DOCUMENT CHANGE REQUEST

DCR number 562	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2009/12/04	Date sent: 2009/12/04	Organisation:
Status: IMPLEMENTED		

Title:	Generic Specification for Charge Coupled Devices Silicon Photosensitive		
Number:	9020	Issue:	1

Other documents affected:

Page:

Specification 9020 issue 1 is re-written as issue 2 to incorporate changes as summarised herein (see Attached for proposed issue 2 that incorporates all the changes).

The layout, format and general content of 9020 issue 2 is based closely on the latest

Paragraph:

Specification 9020 issue 1 is re-written as issue 2 to incorporate changes as summarised herein (see Attached for proposed issue 2 that incorporates all the changes).

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Original wording:

Proposed wording:

Specification is amended to incorporate various policy, technical & editorial amendments & corrections, to implement the proposals of the ESCC CCD and Image Sensors Working Group, as well as to bring all ESCC generic specifications (that have already been converted to the new ESCC format) in line with each other (e.g. ESCC 9000, 5000).

Many of the various changes incorporated into ESCC 9000 issue 6, as detailed and justified in DCR50, DCR138, DCR182, DCR400 have also been included in ESCC 9020 issue 2. These include the following main editorial, policy and technical changes:

a) The Specification has been made applicable and fully usable for procurement of unqualified components as well as for ESCC Qualified components.

b) Reference to the MIL sampling standards have been deleted.

c) Final Production Tests & Burn-in and Electrical Measurements Charts have been incorporated, with some modifications,

into a single Chart "Screening Tests". Some tests from Final Production Tests are incorporated into Special In-Process Controls.

d) The General Flow Chart has been redrawn to clarify the flow of components for Procurement.

e) The SCC testing level C has been deleted; there is now only a single ESCC testing level in ESCC 9020 equivalent to old SCC level B.

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

g) Qualification and Lot Acceptance Testing have been incorporated, with some modifications, into a single Chart F4: "Qualification and Periodic Tests".
Periodic testing is mandatory for qualified components with a defined testing schedule.
Lot Acceptance Testing during procurement has been deleted but an option for customer selected Lot Validation Testing has been added.
Zero failures are allowed during Qualification and Periodic Tests

h) Dimension check is performed on 3 samples instead of 5.

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

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

k) Clarification that the term 'PID' is specific to ESCC qualified components.

l) The concept that Lot Validation Testing is not required for qualified components and Lot Validation Testing will only be done, for either qualified or unqualified components, if specifically stipulated by the Orderer in the PO.

m) The requirement placed on qualified sources to not knowingly supply components that cannot meet the Chart F4 testing is extended to unqualified sources.

n) The introduction of Technology Flow Qualification per ESCC No. 25400.

o) Definition/clarification of available Customer Source Inspections (Pre & Post Encapsulation, plus Final)

p) Definition of failures during Screening, and Qualification, Qualification Maintenance and Lot Validation Testing is corrected to include Visual failures.

q) Obsolete reference documents (i.e. PSS, in Para 2.1) are corrected.

Additional technical changes that apply specifically to ESCC 9020 issue 1 (not related to DCR50, DCR138, DCR182,

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DCR400) are as follows:

r) 'CMOS Imaging Sensors' are added to the title & scope of the Generic Spec.

s) Addition of the definition of hermetic and non-hermetic packages together with clarification & specification of the testing required on these 2 types of package (i.e. Mobile Particle Detection, Seal, Moisture Stress, Internal Gas Analysis).

t) Production Control testing is split to include both Wafer Lot Acceptance and Special In-Process Control.
Special In-Process Control testing amended to include some Final Production Tests and some new tests (new tests are: Substrate Attach Strength, Particle Mapping, Coating Peel and Pull-off Strength).
See attached 9020 issue 2 Draft N new Chart F2 for details.

u) Lot failure during 100% inspection (Para 7.4.1, PDA) is amended to be 5% (was 10%).

v) Charts II & III are amended (to be single Chart F3: Screening Tests) including deletion of some mandatory & optional tests, addition of new tests, as well as some changes in order of tests (new tests are: Particle Mapping, Internal Visual Inspection).
Mobile Particle Detection (equivalent function to PIND Testing in ESCC9000) only applies to hermetic package components. For non-hermetic package components an Internal visual Inspection is performed. No particle removal is permitted (on non-hermetic components) after Particle Mapping in Chart F2.
Internal Visual Inspection is added as a new test in 2 places (may be performed on a partial basis for hermetic package components).
See attached 9020 issue 2 Draft N Chart F3 for details.

