DOCUMENT CHANGE REQUEST

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Title:	Generic Specification for Integrated Circuits Monolithic		
Number:	9000	Issue:	4

Other documents affected:

Page:

See 'proposed wording of change' plus attached 9000 issue 5 Draft C

Paragraph:

See 'proposed wording of change' plus attached 9000 issue 5 Draft C

Original wording:

Proposed wording:

NOTE: THE FOLLOWING CHANGE DETAILS, SUBMITTED FOR REVIEW ON 2009-06-01, REPLACE IN FULL THE ORIGINAL CONTENT OF DCR400 RAISED ON 2008-06-05.

Specification is amended to incorporate various policy, technical & editorial amendments & corrections to bring all ESCC generic specifications (that have been converted to the new ESCC format) in line with each other (i.e. ESCC 9000, 5000, 5010, 9020, 3403, 4009).

The changes included in this DCR400 are closely based on approved DCR399 for ESCC5000.

Note - See attached proposed draft specification ESCC9000 issue 5 Draft C for details.

Change items:
1 Page 7 Para 1.2, Delete Para and replace as follows: ..... 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.
- Qualification of a component within an approved capability domain per ESCC Basic Specification No. 24300.
- 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 Page 7 Para 2.1
Add ESCC Basic Specifications Nos. 23100 & 25400 to the list:
- ESCC 23100, RECOMMENDATIONS ON THE USE OF THE ESCC SPECIFICATION SYSTEM FOR THE EVALUATION AND PROCUREMENT OF UNQUALIFIED COMPONENTS
- ESCC 25400, Requirements for the Technology Flow Qualification of Electronic Components for Space Application.

Add 25400 to the first sentence:
" ... , 22800, 24300, 24600 and 25400, where Manufacturer's ... "

3 Page 8 & 10 Para. 2.2 & 4.5, Amend first document number to be ECSS-Q-ST-70-02 and delete "A" from document title.

4 Page 8 Para. 4.1, amend Para 4.1 to read as follows: ..... 4.1 GENERAL The requirements for the qualification of a component shall be in accordance with ESCC Basic Specification No. 20100.

The requirements for approval of a capability domain and the qualification of a component (type approval testing) within an approved domain shall be in accordance with ESCC Basic Specification No. 24300.

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. .....

5 Page 9 Para 4.1.4, amend sentence to read: "... or the Orderer (for procurement of unqualified components if stipulated in the Purchase Order) reserves the ..."

6 Page 9 Para 4.1.5, Delete Para 4.1.5 and replace with: 4.1.5, 4.1.5.1 & 4.1.5.2 as follows: ..... 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 Die Shear).

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. .....

7 Page 9 Para 4.2
Delete "component type" from the first sentence to read: " ... maintain the qualification of a ..."

Add a new third sub-Para:
"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."

8 Page 9 Para 4.3, Delete Para 4.3 and replace with: 4.3, 4.3.1 & 4.3.2 as follows:
.....
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. .....

9 Page 9 Para 4.3.1
Amend Para number to be Para 4.3.3.

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Amend first sentence to read:
"Lot failure may occur during Wafer Lot Acceptance (Chart F2), Special In-Process Controls (Chart F2), Screening ... "

Amend sentence in 2nd sub-Para to read:
"No further testing or analysis shall be performed on the failed components until so instructed by the ESCC Executive."

Amend sentence in 3rd sub-Para to read:
"No further testing or analysis shall be performed on the failed components until so instructed by the Orderer."

10 Page 10 Para 4.6
Replace first sub-Para with the following:
"For qualification or qualification maintenance total dose radiation testing shall be performed when specified in the Detail Specification to the specified total dose level."

Replace 2nd sub-Para with the following:
"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"

In 4th sub-Para replace "required" by "specified".

11 Page 10 Para 5.1
Delete 1st sentence.

Amend 2nd sub-Para to be:
" 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."

Capitalise "Manufacturer" in last sub-Para.

Amend Para. "4.3.1" to be "4.3.3" in last sub-Para.

12 Page 11 & 12, Amend Special In-Process Controls to be Para.5.3 & Wafer Lot Acceptance to be Para. 5.2 (all sub-Paras and referenced Paras renumbered
accordingly)

13 Page 11 Para 5.2.1, Delete Para 5.2.1 and replace by Paras 5.3.1 & 5.3.2 as follows: ..... 5.3 SPECIAL IN-PROCESS CONTROLS

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

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

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.
.....

14 Page 11 Para 5.2.2, Amend Para to read as follows: ..... 5.3.3 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. .....

15 Page 11 Para 5.3.1, Amend Para to read as follows: ..... 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). .....

16 Page 11 Para 5.3.2, amend Para to read as follows: ..... 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. 8.3.
.....

17 Page 11 & 12 Para 5.3.3
Amend Para 5.3.3 to be Para 5.2.3.

Amend first bullet to read:
" ... in accordance with Para. 8.4 to the specified total dose level."

Amend 2nd bullet to read:
"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 in accordance with Para. 8.4.1 to the stipulated total dose level."

18 Page 12 Para 6.1,
Amend first sentence to read:

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

"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."

Delete 2nd sub-Para ("Unless otherwise specified in the Detail Specification, the tests shall be performed in the order shown.")

19 Page 12 Para 6.2.1, Add to the end of the sentence:
" ... and External Visual Inspection."

20 Page 12 Para 6.2.4, Amend first bullet to be:
" - Visual failure"

21 Page 13 Para 6.4, Amend "Para 4.3.1" to be "4.3.3"

22 Page 13 Para 6.4.1, Delete in first sentence: "... initial measurements of Parameter Drift Values ..." and replace with: "... High Temperature Reverse Bias Burn-in (or Power Burn-in if HTRB Burn-in is not being performed) ..."

