2002, is entirely re-written to incorporate various editorial and technical amendments and corrections, and incorporate all necessary ESCC policy changes, and thus convert this Generic Specification so that it is in-line with the current, agreed, format for Generics (examples being ESCC 9000 Issue 6 and ESCC 5000 Issue 6).

The layout, format and general content of 3502 Issue 2 is based on Generic specification No. 9000 Issue 6 as amended by DCRs 50, 138, 148, 182 and 400. The proposed converted specification, ESCC 3502 Issue 2 Draft B, is attached to this DCR.

This DCR also identifies the additional technical changes to ESCC 3502 Issue 1 not already generally detailed and justified by DCRs 50, 138, 148, 182 and 400.

The main editorial, technical and policy changes are summarised as follows:

The specification has been made applicable and fully usable for procurement of unqualified components as well as for ESCC Qualified (via. either ESCC 20100 or ESCC 25400) components.

The Applicable Documents paragraphs have been revised.

Reference to the IEC sampling standard has been deleted.

The Final Production Tests Chart has been revised and is now the "Screening Tests" Chart, Chart F3.

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Chart I - Testing Levels has been re-drawn to clarify the flow of components for Procurement.

SCC testing level C has been deleted; there is now only a single ESCC testing level which is equivalent to the "old" SCC level B.

Lot failure notification time is now 5 working days (was 2).

Charts II, IV and V have been replaced with two 'new' Charts: F2 - Production Control and F4 - Qualification and Periodic Tests.

Dimension Check is now performed on a sample of 3 components instead of "5 samples only".

All testing which was performed in accordance with an IEC Publication has been revised. This testing is now either in accordance with, or based on, appropriate MIL-STD-883 Test Methods and Conditions.

The minimum required documentation for procurement is now only a Certificate of Conformity/Cover Sheet.

The "check for lot failure" requirement during Screening has been clarified.

There are a number of changes which apply specifically to ESCC 3502 Issue 1 and these are summarised as follows:

The title has been changed from "SURFACE ACOUSTIC WAVE (SAW) DEVICES (FILTERS)" to "SURFACE ACOUSTIC WAVE (SAW) FILTERS, HERMETICALLY SEALED".

Reference to ESCC 23800, Electrostatic Discharge Sensitivity Test Method, has been added to Para. 2.1 ESCC SPECIFICATIONS.

The Thermal Vacuum Test for the Screening of Space Materials was ESA PSS-01-702. This document has since been updated and is now ECSS-Q-ST-70-02.

The Measurement of the peel and pull-off strength of coatings and finishes using pressure-sensitive tapes was ESA PSS-01-713. This document has since been updated and is now ECSS-Q-ST-70-13.

The Paragraph "Incorporated Chip Components" has been deleted.

Verification of Adhesive Strength (part of Special In-Process Controls) has been deleted.

Total Dose Irradiation Testing (part of Special In-Process Controls) has been deleted.

Definition of failures during Screening and Qualification, Qualification Maintenance and Lot Validation Testing has been corrected to include Visual, Mechanical and Handling failures.

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BOND STRENGTH TEST Paragraph (including subparagraphs) has been revised, with ADHESION OF METALLISATION TO SUBSTRATE added. Bond Strength was performed in accordance with IEC Publication No. 749 Test Method A or B and is now performed in accordance with MIL-STD-883 Test Method 2011.

ENCAPSULATION has been deleted.

RAPID CHANGE OF TEMPERATURE, which was performed in accordance with Test 'Na' of IEC Publication No. 68-2-14, has been replaced by TEMPERATURE CYCLING, which is performed in accordance with MIL-STD-883 Test Method 1010.

CONSTANT ACCELERATION was performed in accordance with Test 'Ga' of IEC Publication No. 68-2-7 and is now performed in accordance with MIL-STD-883 Test Method 2001.

The Test Condition for PARTICLE IMPACT NOISE DETECTION has been changed from 'B' to A.

Fine Leak was performed in accordance with Test 'Qk', Method 1 of IEC Publication No. 68-2-17 and is now performed in accordance with MIL-STD-883 Test Method 1014 Condition A or B.

Gross Leak was performed in accordance with Test 'Qc', Method 1 of IEC Publication No. 68-2-17 and is now performed in accordance with MIL-STD-883 Test Method 1014 Condition C.

The Electrical Test Methods have been deleted.

DIMENSION CHECK has been re-written: Was "In accordance with ESA/SCC Basic Specification No. 20500 and the Detail Specification. To be performed on 5 samples only. If a failure occurs, the complete lot shall be checked." Now (as part of EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK) "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. In the event of any failure a 100% Dimension Check shall be performed.".

The Test Method and Conditions for Burn-in have been specified (was "Test conditions as specified in the Detail Specification.").

VIBRATION was performed in accordance with Test 'Fc' of IEC Publication No. 68-2-6 and is now performed in accordance with MIL-STD-883 Test Method 2007.

The Shock Test of SHOCK OR BUMP, which was performed in accordance with Test 'Ea' of IEC Publication No. 68-2-27, has been replaced by MECHANICAL SHOCK which is performed in accordance with MIL-STD-883 Test Method 2002 as both a Screening Test (100%) and as part of the Environmental/Mechanical Subgroup of Qualification and Periodic Tests.

Bump has been deleted.

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CLIMATIC SEQUENCE has been deleted.