w) Charts IV & V are amended (to be single Chart F4: Qualification and Periodic Tests) including deletion of some mandatory tests, addition of new tests, changes in sample size, as well as some changes in order of tests (new tests are: Geometrical Dimension Check, Particle Mapping, Internal visual Inspection, Bond Strength, Die Shear or Substrate Attach Strength, Moisture Stress, Internal Gas Analysis)
Internal Visual Inspection which is added as a new test in 4 places in the new Chart F4 (performed with External Visual Inspection) may be performed on a partial basis for hermetic package components.
A new Control Component Subgroup with 2 control components, to be used for comparison purposes, is added to Chart F4.
See attached 9020 issue 2 Draft N Chart F4 for details.

x) Constant Acceleration testing is deleted (from Final Production Tests & Qual & LAT).

y) Bond Strength: the sample size is fixed at 2 for all components.

z) Seal Test: MIL test conditions are amended to be 'A' only for Fine leak, and 'C' or 'D' for Gross leak.

Justification:

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Note - this DCR replaces rejected DCR475

All changes to ESCC9020 issue 1 (points a) to z) above) have been defined and included to serve the purposes of technical improvement, clarification, accuracy, completeness, simplification and consistency.
Specific technical changes (points r) to z) above) are consistent with proposals made by the ESCC CCD and Image Sensors Working Group.

In addition ESCC9020 has been re-written to closely follow the layout, format and general content of ESCC 9000 issue 6 per DCR50, DCR138, DCR182, DCR400 (points a) to q) above). The justifications for the same changes included in DCR50, DCR138, DCR182, DCR400 also apply to this DCR.

Attachments:

9020DraftN.pdf, null

Modifications:

N/A

Approval signature:

Date signed:

2009-12-04

Pages 1 to 28

PHOTOSENSITIVE CHARGE COUPLED DEVICES AND CMOS IMAGING SENSORS WITH HERMETIC AND NON-HERMETIC PACKAGES

ESCC Generic Specification No. 9020

Issue 2 - Draft N	November 2009

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

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

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

TABLE OF CONTENTS

1. INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification, qualification maintenance, procurement, and delivery of photosensitive charge coupled device and CMOS imaging sensor components with hermetic and non-hermetic packages 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. 21400, Scanning Electron Microscope Inspection of Semiconductor Dice.
– No. 21700, General Requirements for the Marking of ESCC Components.
– No. 22800, ESCC Non-Conformance Control System.
– No. 22900, Total Dose Steady-State Irradiation Test Method.
– 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. 25000, Electro-optical Test Methods for Charge Coupled Devices.
– No. 25400, Requirements 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 Tape.
– 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. In addition the following shall apply:

Hermetic Package:	A component package which by design or construction is able to pass a seal test.
Non-Hermetic Package:	A component package which by design or construction is unable to pass a seal test.

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:

– Wafer Lot Acceptance with, if stipulated in the Purchase Order, total dose radiation testing.
– 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 or Post Encapsulation Customer Source Inspection

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility prior to or post encapsulation (including, for example, performance of Internal Visual Inspection, witness of Bond Strength and either Die Shear or Substrate Attach Strength). 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 Reference Temperature Electrical Measurements, performance of External Visual Inspection and Physical 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 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 Wafer 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.

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.

4.6 RADIATION TESTING

For qualification or qualification maintenance total dose radiation testing shall be performed when specified in the Detail Specification to the specified total dose level.

For procurement, as stipulated in the Purchase Order, total dose radiation testing shall be performed to the total dose level specified in the Detail Specification or to an alternate level if so stipulated in the Purchase Order.

The qualification status of the procured components shall not be impacted by any change to the total dose level applied.

For procurement any lot of components that fails the specified total dose radiation test level may be accepted to a lower level of radiation subject to satisfactory test results at the lower level. In this case the total dose radiation level letter for the lot shall be modified accordingly.

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 WAFER LOT ACCEPTANCE

5.2.1 Process Monitoring Review (Qualified Components Only)

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

the PID (for qualification, qualification maintenance or procurement of qualified components).

A wafer shall be rejected if one or more process control data parameters exceed the allowed distribution as specified in the PID (for qualification, qualification maintenance or procurement of qualified components).

5.2.2 Scanning Electron Microscope (SEM) Inspection

Components supplied to this specification shall be produced from a wafer lot that has been subjected to, and successfully met, the Scanning Electron Microscope Inspection requirements in accordance with Para. 8.5.