23 Page 13 Para 6.4.2
Amend first sentence to be: " ... as specified herein or in the Detail ..."

Amend 2nd sub-Para to be: "Unless otherwise specified, if a lot failure ... etc ... exceed that specified in Para. 6.4.1."

24 Page 13 Para 7, Delete Para and replace with the following: ..... 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, 24300 or 25400 as applicable. They are also applicable to Lot Validation Testing as part of the procurement of qualified or unqualified components. .....

25 Page 13 Para 7.1, Amend title to be: "QUALIFICATION TESTING"

26 Page 13 Para 7.1.1
Delete from 1st sub-Para: "(Screening Tests)"

Replace "given" in 1st & 3rd sub-Paras by "specified"

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Capitalise "Qualification Test Lot"

Delete from 3rd sub-Para: "component type"

27 Page 14 Para 7.1.2
Capitalise "Qualification Test Lot"

28 Page 14 Para 7.1.2.1, amend 2nd sentence to read:
" 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."

29 Page 14 Para 7.1.2.2, amend 5th sub-Para to read:
" 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."

30 Add new Para 7.3 as follows and renumber Paras. 7.3 to 7.9 to be 7.4 to 7.10:
.....
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. .....

31 Page 15 Para 7.3
Delete from first line "Component type"

Amend 2nd sentence to be: "For each subgroup the sample size and the period ..."

Replace "given" in 3rd sentence by " specified".

Amend 2nd sub-Para to be as follows:
"Qualification of a component within a capability approved domain is maintained by maintenance of the approval of the capability domain itself in accordance with ESCC Basic Specification No. 24300."

Add new 3rd sub-Para as follows:
" 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."

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

32 Page 15 Para 7.4, 7.4.1 & 7.4.2, Delete Paras and replace by new Para 7.5 as follows: ..... 7.5 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. .....

33 Page 15 Para 7.5.3, Amend first bullet to be: " - Visual failure"

34 Page 16 Para 7.6, Amend 2nd sub-Para to be: " ... be performed under the responsibility of the Manufacturer ..."

35 Page 16 Para 7.7
Replace "given" in 1st & 2nd sub-Paras by "specified".

Amend Para "7.5" to be "7.6" & Para "4.3.1" to be "4.3.3"

36 Page 17 Para 8.2
Amend Para heading to be:
"BOND STRENGTH, AND DIE SHEAR OR SUBSTRATE ATTACH STRENGTH"

37 Page 17 Para 8.2.1,
Delete all apostrophes from test condition letters.
e.g. 'C' becomes C

Replace reference to "subgroup 3" in the 3rd sub-Para by "the Assembly Capability Subgroup"

38 Page 17 Para 8.2.2
Amend Para heading to be:
"Die Shear or Substrate Attach Strength"

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Amend 1st sentence to be:
" MIL-STD-883 Test Method 2019 or 2027"

39 Page 17 Para 8.4
Replace "required" by "stipulated".

40 Page 18 Para 8.10, Delete last sentence in 2nd sub-Para and replace by: "In the event of any failure, a 100% Dimension Check shall be performed."

41 Page 19 Para 8.16, Add new 2nd sentence as follows:
"A single failure shall be cause for lot failure."

42 Page 20 Para 8.20
Amend final sub-Para to be: "... at 0 hours (initial) and T ..."

Add at the end of final sub-Para: "Drift shall be related to the initial measurement."

43 Page 20 Para 8.21
Amend Test Conditions bullet to refer to "MIL-STD-883 Test Method 1015".

Add at the end of final Data Points bullet: "Drift shall be related to the initial measurement for Power Burn-in."

44 Page 20 Para 9.1, Change bullets (d) & (e) to be (e) & (d) respectively.

45 Page 21 Para 9.1
Amend final sub-Para first sentence to be: " ... preferably be available in electronic ..."

Amend last sentence to be :"The preferred storage medium is CD-ROM and the preferred file format is PDF."

46 Page 21 Para 9.1.3, Replace "required" by "stipulated".

47 Page 21 Para 9.3, in first sentence delete: ", if not in accordance with the data given in the PID"

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

48 Page 22 Para 9.5,
Amend Para number to be 9.6.

Amend last sentence to read:
" For the Bond Strength and either Die Shear or Substrate Attach Strength tests, the separation forces and categories shall be recorded."

49 Page 22 Para 9.6
Amend Para number to be 9.5

Amend 2nd sub-Para to be:
"Total dose radiation test report ..."

50 Page 23 Para 9.9
Amend bullet (a) to be: "... during Wafer Lot Acceptance, Special In-Process Controls, Screening ..."

Delete bullet (b) and replace by:
"(b) Traceability information including serial number (if applicable) of the failed component."

51 Page 23 Para 9.10
Amend Para to read:
" A Certificate of Conformity shall be established in accordance with the requirements of ESCC Basic Specification Nos. 20100, 24300 or 25400."

52 Page 23 Para 10
Amend bullet (b) to be:
"(b) The components used for Lot Validation Testing (as applicable), but not forming part of the delivery lot, if stipulated in the Purchase Order."

Amend bullet (c) to be: " ... requirements of Paras. 9.1.2 and 9.1.3."

Amend final sub-Para to read:
" 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, 24300 or 25400 and the relevant paragraphs of Section 9 of this specification."

53 Page 24 Chart F1
Change the order of items in the top box to be:

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

- Wafer Lot Acceptance
- Special In-Process Controls

Under "ESCC Qualified" amend Lot Validation Testing box to be: ..... Lot Validation Testing Para.7.5 / Chart F4 (Note 1) .....