SOLDERABILITY was performed in accordance with Test 'Ta' Method 1 of IEC Publication No. 68-2-20 and is now performed in accordance with MIL-STD-883 Test Method 2003.

ROBUSTNESS OF TERMINATIONS, which was performed in accordance with Test 'Ua1' of IEC Publication No. 68-2-21, has been replaced by TERMINAL STRENGTH which is performed in accordance with MIL-STD-883 Test Method 2004.

The Test Method and Conditions for OPERATING LIFE have been specified (was "Test Conditions: As specified in the Detail Specification."). The specified duration for Operating Life when performed during Lot Acceptance Testing was 1000 hours; Operating Life is now performed as part of the Endurance Subgroup of Qualification and Periodic Tests and has a single, fixed, duration of 2000 hours.

HIGH TEMPERATURE STORAGE has been deleted.

The following have been added to the TEST METHODS AND PROCEDURES section:

HIGH TEMPERATURE STABILISATION BAKE
MOISTURE STRESS
INTERNAL WATER VAPOUR CONTENT

Justification:

All changes have been defined and included to serve the purposes of technical improvement, clarification, accuracy, completeness, simplification and consistency. The aim is to simplify and improve the content and interpretation of the specification and its requirements whilst maintaining an acceptable technical baseline and the same overall structure as the previous ESCC 3502 Issue 1 (ESA/SCC 3502 Issue 2A). In addition, 3502 Issue 2 has been re-written to closely follow the layout, format and general content of ESCC 9000 as amended by DCRs 50, 138, 148, 182 and 400. Note the justifications for the changes which are common to DCRs 50, 138, 148, 182 and 400 and this DCR also apply to this DCR.

Additional justification for the specific changes to ESCC 3502 Issue 1 are as follows:

The title has been changed to improve its clarity, also to make it consistent with the titles of the â..convertedâ.. Generics.

A reference to ESCC 23800 has to be included in the Generic Specifications of all types of component which are known to be susceptible to electrostatic discharge.

Removing the â..Incorporated Chip Componentsâ. paragraph improves the specâ..s clarity and consistency; this paragraphâ..s inference was that SAW Filters should be considered Hybrid Devices, but the other content of the spec disagreed with this.

The construction methods of, and materials used in, SAW Filters are such that â..Verification of Adhesion Strengthâ.. and â..Total Dose Irradiation Testingâ.. are unnecessary.

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The test methods / procedures prescribed in a Generic should be in accordance with ESCC, ECSS or MIL methods. The IEC System should only be used when it is absolutely necessary to do so (for example when there are no suitable ESCC, ECSS or MIL methods).

There is no need to have a paragraph stating that Encapsulation shall be in accordance with the P.I.D. because the requirements for lid attachment are specified in Paragraph 4.5 (Materials and Finishes).

SAW Filters are considered similar to, even more robust than, Integrated Circuits and therefore the PIND Test Condition defined in ESCC 9000, A (which is more stringent than Test Condition B), has been applied.

The Electrical Test Methods paragraph has been deleted because all the Electrical Measurements to be performed, along with their Methods and Conditions, shall be specified in the Detail Specification(s).

The â..Visual Inspectionâ. and â..Dimension Checkâ. paragraphs have been combined and re-written for the purposes of clarity and consistency (this is standard practice when converting Generics).

The option of either a "Shock or Bump" test was originally specified, implying Bump would not be performed if Shock is performed. It is believed that the Bump test has never been applied by any SAW Filter manufacturers. Shock has therefore been retained on its own, and has been amended to Mechanical Shock (MIL-STD-883 Test Method 2002 Test Condition B; the number of shocks depend on whether the test is performed during Screening or as a Qualification, Qualification Maintenance or Lot Verification test). It has been shown that Mechanical Shock test is not detrimental to SAW Filters (i.e. it can be considered non-destructive) and is a useful Screening Test.

The Climatic Sequence of 'Dry Heat â.. Damp Heat (Accelerated) â.. Cold Test â.. Damp Heat (Accelerated) â.. Recovery â.. Visual Inspection â.. Electrical Measurements' has been replaced by the simpler alternative of Moisture Stress testing (Moisture Resistance and Temperature Cycling). The â..newâ.. Moisture Stress testing will guarantee similar confidence in Component Lots as the â..oldâ.. Climatic Sequence, yet it will be more cost-effective.

The High Temperature Storage test is considered unnecessary due to the nature of the Operating Life Test. In addition a similar test â..High Temperature Stabilisation Bakeâ. has been added to Screening Tests.

Internal Water Vapour Content has been added to the Assembly Capability Subgroup of Qualification and Periodic Tests; it is considered necessary due to the types of hermetically sealed package available for SAW Filters.

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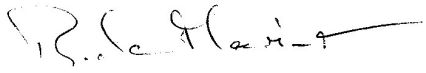
| Attachments: |
| 3502_Issue_2_Draft_B.pdf, null |
| Modifications: |
| N/A |
| Approval signature: |
|  |
| Date signed: |
| 2011-06-17 |

# SURFACE ACOUSTIC WAVE (SAW) FILTERS, HERMETICALLY SEALED

## ESCC Generic Specification No. 3502


| | |
|---|---|
| Issue 2 - Draft B | January 2010 |


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

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| DCR No. | CHANGE DESCRIPTION |
|---|---|
| TBD | Specification upissued to incorporate editorial, technical and policy changes per DCR. |

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## 1. INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification, qualification maintenance, procurement, and delivery of hermetically sealed surface acoustic wave (SAW) filters 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 components qualified in accordance with one of the following ESCC Methods:

– Qualification of Standard Components per ESCC Basic Specification No. 20100.
– Technology Flow Qualification per ESCC Basic Specification No. 25400.