5.2.3 Total Dose Radiation Testing

For qualification or qualification maintenance:

– If specified in the Detail Specification, components shall be produced from a wafer lot which has been subjected to and successfully completed Total Dose Radiation Testing on packaged components in accordance with Para. 8.6 to the specified total dose level.

During procurement:

– If specified in the Detail Specification and stipulated in the Purchase Order, components shall be produced from a wafer lot which has been subjected to and successfully completed Total Dose Radiation Testing on packaged components in accordance with Para. 8.6 to the stipulated total dose level.

5.2.4 Documentation

Documentation of Wafer Lot Acceptance shall be in accordance with Para. 9.5.

5.3 SPECIAL IN-PROCESS CONTROLS

5.3.1 Internal Visual Inspection

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

Internal Visual Inspection may be performed after encapsulation on the condition that the attached window allows a complete overall view of the cavity and of the component's construction.

5.3.2 Bond Strength, and Die Shear or Substrate Attach Strength

Bond Strength and either Die Shear or Substrate Attach Strength tests shall be performed on test samples in accordance with Para. 8.2. A single failure shall be cause for lot failure. These tests are considered as destructive and therefore components so tested shall not form part of the delivery lot.

5.3.3 Physical Dimension Check

Physical Dimension Check shall be performed in accordance with Para. 8.3.1 on 3 samples only.

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

5.3.4 Geometrical Dimension Check

Geometrical Dimension Check shall be performed in accordance with Para. 8.3.2.

5.3.5 Particle Mapping

Particle Mapping shall be performed in accordance with Para. 8.3.3

5.3.6 Coating Peel and Pull-off Strength

If specified in the Detail Specification Coating Peel and Pull-off Strength tests shall be performed on test samples in accordance with Para. 8.4. A single failure shall be cause for lot failure. These tests are considered as destructive and therefore components so tested shall not form part of the delivery lot.

5.3.7 Weight

Unless otherwise specified, the maximum weight of the component specified in the Detail Specification shall be guaranteed but not tested.

5.3.8 Documentation

Documentation of Special In-Process Controls shall be in accordance with Para. 9.6.

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.

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. Mobile Particle Detection, Seal and External Visual 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 (Δ) 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 Reference 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 of 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.

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

6.5 DOCUMENTATION

Documentation of Screening Tests shall be in accordance with Para. 9.7.

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 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 specified in ESCC Basic Specification No. 20100.

7.1.2 Distribution within the Qualification Test Lot

Where a Detail Specification covers a range, or series of components that are considered similar, then the Qualification Test Lot shall be comprised of component types so selected that they adequately represent all of the various mechanical, structural and electrical peculiarities of that range or series.

The distribution shall be as specified by, or agreed with, the ESCC Executive.

7.2 QUALIFICATION WITHIN A TECHNOLOGY FLOW

The qualification of a component produced 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 given 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 by 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 and 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. 9.8.

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 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 INTERNAL VISUAL INSPECTION

ESCC Basic Specification No. 20400.

For hermetic package components inspected after encapsulation, a full Internal Visual Inspection may be possible through the attached window if the window allows a complete overall view of the cavity and of the component's construction. If a full Internal Visual Inspection is not possible a Partial Internal Visual Inspection shall be performed. In such cases the Partial Internal Visual Inspection shall be as specified in the Detail Specification.

8.2 BOND STRENGTH, AND DIE SHEAR OR SUBSTRATE ATTACH STRENGTH

8.2.1 Bond Strength

MIL-STD-883 Test Method 2011

- Test condition C or D for thermo-compression, ultrasonic or wedge bonding.
- Test condition F for flip-chip bonding.
- Test condition G or H for beam lead bonding.

Test samples: For Special In-Process Controls 2 test samples shall be selected at random from the lot of components accepted after Internal Visual Inspection. All bonds shall be tested.

For Qualification and Periodic Tests 2 test samples shall be selected for each applicable Subgroup test of Chart F4. All bonds shall be tested.

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 Die Shear or Substrate Attach Strength

MIL-STD-883 Test Method 2019 or 2027.

The same test samples submitted to Bond Strength shall be used. Individual separation forces and categories shall be recorded. A single failure shall be cause for lot failure.

8.3 EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK

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

8.3.1 Physical Dimension Check

Physical 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% Physical Dimension Check shall be performed.

8.3.2 Geometrical Dimension Check

Geometrical Dimension Check (during Special In-Process Controls only) shall be performed in accordance with ESCC Basic Specification No. 20500 and the Detail Specification on all components unless otherwise specified.