Amend Para. No, in Periodic box to be 7.4

Under "Not ESCC Qualified" renumber as Para. 7.5 and add "(Note 2)" in the Lot Validation Testing box.

Amend Note 1 to be:
"1. Lot Validation Testing is not required for qualified components unless specifically stipulated in the Purchase Order."

Add new Note 2 as follows:
"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)."

54 Page 25 Chart F2
Renumber Para 5.2.* & 5.3.* as applicable.

Delete from the first 3 boxes under Special In-Process Controls: "(pre-encapsulation inspection)"

Amend title in Die Shear box to be "Die Shear or Substrate Attach Strength"

Amend note numbers 2 & 3 to be 3 & 2 respectively.

In Note 3 replace "required" by "stipulated"

55 Page 26 & 27 Chart F3
Add new 2nd box:
"Para 6.1 Serialisation"

Delete note 1 and renumber other notes accordingly.

In 7th box amend to be " ... HTRB Burn-in,"

In 14th box delete "Para 8.8.1 and Para 8.8.2" and replace by "Para 8.8"

56 Page 27 Chart F4
Delete top box

DOCUMENT CHANGE REQUEST

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

In each sample quantity of components box add reference to new notes "(4)" & "(5)".

In all Seal test boxes amend to be: ..... Seal (Fine and Gross Leak) Para 8.8 .....

Move the Permanence of Marking box to the beginning of subgroup 3 prior to Terminal Strength.

Amend note 4 to be note 6.

Add reference to new note "(7)" in Internal Visual Inspection box in subgroup 3.

Amend Die Shear Box in subgroup 3 to be "Die Shear or Substrate Attach Strength".

Add new notes 4 & 7 as follows:
"4. For distribution within the subgroups, see Para. 7.1.2 for qualification and qualification maintenance, and Para. 7.5 for Lot Validation Testing." "7. The components shall be deencapsulated using suitable means to facilitate Internal Visual Inspection, Bond Strength and either Die Shear or Substrate Attach Strength."

Justification:

This specification is proposed to be amended to incorporate various policy, technical & editorial amendments & corrections to bring all ESCC generic specifications (that have been converted to the new ESCC format) in line with each other (ESCC 9000, 5000, 5010, 9020, 3403, 4009)(plus all other ESCC generics in due course).

The changes contained in this DCR relate to the following points.

Note - Each relevant change item in "Proposed Wording Of Change" above is identified for each point:

A - Introduction of ESCC 23100 (RECOMMENDATIONS ON THE USE OF THE ESCC SPECIFICATION SYSTEM FOR THE EVALUATION AND PROCUREMENT OF UNQUALIFIED
COMPONENTS) to the generic spec. The responsibility for procurement of unqualified components including definition of Lot Validation Testing requirements lies with the Orderer and his PO. The current 9000 spec does not give any guidelines for procurement of unqualified components. Change items affected: 1, 2, 4, 5, 15, 24, 32, 53,

B - Clarification that the term 'PID' is specific to ESCC qualified components. The current spec implies a PID requirement per ESCC20100 (22700) for unqualified components which is not necessarily the case. Change items affected: 8, 11, 15, 47,

C - The concept that Lot Validation Testing is not required for qualified components and will only be done if specifically

stipulated by the Orderer in the PO. In general for qualified parts LVT is not required as a consequence of the manufacturer's fulfilment of the periodic testing requirements. However, a user should not be prevented from ordering an LVT if considered necessary. This could comprise any individual test or individual test sequence as specified in Chart F4. Also the current spec is unclear for qualified components in that it specifically implies that Chart F4 Subgroup 2 testing may be applicable, which is not specifically true. For unqualified component procurement an LVT would be expected but this should not be prescribed; the responsibility for defining the appropriate range of LVT to be performed lies with the Orderer (in line with the recommendations of ESCC 23100). The current generic spec does not give any guidelines for LVT to be performed on unqualified components. Procurement circumstances vary and it remains the Orderer's responsibility to order the appropriate level of LVT. Change items affected: 6, 32, 52, 53

D - Clarification of Customer Source inspection options for Pre-Cap & Buy-off where the customer & manufacturer mutually agree what is to be performed and how much notification is required. The current spec is inflexible in this respect and only identifies 'precap' as an option. Change items affected: 6, 13, 54

E - Correction of the Screening PDA calculation. The reference quantity for PDA should be all electrically good parts going into the first burn-in (excluding any failures to the initial electrical). The current spec incorrectly defines the reference quantity as the quantity tested at initial electrical. Change items affected: 22

F - When using the ESCC System to procure components from an unqualified source and marking the parts with the ESCC component number the manufacturer should possess a manufacturing and quality assurance system that is compatible with space application. As such the user expectation should be that parts would be compatible with passing the testing requirements of Chart F4. Accordingly the requirement placed on qualified sources to "not knowingly supply components that cannot meet" the Chart F4 testing is extended to unqualified sources. Change items affected: 8

G - The introduction of Technology Flow Qualification per ESCC No. 25400. Change items affected: 1, 2, 4, 7, 24, 30, 31, 51, 52

H - General editorial amendments made for the purposes of minor corrections, maintaining logical requirements and consistency plus providing clarification and the removal of ambiguity. Change items affected: 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56

Other specific justifications:

The term "Component type qualification" is not used in ESCC 20100; it is replaced by "qualification" Change items affected: 4, 7, 24, 25, 26, 31

DOCUMENT CHANGE REQUEST

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

The term "pre-encapsulation inspection" relates to the source inspection performed, if required, by the Orderer. The term for the inspection performed by the manufacturer during Special In-Process controls is "Internal Visual Inspection" and is corrected accordingly. Change items affected: 6, 13, 54

The Die Shear Test is amended to be either Die Shear or Substrate Attach Strength in order to cover the range of die assembly processes. Change items affected: 13, 36, 38, 48, 54, 56

Changes to allow the required flexibility to specify deviations to the
requirements:
Change items affected:
11, 18, 23

9 Page 9 Para 4.3.1 Clarification that the Manufacturer should do nothing with any failed components until so instructed by the ESCC Executive or Orderer as applicable.