It is also primarily applicable to the procurement of components so qualified.

This specification may also be applied to the procurement of unqualified components, recommendations for which are given in ESCC Basic Specification No. 23100.

## 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 qualification or placing the Purchase Order.

2.1 ESCC SPECIFICATIONS

– No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.
– No. 20400, Internal Visual Inspection.
– No. 20500, External Visual Inspection.
– No. 20600, Preservation, Packaging and Dispatch of ESCC Components.
– No. 20900, Radiographic Inspection of 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. 23100, Recommendations on the use of the ESCC Specification System for the Evaluation and Procurement of Unqualified Components.
– No. 23500, Lead Materials and Finishes for Components for Space Application.
– No. 23800, Electrostatic Discharge Sensitivity Test Method.
– No. 24600, Minimum Quality System Requirements.
– No. 24800, Resistance to Solvents of Marking, Materials and Finishes.
– No. 25400, Requirement for the Technology Flow Qualification of Electronic Components for Space Application.

For qualification and qualification maintenance or procurement of qualified components, with the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800, 24600 and 25400, 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 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.

2.2 OTHER (REFERENCE) DOCUMENTS

– ECSS-Q-ST-70-02, Thermal Vacuum Test for the Screening of Space Materials.
– ECSS-Q-ST-70-13, Measurement of the peel and pull-off strength of coatings and finishes using pressure-sensitive tapes.
– MIL-STD-883, Test Methods and Procedures for Micro-electronics.

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. REQUIREMENTS

4.1 GENERAL

The requirements for the qualification of a component shall be in accordance with ESCC Basic Specification No. 20100.

The requirements for Technology Flow Qualification and the listing of qualified component types shall be in accordance with ESCC Basic Specification No. 25400.

The test requirements for procurement of both qualified and unqualified components (see Chart F1) shall comprise:

– Special In-Process Controls.
– Screening Tests.
– Periodic Testing (for qualified components only).

– Lot Validation Testing if stipulated in the Purchase Order.

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 if stipulated in the Purchase Order) reserves the right to monitor any of the tests and inspections scheduled in the applicable specifications.

4.1.5 Customer Source Inspection

*4.1.5.1 Pre-Encapsulation Customer Source Inspection*

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility prior to encapsulation (including, for example, performance of Internal Visual Inspection, witness of Bond Strength and Adhesion of Metallisation to Substrate). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

*4.1.5.2 Final Customer Source Inspection*

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility at the end of Screening or during Lot Validation Testing, if applicable, (including, for example, witness of final Room Temperature Electrical Measurements, performance of External Visual Inspection and Dimension Check, review of the data documentation package). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

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.

To obtain and maintain the qualification of a component produced using a qualified Technology Flow, a Manufacturer shall satisfy the requirements of ESCC Basic Specification No. 25400.

4.3 DELIVERABLE COMPONENTS

4.3.1 ESCC Qualified Components

Components delivered to this specification shall be processed and inspected in accordance with the relevant Process Identification Document (PID).

4.3.2 ESCC Components

Each component, irrespective of qualification status, identified with an ESCC component number and delivered to this specification shall:

– be traceable to its production lot.
– have satisfactorily completed all the tests required by the relevant issues of the applicable specifications.
– be produced from lots that are considered by the Manufacturer to be 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, demonstrably, it could not have passed these tests at the time of manufacture, this shall be grounds for rejection of the delivered lot.

4.3.3 Lot Failure

Lot failure may occur during Substrate Lot Acceptance (Chart F2), Special In-Process Controls (Chart F2), 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 or analysis shall be performed on the failed components until so instructed by the ESCC Executive.

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 or analysis shall be performed on the failed components until so instructed by the Orderer. The Orderer shall inform the Manufacturer within 5 working days of receipt of notification what action shall be taken.

4.4 MARKING

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

4.5 MATERIALS AND FINISHES

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.

Unless otherwise specified in the Detail Specification the component shall be hermetically sealed and shall have a metal body with hard glass seal or a ceramic body or combination of these. The component case lid shall be welded, brazed, preform soldered or glass frit sealed.

All non-metallic materials and finishes, that are not within a hermetically sealed enclosure, of the components specified in the Detail Specification shall meet the outgassing requirements as outlined in ECSS-Q-ST-70-02.

## 5. PRODUCTION CONTROL

### 5.1 GENERAL

Unless otherwise specified herein or 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 in the sequence 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 requirements are detailed in the paragraphs referenced in Chart F2.

For qualified components the full production control provisions are defined in the PID.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

#### 5.1.1 Rebonding

The rebonding of wires during assembly is not permitted.

### 5.2 SUBSTRATE LOT ACCEPTANCE

#### 5.2.1 Process Monitoring Review

Process monitoring review shall be done in compliance with the Manufacturer's SPC rules described in the PID.

A lot shall be rejected if one or more process control data parameters exceed the allowed distribution as specified in the PID.

### 5.3 SPECIAL IN-PROCESS CONTROLS

#### 5.3.1 Internal Visual Inspection

Internal Visual Inspection shall be performed in accordance with Para. 8.1.