8.3.3 Particle Mapping

Any foreign particle within the package that is large enough to reduce the narrowest spacing between unglassivated operating material to less than 50% (metallisation, bare semiconductor material, mounting material, bonding wire, etc.) or is greater than or equal to the minimum particle size for pixel occultation, as specified in the Detail Specification, shall be identified and recorded against serial number, and by its xy location and size. If any such particle has moved from its initial location recorded during Special In-Process Controls the component shall be rejected.

8.4 COATING PEEL AND PULL-OFF STRENGTH

Unless otherwise specified, a peel and pull-off test shall be performed on the window and/or the die coating in accordance with ECSS-Q-ST-70-13 and the Detail Specification on 2 representative samples per lot and per coating lot. A single failure shall be cause for lot failure.

8.5 SCANNING ELECTRON MICROSCOPE INSPECTION

ESCC Basic Specification No. 21400.

8.6 TOTAL DOSE RADIATION TESTING

ESCC Basic Specification No. 22900 to the total dose level specified in the Detail Specification or as stipulated in the Purchase Order.

Prior to the irradiation test sequence, the test samples shall be subjected to High Temperature Stabilisation Bake in accordance with Para. 8.7 followed by Burn-in in accordance with Para. 8.11.

8.7 HIGH TEMPERATURE STABILISATION BAKE

MIL-STD-883, Test Method 1008, Duration: 48hours at maximum storage temperature rating specified in the Detail Specification.

8.8 TEMPERATURE CYCLING

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

For Screening Tests number of test cycles = 10.
For Qualification and Periodic Tests number of cycles = 50.

8.9 MOBILE PARTICLE DETECTION

Hermetic package components only

Components shall be subjected to a mechanical shock/vibration test as specified in MIL-STD-883 Test Method 2020 Test Condition A or MIL-STD-883 Test Method 2002 Test Condition A. The test method

shall be as specified in the Detail Specification.

Particle Mapping shall be performed in accordance with Para. 8.3.3 before and after the mechanical shock/vibration test sequence.

8.10 ELECTRICAL MEASUREMENTS

8.10.1 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.

8.10.2 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.

8.10.3 Reference Temperature Electrical Measurements

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

8.10.4 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.

8.11 BURN-IN

MIL-STD-883, Test Method 1015 Test Condition B, D or E.

- Duration
  Unless otherwise specified in the Detail Specification, components shall be subjected to a total Burn-in period of 240 (+24 -0) hours.

- Test Conditions
  As specified in Burn-in in the Detail Specification.
  The alternative temperature and time combinations per MIL-STD-883 Test Method 1015 are permissible provided that the maximum operating ratings for a component are not exceeded.

- Data Points
  As specified in Parameter Drift Values in the Detail Specification at 0 hours (initial) and T (+24 -0) hours (where T is the specified duration). Drift shall be related to the initial measurement.

8.12 SEAL

Hermetic package components only.

8.12.1 Seal, Fine Leak

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

8.12.2 Seal, Gross Leak

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

8.13 MECHANICAL SHOCK

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

8.14 VIBRATION

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

8.15 MOISTURE STRESS

A moisture stress test shall be performed as follows depending on the package.

(a) For Hermetic Package Components
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%
  - ambient temperature: +85°C
  - no electrical bias
  - duration: 240 hours

– Phase 2: Temperature cycling around dew point
  - cycling between -10°C and +50°C under a non-condensing atmosphere
  - rate: 3°C/minute
  - low temperature and high temperature dwell time: 3 hours
  - number of cycles: 10
  - electrical bias shall be applied.

(b) For Non-Hermetic Package Components
Components shall be subjected to a bake in accordance with the following conditions:
- relative humidity: 70%
- ambient temperature: +70°C
- no electrical bias
- duration: 500 hours

8.16 HIGH TEMPERATURE STORAGE

MIL-STD-883, Test Method 1008, Duration: 2000 hours at maximum storage temperature rating specified in the Detail Specification.

8.17 OPERATING LIFE

MIL-STD-883, Test Method 1005.

– Duration: 2000 hours.

– Conditions: As specified in Operating Life in the Detail Specification.

– 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.

8.18 PERMANENCE OF MARKING

ESCC Basic Specification No. 24800.

8.19 INTERNAL GAS ANALYSIS

Hermetic package components only.

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

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

8.20 TERMINAL STRENGTH

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

8.21 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, RA, and OA) may be used but shall be immediately cleaned off after dipping using an acceptable solvent.

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) Wafer Lot Acceptance data (Chart F2).
(e) Special In-Process Controls data (Chart F2).
(f) Screening Tests data (Chart F3).
(g) Qualification and Periodic Tests data including Lot Validation Testing data (when applicable) (Chart F4).
(h) Failed components list and failure analysis report (when applicable).
(i) Certificate of Conformity.