23 Page 13 Para 6.4.2 As Chart F3 also includes sample testing (Solderability
test) this Para is amended to also identify sample tests "herein".

34 Page 15 Para 7.5 This allows Manufacturers to use a 3rd party to perform failure analysis.

45 Page 21 Para 9.1
Changing "supplied" to "available" clarifies that all the data items in this Para are not actually supplied unless specifically agreed between the Manufacturer & the Orderer (ref. Para 9.1.3). Diskettes & ASCII files are now considered obsolete and therefore are not preferred data documentation options.

47 Page 21 Para 9.3, Removal of the reference to the PID does not prevent a qualified Manufacturer still using the test equipment list contained in his PID to satisfy this requirement. As amended the Para now does define the requirements for both qualified & unqualified components (as the term 'PID' only refers to qualified components)

52 Page 23 Para 10(b), This clarifies that the PO should specify if LVT samples should be delivered to the Orderer or not (giving the Manufacturer and Orderer the opportunity to agree the details of this subject)

DOCUMENT CHANGE REQUEST

DCR number 400	Changes required for: General	Originator: Steve Thacker - ESCC
Date: 2008/06/10	Date sent: 2008/06/10	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

52 Page 23 Para 10(c), The relevant documentation to be delivered for procurement is specifically only items per Para 9.1.2 & 9.1.3. The change clarifies this point.

53 Page 25 Chart F1, Notes 1 & 2 are added to both LVT boxes to clarify in this overview that LVT is only performed if stipulated by the Orderer in the PO.

54 Page 26 Chart F2, As Wafer Lot Acceptance is performed prior to Special In-Process Controls the sequence & Para numbering is changed accordingly for clarification. Change items affected: 4, 9, 12, 44, 48, 49, 50, 53, 54

56 Page 29 Chart F4, Permanence of Marking
The Permanence of Marking test is moved to subgroup 3 in Chart F4. This is done for the purposes of cost reduction with minimal impact on quality (changing it to be a 24 Month periodic test on a reduced sample size).
Note: Permanence of Marking is classed as an assembly capability test and as such belongs in the assembly capability subgroup 3. There is no specific relevance of Permanence of Marking to Endurance testing (Operating Life) and hence no justification to maintain Permanence of Marking at the end of subgroup 2. Permanence of Marking was previously performed (in ESA/SCC 5000 issue 9A) during LAT3 (along with Terminal Strength). Also previously LAT3 testing was not mandatory for ESCC qualified components. Accordingly performance of Permanence of Marking with a 24 month period is consistent with the previous ESA/SCC standard for MOQ which effectively required the test be performed on a biannual basis (LAT1). The reduction in sample size is considered uncritical for such a process/material based test.

Attachments:

DCR_TBA_Attachment_9000_markup_draft_5A.pdf, 9000.pdf, null

Modifications:

The following additional change is required to be consistent with the conclusion on ESCC 5000 issue 4

Para. 5.1,Add new 4th sub-Para as follows:

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

Approval signature:

Date signed:
2008-06-10

MARK-UP FOR DCR

S.T
25/3/08

European Space Components Coordination

Pages 1 to 27

INTEGRATED CIRCUITS, MONOLITHIC, HERMETICALLY SEALED

ESCC Generic Specification No. 9000

5 Draft A March 2008.

Issue A	~~August 2005~~

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

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2008. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
~~148, 182~~ 391, TBD	Specification upissued to incorporate editorial and technical changes per DCR.

As per Contents

TABLE OF CONTENTS

1. INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification, qualification maintenance, procurement, and delivery of hermetically sealed monolithic integrated circuit components for space applications. This specification contains the appropriate inspection and test schedules and also specifies the data documentation requirements.

1.2 APPLICABILITY

This specification is primarily applicable to the granting of qualification approval to a component in accordance with ESCC Basic Specification No. 20100 or 24300 and the procurement of such components from qualified or capability approved Manufacturers. It may also be applied for procurement of unqualified components.

see attached

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 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. 23500, Lead Materials and Finishes for Components for Space Application.
- No. 23800, Electrostatic Discharge Sensitivity Test Method.
- No. 24300, Requirements for the Capability Approval of Electronic Component Technologies for Space Application.
- No. 24600, Minimum Quality System Requirements.
- No. 24800, Resistance to Solvents of Marking, Materials and Finishes.

23100 → see attached

25100 25400 → see attached.

and 25400

For qualification and qualification maintenance or procurement of qualified components, with the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800, 24300 and 24600, where Manufacturers' specifications are equivalent to, or more stringent than, the ESCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the ESCC Executive.

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

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

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

Para 1.2
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.
- Capability Approval per ESCC Basic Specification No. 24300.
- 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.

Para 2.1
- ESCC 23100, ESCC Recommendations for the Evaluation and Procurement of Unqualified Components for Space Application.
- ESCC 25100, Single Event Effects Test Method and Guidelines.
- ESCC 25400, Requirements for the Technology Flow Qualification of Electronic Components for Space Application.