#### 5.3.2 Bond Strength

Bond strength test shall be performed on test samples in accordance with Para. 8.2. A single failure shall be cause for lot failure. This test is considered destructive and therefore components so tested shall not

form part of the delivery lot.

5.3.3 Adhesion of Metallisation to Substrate

Adhesion of Metallisation to Substrate test shall be performed in accordance with Para. 8.2.2 on 2 representative samples. A single failure shall be cause for lot failure. This test is considered destructive and therefore components so tested shall not form part of the delivery lot.

5.3.4 Dimension Check

Dimension Check shall be performed in accordance with Para. 8.10 on 3 samples only.

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

5.3.5 Weight

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

5.3.6 Documentation

Documentation of Special In-Process Controls shall be in accordance with Para. 9.5.

## 6. SCREENING TESTS

6.1 GENERAL

Unless otherwise specified herein or in the Detail Specification, all lots of 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 in the sequence shown. All components shall be serialised prior to the tests and inspections

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 Environmental and Mechanical Test Failure

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, i.e. PIND, Seal, External Visual Inspection and Radiographic Inspection.

6.2.2 Parameter Drift Failure

The acceptable change limits are shown in Parameter Drift Values in the Detail Specification. A component shall be counted as a parameter drift failure if the changes during Burn-in are larger than the drift values ($\Delta$) specified.

6.2.3 Parameter Limit Failure

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

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.

6.2.4 Other Failures

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

– Visual 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 LOT FAILURE

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

6.4.1 Lot Failure during 100% Testing

If the number of components failed on the basis of the failure criteria specified in Paras. 6.2.2 and 6.2.3 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 in the Detail Specification, is exceeded.

Unless otherwise specified, 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

The requirements of this paragraph are applicable to the tests performed on components or test structures as part of qualification or qualification maintenance in accordance with either ESCC Basic Specification No. 20100 or 25400 as applicable. They are also applicable to Lot Validation Testing as part of the procurement of qualified or unqualified components.

7.1 COMPONENT TYPE QUALIFICATION TESTING

7.1.1 General

Qualification testing shall be in accordance with the requirements specified 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. 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 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, depending on whether it is required to obtain qualification for a single component type or for a family of component types.

*7.1.2.1 Single Component Type*

When it is proposed to submit a single component for qualification testing, the sample quantity shall be as specified in Chart F4, Note 1. However, when such a single component type is to be qualified in more than one type of package, each package variation must be equally represented in the Environmental/Mechanical, Endurance and Assembly/Capability subgroups. For this purpose, the applicable sample distribution shall be the same as for the qualification of a family of component types as specified in Chart F4, Note 2 or Note 3.

*7.1.2.2 Family of Component Types*

A family of component types is a series of components produced by the same manufacturing techniques, up to and including final encapsulation, using the same types of machines and apparatus. Such components will be designed for the same supply, bias and signal voltages and for an input/output compatibility with each other under an established set of loading rules. They shall be produced using the same technology and identical design rules.

Qualification may be granted to a family of components subject to the successful outcome of the qualification testing of certain specified component types to represent the family.

Structurally similar components from such a family may be grouped together for the purpose of selecting samples for qualification testing. The component types selected must adequately represent all of the various mechanical, structural and electrical elements encountered within the family.

The component types chosen must be those that employ the extremes of design rules and tolerances and contain the maximum of internal sub-circuitry complexity, i.e. usually those that give the greatest risk of rejection.

When qualification is required for component types in more than one type of package, each package must be adequately represented in the Environmental/Mechanical, Endurance and Assembly/Capability subgroups.

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.

The number of component types selected as representative of the family will therefore determine the total number of components comprising the qualification test lot. Depending on the number of types selected, the sample sizes shall be as specified in Chart F4, Note 2 or Note 3.

In the case of four or more component types selected, different pass/fail criteria from those shown in

Chart F4 may be applicable. When appropriate, these shall be agreed with the ESCC Executive prior to the commencement of qualification testing.

7.2 QUALIFICATION WITHIN A TECHNOLOGY FLOW

The qualification of a component using a qualified Technology Flow shall be in accordance with ESCC Basic Specification No. 25400.

7.3 QUALIFICATION MAINTENANCE (PERIODIC TESTING)

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

Qualification of a component, produced using a qualified Technology Flow, is maintained by the maintenance of the Technology Flow Qualification itself in accordance with ESCC Basic Specification No. 25400.

7.4 LOT VALIDATION TESTING

For procurement of qualified components, Lot Validation Testing is not required and shall only be performed if specifically stipulated in the Purchase Order.

For procurement of unqualified components the need for Lot Validation Testing shall be determined by the Orderer (ref. ESCC Basic Specification No. 23100).

When Lot Validation Testing is required, it shall consist of the performance of one or more of the tests or subgroup test sequences of Chart F4. The testing to be performed and the sample size shall be as stipulated in the Purchase Order.

When procurement of more than one component type is involved from a family, range or series, the selection of representative samples shall also be stipulated in the Purchase Order.

7.5 FAILURE CRITERIA

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

7.5.1 Environmental and Mechanical Test Failures

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. Seal, Terminal Strength, etc.

7.5.2 Electrical Failures

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.

7.5.3 Other Failures

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

– Visual failure
– Mechanical failure
– Handling failure
– Lost component

7.6 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 7.5.

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 under the responsibility of 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.

7.7 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 specified in Para. 7.5.