Items (a) to (i) 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 available 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 (i) 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 SHEET(S)

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) Total dose radiation test level (if applicable).
(h) Information relative to any additions to this specification and/or the Detail Specification.
(i) Manufacturer's name and address.
(j) Location of the manufacturing plant (specify place of diffusion, assembly and test).
(k) Signature on behalf of Manufacturer.
(l) 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 WAFER LOT ACCEPTANCE DATA (CHART F2)

Data of SEM Inspection shall be prepared in accordance with the requirements of ESCC Basic Specification No. 21400.

Total dose radiation test report shall be prepared in accordance with the requirements of ESCC Basic Specification No. 22900 (if specified).

9.6 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 either Die Shear or Substrate Attach Strength tests, the separation forces and categories shall be recorded.

9.7 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. Particle Mapping results shall be recorded against serial number.

9.8 QUALIFICATION AND PERIODIC TESTS DATA (CHART F4)

9.8.1 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.

9.8.2 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.

9.8.3 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.

9.9 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 Wafer Lot Acceptance, Special In-Process Controls, Screening Tests and Qualification and Periodic Tests.
(b) Traceability information including 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).

9.10 CERTIFICATE OF CONFORMITY

A Certificate of Conformity shall be established in accordance with the requirements of ESCC Basic Specification Nos. 20100 or 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.

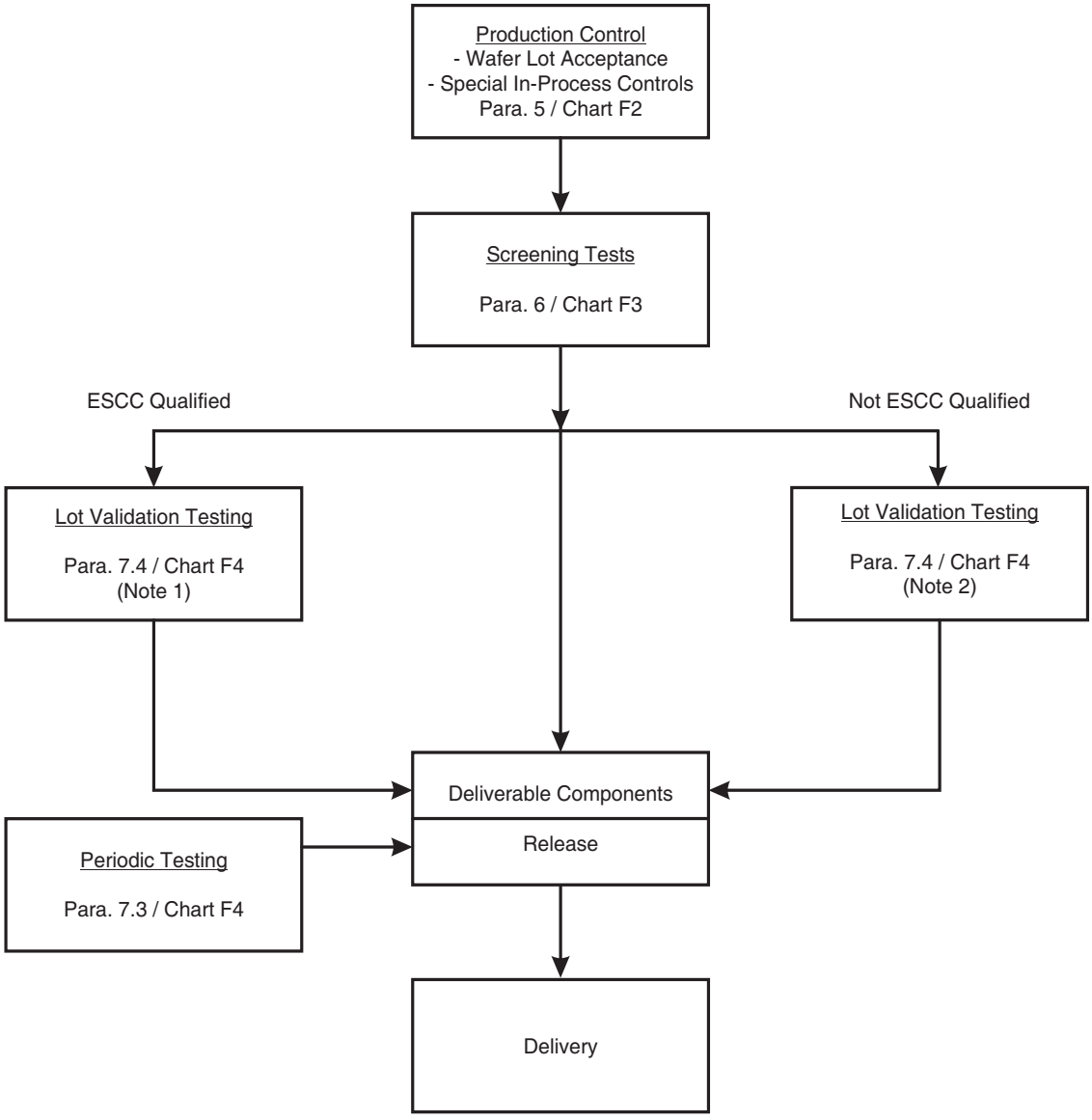
For qualification or qualification maintenance, the disposition of the Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification Nos. 20100 or 25400 and the relevant paragraphs of Section 9 of this specification.