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-70-02, Thermal Vacuum Test for the Screening of Space Materials.
- 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 test requirements for the component type qualification of a component shall comprise Special In-Process Controls, Wafer Lot Acceptance with radiation tests (if specified), Screening Tests and Component Type Qualification Testing.

see attached

The requirements for approval of a capability domain and the qualification of a component (type approval testing) within an approved domain are given in ESCC Basic Specification No. 24300.

The test requirements for procurement of components shall comprise Special In-Process Controls, Wafer Lot Acceptance with radiation tests if required in the Purchase Order, Screening Tests, together with Periodic Testing for qualified components and Lot Validation Testing for qualified (if required in the Purchase Order) and unqualified components (see Chart F1).

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 GENERAL
The test requirements for the qualification of a component shall comprise:
- Wafer Lot Acceptance with, if specified, radiation tests
- Special In-Process Controls
- Screening Tests
- Qualification Testing

The requirements for approval of a capability domain and the qualification of a component (type approval testing) within an approved domain shall be in accordance with ESCC Basic Specification No. 24300.

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, radiation tests
- Special In-Process Controls
- Screening Tests
- Periodic Testing (for qualified components only)
- Lot Validation Testing if stipulated in the Purchase Order

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

if stipulated in the Purchase Order;

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

Customer Source Inspection

4.1.5 Pre-encapsulation Inspection Witnessing

see attached 4.1.5.1 4.1.5.2

If required in the Purchase Order, the Orderer may witness or perform the pre-encapsulation inspection and the Manufacturer must notify the Orderer at least 2 working weeks before the commencement of the inspection.

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 in a capability approved domain, a Manufacturer shall satisfy the requirements of ESCC Basic Specification No. 24300.

see attached → To obtain etc - - -

4.3 DELIVERABLE COMPONENTS

see attached 4.3 4.3.1 4.3.2

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

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

4.3.1 3 Lot Failure

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

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

unless so instructed by the Orderer.

4.1.5 Customer Source Inspection
4.1.5.1 Pre-Encapsulation Source Inspection
If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility prior to encapsulation (e.g. perform Internal Visual Inspection). 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 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 (e.g. witness of final Room Temperature Electrical Measurements). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

Para 4.2
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 required tests.
- 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.

4.4 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. 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-70-02.

4.6 RADIATION TESTING

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

4.6.1 Total Dose Radiation Testing

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

4.6.2 see attached.

5. PRODUCTION CONTROL

5.1 GENERAL

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

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

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.

4.6.2 SINGLE EVENT EFFECTS TESTING
For qualification or qualification maintenance SEE testing shall be performed when specified in the Detail Specification. The test requirements shall be as specified in the Detail Specification.

For procurement, as stipulated in the Purchase Order, SEE testing shall be performed as specified in the Detail Specification or in accordance with alternate requirements as stipulated in the Purchase Order.

The qualification status of the procured components shall not be impacted by any SEE test results.

5.~~2~~3 SPECIAL IN-PROCESS CONTROLS

5.~~2~~3.1 ~~Pre-encapsulation~~ Internal Visual Inspection shall be performed

~~Pre-encapsulation inspection shall consist of~~ Internal Visual Inspection in accordance with Para. 8.1 ~~plus Bond Strength and Die Shear tests in accordance with Para. 8.2~~.

5.3.2 Bond Strength and Die Shear

Bond Strength and Die Shear 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.~~2~~3.~~2~~ Dimension Check Dimension Check shall be performed in accordance with Para. 8.10 on 3 samples only.

5.3.3

~~If a failure occurs, the complete lot shall be checked~~. In the event of any failure a 100% Dimension Check shall be performed.

5.~~2~~3.~~3~~ Weight

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

5.~~2~~3.~~4~~ Documentation

5.3.5 Documentation of Special In-Process Controls shall be in accordance with Para. 9.~~5~~6.

5.~~3~~2 WAFER LOT ACCEPTANCE

5.~~3~~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 (~~ditto~~).

5.~~3~~2.2 Scanning Electron Microscope (SEM) Inspection

Components supplied to this specification shall be produced from wafer lots that have been subjected to, and successfully met, the scanning electron microscope inspection requirements in accordance with Para. 8.3.

5.2.3 RADIATION Testing.

5.~~3~~3.~~3~~ Total Dose Radiation Testing

5.2.3.1 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 in accordance with Para. ~~8.4~~ 8.4.1 to the total dose level ~~given~~ specified.

During procurement:

- If specified in the Detail Specification and ~~required~~ stipulated in the Purchase Order, components shall be produced from a wafer lot which has been subjected to and successfully completed Total Dose

8.4.1
Radiation Testing in accordance with Para. ~~8.4~~ to the ~~required~~ specified total dose level.

5.2.3.2 ⇒ see attached

5.~~3~~.4 Documentation
2
Documentation of Wafer Lot Acceptance shall be in accordance with Para. 9.~~8~~.
5

6. SCREENING TESTS

6.1 GENERAL
Unless otherwise specified ~~in the Detail Specification~~, all lots of components used for qualification and qualification maintenance, Lot Validation Testing, and for delivery, shall be subjected to tests and inspections in accordance with Chart F3. All components shall be serialised prior to the tests and inspections.
in the sequence shown.

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

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

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

6.2 FAILURE CRITERIA

6.2.1 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, Solderability, 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 High Temperature Reverse Bias Burn-in or during Power 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 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 HTRB 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:

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

5.2.3.2 Single Event Effects 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 SEE Testing in accordance with Para. 8.4.2.

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 SEE Testing in accordance with Para. 8.4.2.

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. 4.3.1.

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 ~~initial measurements of Parameter Drift Values~~ 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 in the Detail Specification, is exceeded.