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 specified in Para. 7.5.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

7.8 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING SAMPLES

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

7.9 DOCUMENTATION

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

## 8. TEST METHODS AND PROCEDURES

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 qualified 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 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 the Orderer, subject to the approval of the ESCC Executive.

8.1 INTERNAL VISUAL INSPECTION

ESCC Basic Specification No. 20400.

8.2 BOND STRENGTH AND ADHESION OF METALLISATION TO SUBSTRATE

8.2.1 Bond Strength

MIL-STD-883 Test Method 2011

– Test condition C or D for thermo-compression, ultrasonic, thermosonic or wedge bonding.
– Test condition G or H for beam lead bonding.

Test samples: For Special In-Process Controls the required test samples shall be selected at random from the lot of components accepted after Internal Visual Inspection.

For Qualification and Periodic Tests the required test samples shall be selected from the components in the Assembly Capability Subgroup of Chart F4.

Quantity of internal bond wires 8 or less; Test samples = 3, Test all bonds
Quantity of internal bond wires 9 to 24; Test samples = 2, Test all bonds
Quantity of internal bond wires 25 or more; Test samples = 2, Test 50% of bonds

If agreed by the ESCC Executive (for qualification or qualification maintenance) or the Orderer (for procurement) the test samples for Special In-Process Controls may have only passed the low magnification phase of the Internal Visual Inspection.

Individual separation forces and categories shall be recorded. A single failure shall be cause for lot failure.

8.2.2 Adhesion of Metallisation to Substrate

Unless otherwise specified, a peel and pull-off test shall be performed in accordance with ECSS-Q-ST-70-13 and the Detail Specification on two representative transducer samples per lot.

The test is limited to pressure-sensitive tape having a peel adhesion strength of 440 g/cm +/- 10%.

A single failure shall be cause for lot failure.

8.3 HIGH TEMPERATURE STABILISATION BAKE

MIL-STD-883, Test Method 1008, Duration: 24 hours at maximum storage temperature rating specified in the Detail Specification.

8.4 TEMPERATURE CYCLING

MIL-STD-883, Test Method 1010. Test Condition B.

Chart F3: 10 cycles
Chart F4: 100 cycles

8.5 PARTICLE IMPACT NOISE DETECTION (PIND)

MIL-STD-883, Test Method 2020, Test Condition A.

8.6 SEAL

8.6.1 Seal, Fine Leak

MIL-STD-883, Test Method 1014, Condition A or B.

8.6.2 Seal, Gross Leak

MIL-STD-883, Test Method 1014, Condition C.

8.7 ELECTRICAL MEASUREMENTS

8.7.1 Parameter Drift Values

At each of the relevant data points during Screening Tests, Parameter Drift Values shall be measured as specified in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated.

8.7.2 High and Low Temperatures Electrical Measurements

High and Low Temperatures Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers.

8.7.3 Room Temperature Electrical Measurements

Room Temperature Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers.

8.7.4 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.

8.8 EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK

External Visual Inspection shall be performed in accordance with ESCC Basic Specification No. 20500.

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

8.9 MECHANICAL SHOCK

MIL-STD-883, Test Method 2002, Test Condition: B.

Chart F3: 5 shocks
Chart F4: 10 shocks

8.10 VIBRATION

MIL-STD-883, Test Method 2007, Test Condition: A.

8.11 CONSTANT ACCELERATION

MIL-STD-883, Test Method 2001, Y1 axis.

Cond. B for package sizes up to 25.4mm x 25.4 mm.
Cond. A for package sizes above 25.4mm x 25.4 mm and up to 25.4mm x 50.8 mm.

Not applicable for package sizes above 25.4mm x 50.8mm.

8.12 MOISTURE STRESS

Components shall be subjected to a moisture resistance test followed by a temperature cycling test in accordance with the following conditions:

– Phase 1, Moisture Resistance:
  - Relative humidity: 85 ±3%
  - Temperature: +85 ±5$^{o}$C
  - No electrical bias
  - Duration: 240 hours

– Phase 2, Temperature Cycling
  - MIL-STD-883, Test Method 1010, Test Condition: B.
  - number of cycles: 10

8.13 SOLDERABILITY

MIL-STD-883, Test Method 2003, to be performed on all terminals.

Solderability testing may be performed on empty packages or electrical rejects. The test samples used must be of the same package type and must have been manufactured using the same process, at the same time and have been subjected to the same screening as the packages of the delivery lot with which they are associated.

For components with gold plated lead finish activated fluxes (RMA and RA) may be used but shall be immediately cleaned off after dipping using an acceptable solvent.

8.14 PERMANENCE OF MARKING

ESCC Basic Specification No. 24800.

8.15 TERMINAL STRENGTH

MIL-STD-883, Test Method 2004, Test Condition D for leadless packages or Test Condition B2 for all other packages. For Condition B2, 3 leads (excluding corner leads when possible) or 10% of the leads (whichever is greater) shall be randomly selected on each component.

8.16 OPERATING LIFE

MIL-STD-883, Test Method 1005.

– Duration: 2000 hours.

– Conditions: no power applied.
– Temperature: +125°C
– 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.

8.17 BURN-IN

MIL-STD-883, Test Method 1015.

– Duration: Unless otherwise specified in the Detail Specification, components shall be subjected to a total burn-in period of 240 (+24 -0) hours.
– Conditions: no power applied.
– Temperature: +125°C
– Data Points.
  As specified in Parameter Drift Values in the Detail Specification at T (+24 -0) hours (where T is the specified duration).