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. Each component's primary package shall be hermetically sealed in a dry nitrogen atmosphere.

12. CHARTS

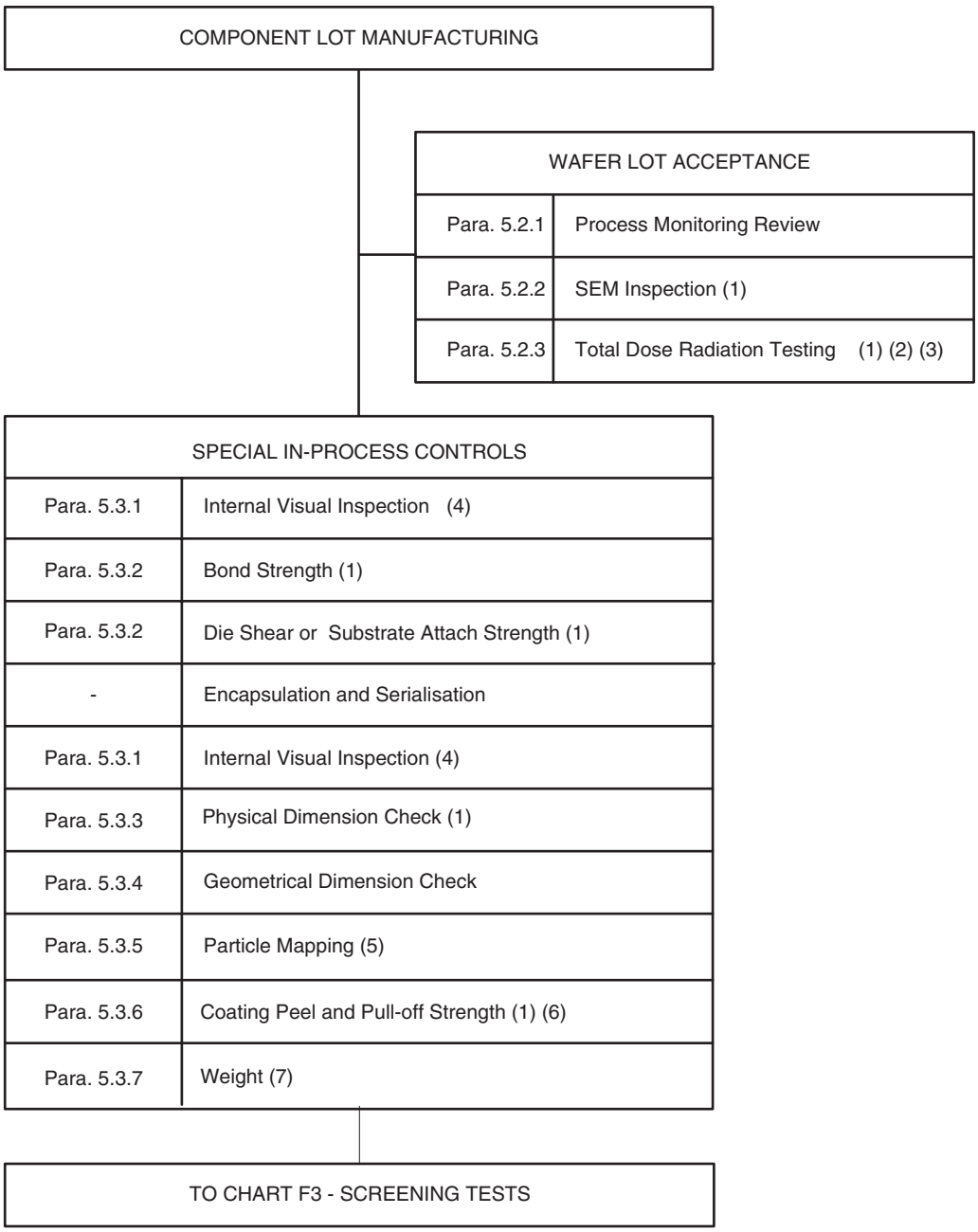
12.1 CHART F1 - GENERAL FLOW FOR PROCUREMENT