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

No failures are allowed for the Solderability test.

6.5 DOCUMENTATION

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

7. QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING

Requirements of this paragraph are applicable to the tests performed for component type qualification and qualification maintenance, qualification and qualification maintenance of a component within a capability approved domain and also for Lot Validation Testing.

7.1 ~~COMPONENT TYPE~~ QUALIFICATION TESTING

7.1.1 General

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

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

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

Para 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, ~~24400~~ 24300, or 25400 as applicable. They are also applicable to Lot Validation Testing as part of the procurement of qualified or unqualified components.

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 ~~1~~ type of package, each package variation must be equally represented in, the environmental/mechanical ~~subgroup (Subgroup 1)~~, ~~the~~ endurance ~~subgroup (Subgroup 2)~~ and ~~the~~ assembly capability subgroup ~~(Subgroup 3)~~. 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 (e.g. the same diffusion schedules, method of metallisation, etc.) 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, ~~subgroup (Subgroup 1) and in the assembly/capability subgroup (Subgroup 3)~~.

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 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 CAPABILITY APPROVED DOMAIN

The qualification of a component within a capability approved domain shall be in accordance with ESCC Basic Specification No. 24300.

7.3 QUALIFICATION WITHIN A TECHNOLOGY FLOW

See attached.

7.3 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)

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

Qualification of a component within a capability approved domain is maintained by periodic testing as specified in ESCC Basic Specification No. 24300.

7.4 LOT VALIDATION TESTING

7.4.1 General

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

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

7.4.2 Distribution within the Sample for Lot Validation Testing

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

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

7.5 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 inspection failure
- Mechanical failure
- Handling failure

Para 7.3

Qualification of a component within a capability approved domain is maintained by maintenance of t
he approval of the capability
domain itself in accordance with ESCC Basic Specification No. 24300.

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

Para. 7.5 LOT VALIDATION TESTING
For procurement of qualified components, Lot Validation Testing is not required and shall only be p
erformed 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). Lot Validation Testing shall be performed as stipulated in the Purchase O
rder.

When Lot Validation Testing is required, it shall consist of the performance of one or more of the te
sts 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 represent
ative samples shall also be
stipulated in the Purchase Order.

– Lost component

7.6 7 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 7.5. 6

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

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

7.7 8 LOT FAILURE

For qualification and qualification maintenance, the lot shall be considered as failed if one component in any subgroup of Chart F4 is a failed component based on the criteria given in Para. 7.5. 6

For procurement, the lot shall be considered as failed if one component in any test specified for Lot Validation Testing is a failed component based on the criteria given in Para. 7.5. 6 3

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

7.8 9 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 10 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.

8.2 BOND STRENGTH AND DIE SHEAR

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 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 Subgroup 3 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 Die Shear

MIL-STD-883 Test Method 2019

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 SCANNING ELECTRON MICROSCOPE INSPECTION

ESCC Basic Specification No. 21400.

8.4 RADIATION TESTING

8.4.1 TOTAL DOSE RADIATION TESTING

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

8.4.2 see attached →

8.5 HIGH TEMPERATURE STABILISATION BAKE

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

8.6 TEMPERATURE CYCLING

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

8.7 PARTICLE IMPACT NOISE DETECTION (PIND)

Only applicable to devices with cavities.

8.4.2 SINGLE EVENT EFFECTS TESTING
ESCC Basic Specification No. 25100 with test requirements as specified in the Detail Specification or as stipulated in the Purchase
Order.

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

8.8 SEAL

8.8.1 Seal, Fine Leak

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

8.8.2 Seal, Gross Leak

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

8.9 ELECTRICAL MEASUREMENTS

8.9.1 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.

8.9.2 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.

8.9.3 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.

8.9.4 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.

8.10 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. ~~If a failure occurs the complete lot shall be checked~~. In the event of any failure a 100% Dimension Check shall be performed.

8.11 MECHANICAL SHOCK

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

8.12 VIBRATION

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

8.13 CONSTANT ACCELERATION

MIL-STD-883, Test Method 2001, Test Condition: E (resultant centrifugal acceleration to be in the Y1 axis only). For components which have a package weight of 5 grammes or more, or whose inner seal or

cavity perimeter is more than 5 cm, Condition D shall be used.

8.14 THERMAL SHOCK
MIL-STD-883. Test Method 1011, Test Condition C.

8.15 MOISTURE RESISTANCE
MIL-STD-883, Test Method 1004.

8.16 SOLDERABILITY
For procurement lots: 5 samples. A single failure shall be cause for lot failure.

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.

Solderability testing is classed as destructive and therefore components so tested shall not form part of the delivery lot.

8.17 PERMANENCE OF MARKING
ESCC Basic Specification No. 24800.

8.18 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.

8.19 OPERATING LIFE
MIL-STD-883, Test Method 1005.

- Duration: 2000 hours.
- Conditions: As specified in Operating Life in the Detail Specification.
- Data Points P
  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.

8.20 HIGH TEMPERATURE REVERSE BIAS BURN-IN
- MIL-STD-883, Test Method 1015, Test Condition A.

– Duration and Test Conditions
As specified, where applicable, in High Temperature Reverse Bias Burn-in in the Detail Specification.

– Data Points
As specified in the 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.

8.21 POWER 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 Power Burn-in period of 240 (+24 -0) hours.

– Test Conditions
As specified in Power Burn-in in the Detail Specification.
The alternative temperature and time combinations per MIL-STD-883 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 T (+24 -0) hours (where T is the specified duration).

If High Temperature Reverse Bias Burn-in is not being performed, the 0 hours (initial) measurement is also required. Drift shall be related to the initial measurement for Power Burn-in.