8.18 INTERNAL WATER VAPOUR CONTENT

MIL-STD-883, Test Method 1018, procedure 1.

The maximum allowable water-vapour content shall be 5000ppmv.

8.19 RADIOGRAPHIC INSPECTION

In accordance with ESCC Basic Specification No. 20900.

## 9. DATA DOCUMENTATION

9.1 GENERAL

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 (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 medium is CD-ROM and the preferred file format is 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 Component Procurement and Delivery

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 (including range of delivered serial numbers).

9.1.3 Additional Documentation

The Manufacturer shall deliver additional documentation containing data and reports to the Orderer, if stipulated 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 COVER SHEETS

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) Range of delivered serial numbers.
(f) Number of the Purchase Order.
(g) Information relative to any additions to this specification and/or the Detail Specification.
(h) Manufacturer's name and address.
(i) Location of the manufacturing plant.
(j) Signature on behalf of Manufacturer.
(k) 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. 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. For the Bond Strength and Adhesion of Metallisation to Substrate tests, the separation forces and categories shall be recorded.

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. For each test requiring electrical measurements the results shall be recorded against component serial number. Component drift calculations shall be recorded for each specified test against component serial number.

9.7 QUALIFICATION AND PERIODIC TESTS DATA (CHART F4)

9.7.1 Qualification Testing

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) Traceability information including 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 CERTIFICATE OF CONFORMITY

A Certificate of Conformity shall be established in accordance with the requirements of ESCC Basic Specification No. 20100 or ESCC Basic Specification No. 25400.

## 10. DELIVERY

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

(a) The delivery lot.
(b) The components used for Lot Validation Testing (as applicable), but not forming part of the delivery lot, if stipulated in the Purchase Order.
(c) The relevant documentation in accordance with the requirements of Paras. 9.1.2 and 9.1.3.

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.

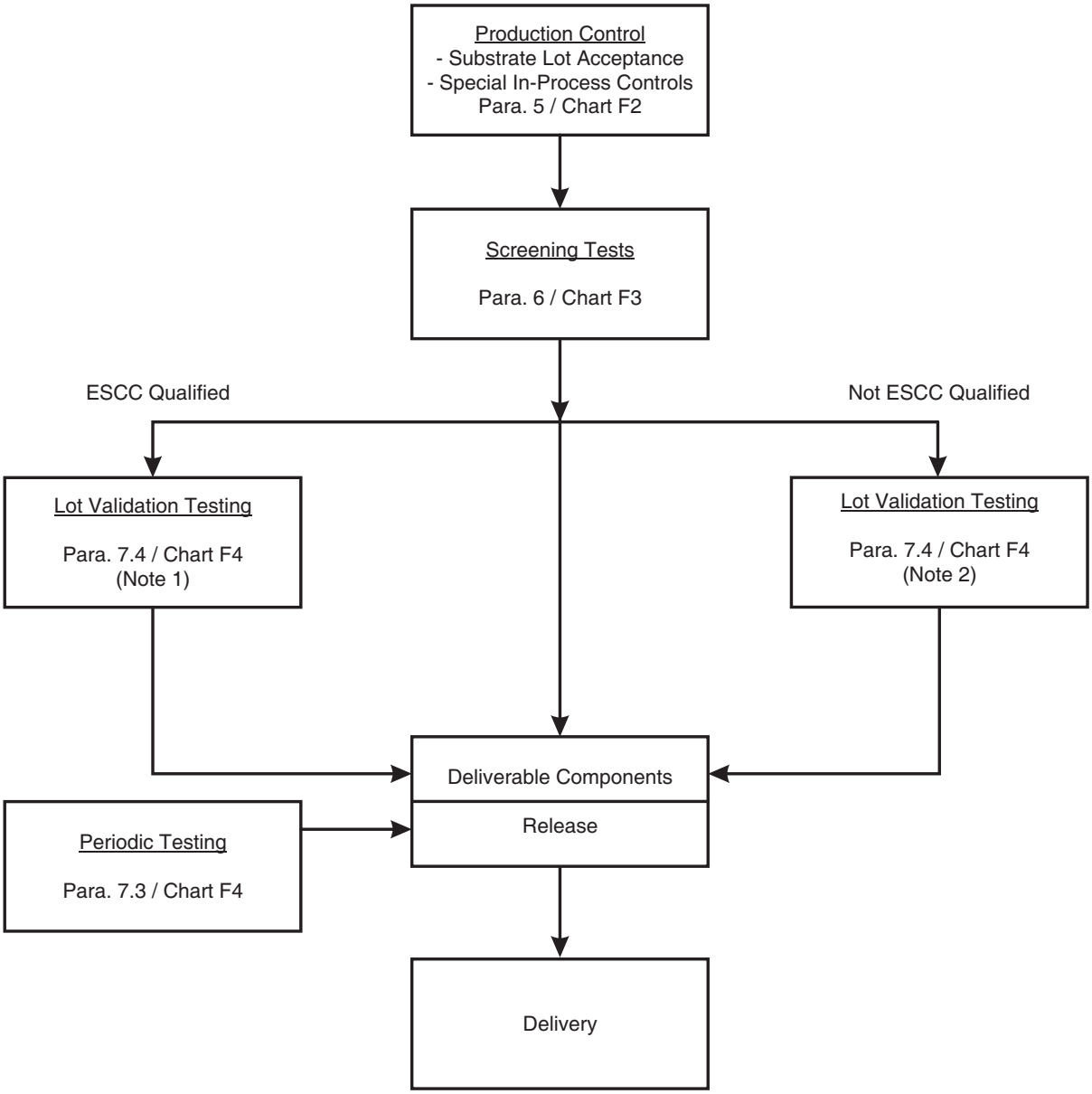
For qualification or qualification maintenance, the disposition of the Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification Nos. 20100 or 25400 and the relevant paragraphs of Section 9 of this specification.