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

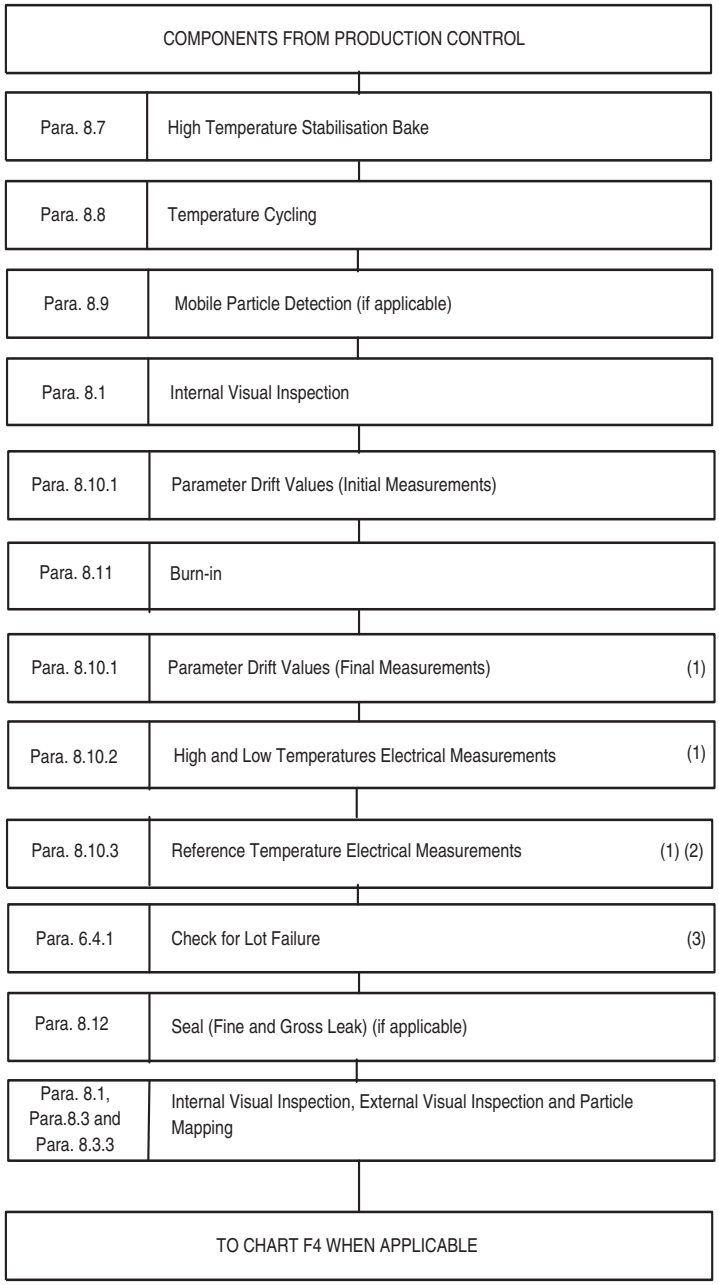


NOTES:

1. Performed on a sample basis.
2. If specified in the Detail Specification and stipulated in the Purchase Order.
3. Testing, performed on packaged components, includes High Temperature Stabilisation Bake and Burn-in performed prior to the irradiation test sequence.
4. Internal Visual Inspection may be performed after encapsulation on the condition that the attached window allows a complete overall view of the cavity and of the component's construction.
5. For non-hermetic package components, mobile particles shall be removed. No subsequent particle removal shall be allowed.
   The removal method shall be agreed by the ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of

unqualified components).
6. If specified in the Detail Specification.
7. Guaranteed but not tested.