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) ~~(e)~~ Special In-Process Controls data (Chart F2).
(e) ~~(d)~~ Wafer Lot Acceptance 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 ~~supplied~~ available in electronic format suitable for reading using a compatible PC. The format supplied shall be legible, durable and indexed. The preferred storage ~~media are 3 1/2 inch diskettes or~~ medium is CD-ROM and the preferred file format ~~are ASCII or~~ 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 ~~required~~ 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 Manufacturers part type number.
(d) Lot identification.
(e) Range of delivered serial numbers.
(f) Number of the Purchase Order.
(g) Radiation testing 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, ~~if not in accordance with the data given in this PID~~. Where applicable, this list shall contain inventory number, Manufacturer's type number, serial number, etc. This list shall indicate for which tests such equipment was used.

9.4 LIST OF TEST REFERENCES

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

9.6 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 Die Shear tests, the separation forces and categories shall be recorded.

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.

Radiation test reports shall be prepared in accordance with the requirements of ESCC Basic Specification No. 22900 and/or 25100 (if specified).

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.

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 Special In-Process Controls, Wafer Lot Acceptance, Screening Tests and Qualification and Periodic Tests.
(b) ~~The serial number (if applicable) of the failed component~~.
(c) The failed parameter and the failure mode of the component.
(d) Detailed failure analysis (if requested by the ESCC Executive or Orderer).

(b) Traceability information including serial number (if applicable) of the failed component.

9.10 CERTIFICATE OF CONFORMITY in accordance with the requirements of

A Certificate of Conformity shall be established ~~as defined in~~ ESCC Basic Specification No. 20100 or ESCC Basic Specification No. 24300.

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 (~~when~~ 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 ~~Section~~ 9. 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.

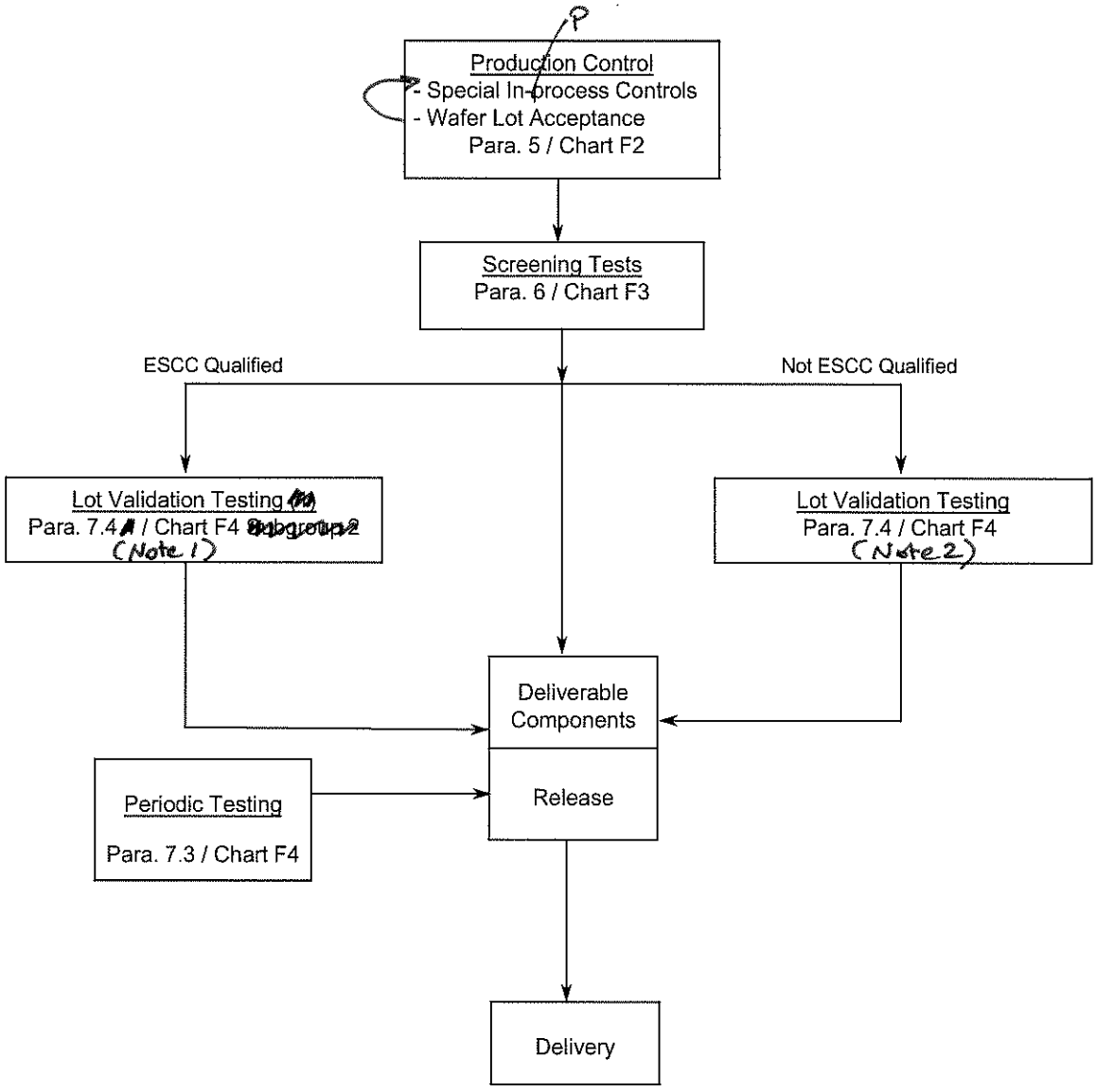
For qualification or qualification maintenance, the disposition of the ~~test lot~~ Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification Nos. 20100 or 24300 and the relevant paragraphs of Section 9 of this specification.