## 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. CHARTS

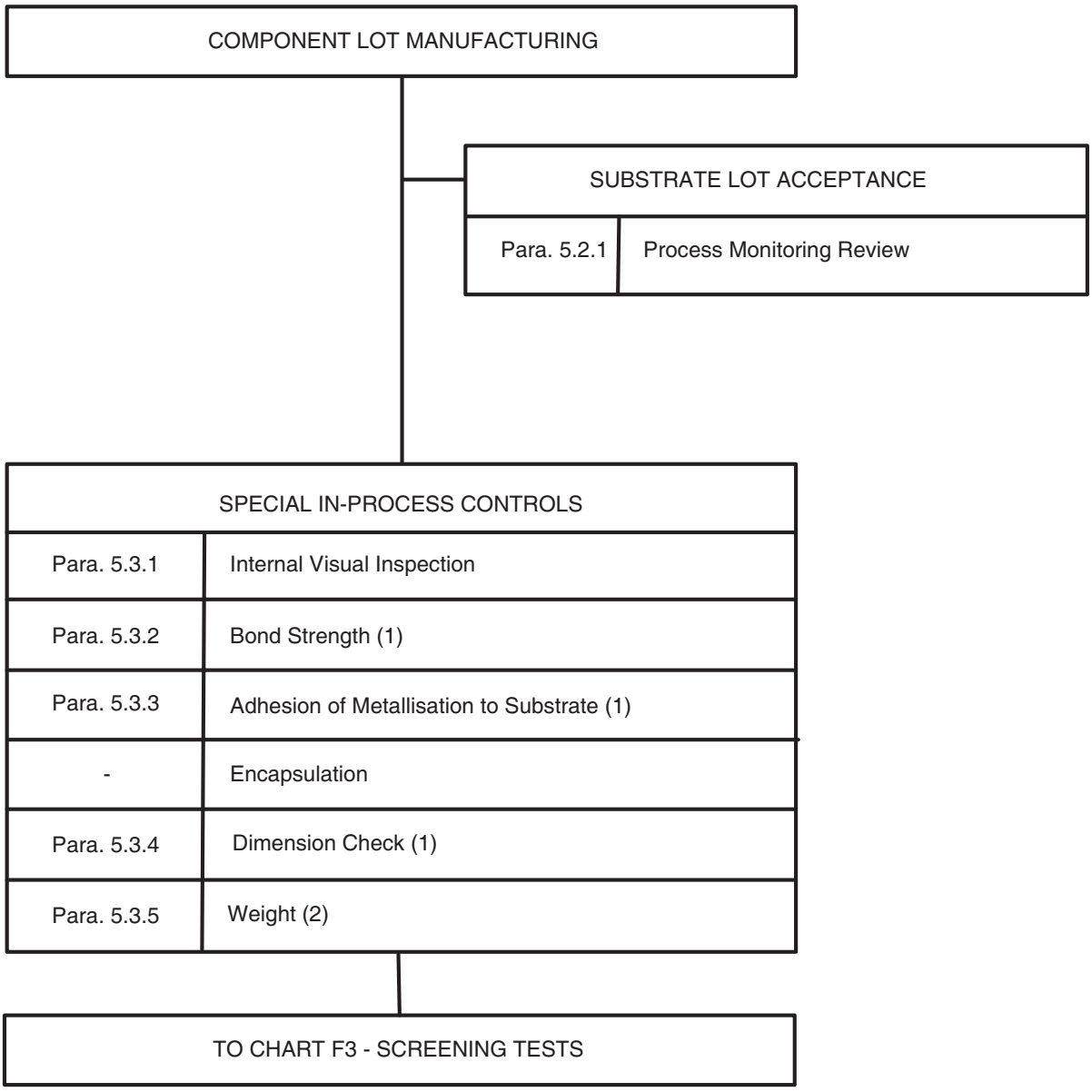
### 12.1 CHART F1 - GENERAL FLOW FOR PROCUREMENT




**NOTES:**

1. Lot Validation Testing is not required for qualified components unless specifically stipulated in the Purchase Order.
2. For unqualified components the need for Lot Validation Testing shall be determined by the Orderer and the required testing shall be as stipulated in the Purchase Order (ref. ESCC Basic Specification No. 23100).