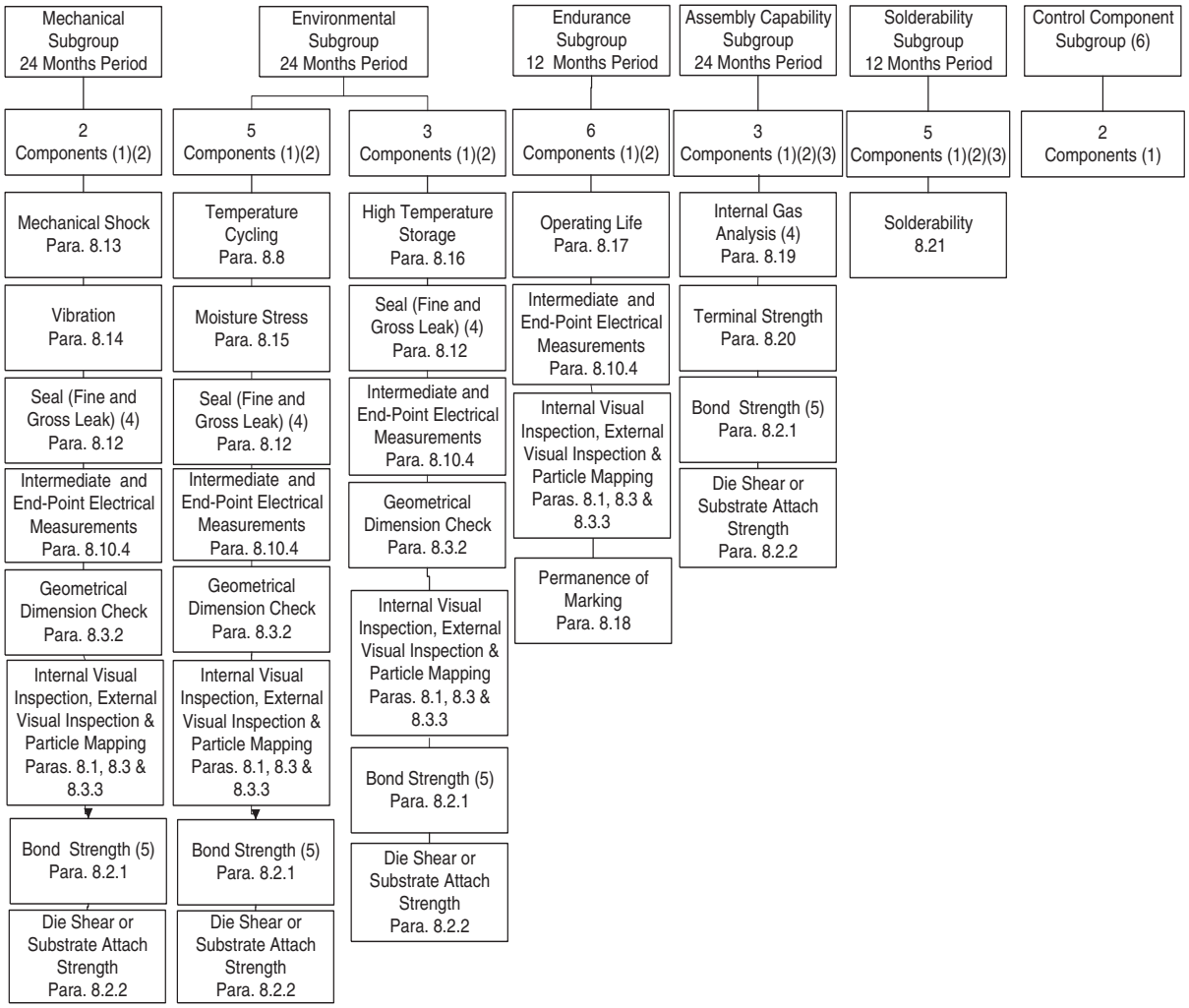
12.3 CHART F3 - SCREENING TESTS



NOTES:
1. The lot failure criteria of Para. 6.4 apply to this test.
2. Measurements of Parameter Drift Values need not be repeated in Reference Temperature Electrical Measurements.
3. Check for Lot Failure shall take into account all electrical parameter failures that may occur during

Screening Tests in accordance with Para. 8.10.1, 8.10.2, 8.10.3 subsequent to Burn-in.

12.4 CHART F4 - QUALIFICATION AND PERIODIC TESTS



NOTES:

1. For distribution within the subgroup see Para. 7.1.2 for qualification and qualification maintenance and Para. 7.4 for Lot Validation Testing.
2. No failures are permitted.
3. When both the Assembly Capability Subgroup and the Solderability Subgroup are being performed they may be integrated into a single subgroup of 5 components. Solderability shall be the first test in the sequence.
4. If applicable.
5. The components shall be deencapsulated using suitable means to facilitate Bond Strength, and Die Shear or Substrate Attach Strength.
6. This subgroup shall be performed for comparison purposes. Whenever electrical measurements are performed during any other subgroup testing the components in the Control Component Subgroup shall also be subjected to the same electrical measurements.