12.2 CHART F2 - PRODUCTION CONTROL




**NOTES:**
1. Performed on a sample basis.
2. Guaranteed but not tested.

12.3 CHART F3 - SCREENING TESTS

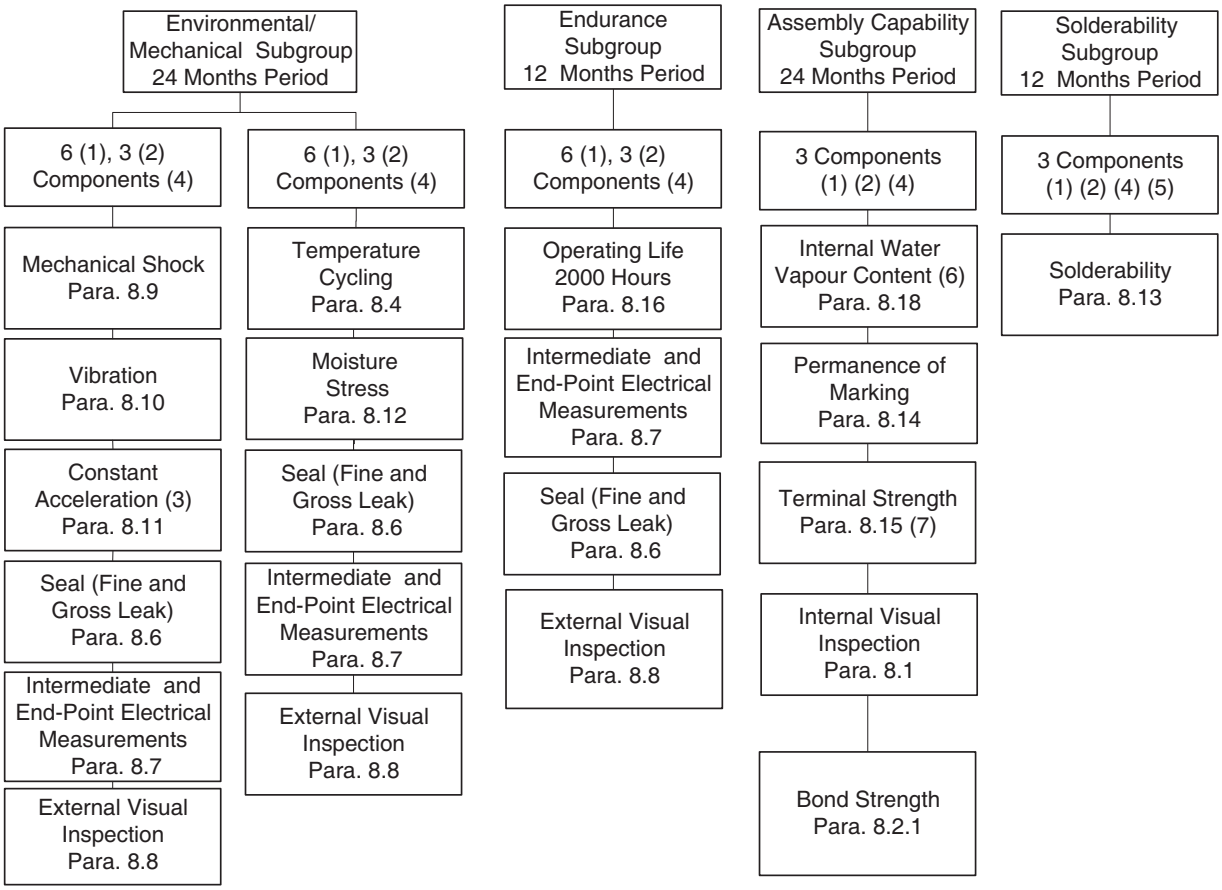
| | |
|---|---|
| COMPONENTS FROM PRODUCTION CONTROL | |
| Para. 6.1 | Serialisation |
| Para. 8.3 | High Temperature Stabilisation Bake |
| Para. 8.4 | Temperature Cycling |
| Para. 8.9 | Mechanical Shock |
| Para. 8.5 | Particle Impact Noise Detection (PIND) |
| Para. 8.7 | Parameter Drift Values (Initial Measurements) (1) |
| Para. 8.17 | Burn-in |
| Para. 8.7 | Parameter Drift Values (Final Measurements) (1) |
| Para. 8.7.2 | High and Low Temperatures Electrical Measurements (1) |
| - | Hot Solder Dip (if applicable) (2) |
| Para. 8.7.3 | Room Temperature Electrical Measurements (1) (3) |
| Para. 6.4.1 | Check for Lot Failure (4) |
| Para. 8.19 | Radiographic Inspection |
| Para. 8.6 | Seal (Fine and Gross Leak) |
| Para. 8.8 | External Visual Inspection |
| TO CHART F4 WHEN APPLICABLE | |

**NOTES:**
1. The lot failure criteria of Para. 6.4 apply to this test.
2. For components with hot solder dip final lead finish the hot solder dip processing shall be performed at any time prior to Room Temperature Electrical Measurements during Screening Tests. The

requirements for hot solder dip are specified in ESCC Basic Specification No. 23500.

3. Measurements of Parameter Drift Values need not be repeated in Room Temperature Electrical Measurements.
4. Check for Lot Failure shall take into account all electrical parameter failures that may occur during Screening Tests in accordance with Paras. 8.9.1, 8.9.2, 8.9.3 subsequent to Burn-in.

12.4 CHART F4 - QUALIFICATION AND PERIODIC TESTS




**NOTES:**

1. Single type (see Para. 7.1.2.1)
2. Per type for two types selected (see Para. 7.1.2.2)
3. If applicable.
4. No failures are permitted.
5. When both the Assembly Capability Subgroup and the Solderability Subgroup are being performed, they may be integrated into a single subgroup of 3 components per package type. Solderability shall be the first test in the sequence.
6. One component per package type shall be tested.
7. Upon completion of Terminal Strength the components shall be de-encapsulated using suitable means to facilitate Internal Visual Inspection and Bond Strength.