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 optional~~ for qualified components ~~and shall only be performed if required in~~ the Purchase Order.
2. For unqualified components the need for Lot Validation Testing shall be determined by the Ordering Authority and the required testing stipulated in the Purchase Order (Ref. ESCC Basic Specification No. 23100).

12.2 CHART F2 - PRODUCTION CONTROL

COMPONENT LOT MANUFACTURING

WAFER LOT ACCEPTANCE	
Para. 5.~~2~~2.1	Process Monitoring Review
Para. 5.~~2~~2.2	SEM Inspection (1)
Para. 5.~~2~~2.3	~~Total Dose~~ Radiation Testing (1) ~~(2)~~ (2)

(Total Dose / SEE)

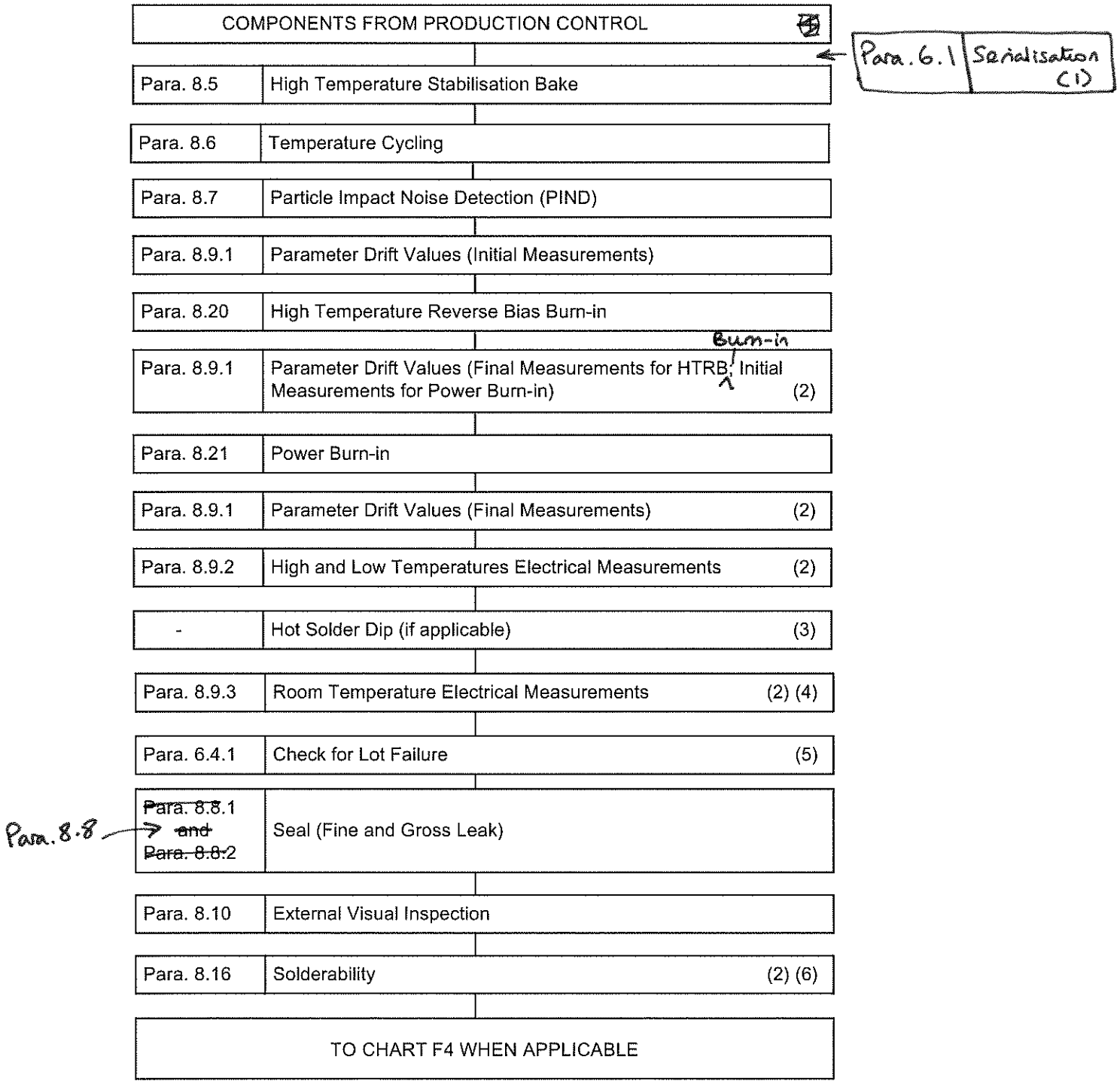
SPECIAL IN-PROCESS CONTROLS	
Para. 5.~~2~~3.1	Internal Visual Inspection ~~(Pre-encapsulation Inspection)~~
Para. 5.~~2~~3.2	Bond Strength ~~(Pre-encapsulation Inspection)~~ (1)
Para. 5.~~2~~3.2	Die Shear ~~(Pre-encapsulation Inspection)~~ (1)
-	Encapsulation
Para. ~~5.2.2~~ 5.3.3	Dimension Check (1)
Para. ~~5.2.3~~ 5.3.4	Weight ~~(2)~~ (3)

TO CHART F3 - SCREENING TESTS

NOTES:

1. Performed on a sample basis.
2. Guaranteed but not tested.
3. If specified in the Detail Specification and ~~required~~ Stipulated in the Purchase Order.

12.3 CHART F3 - SCREENING TESTS



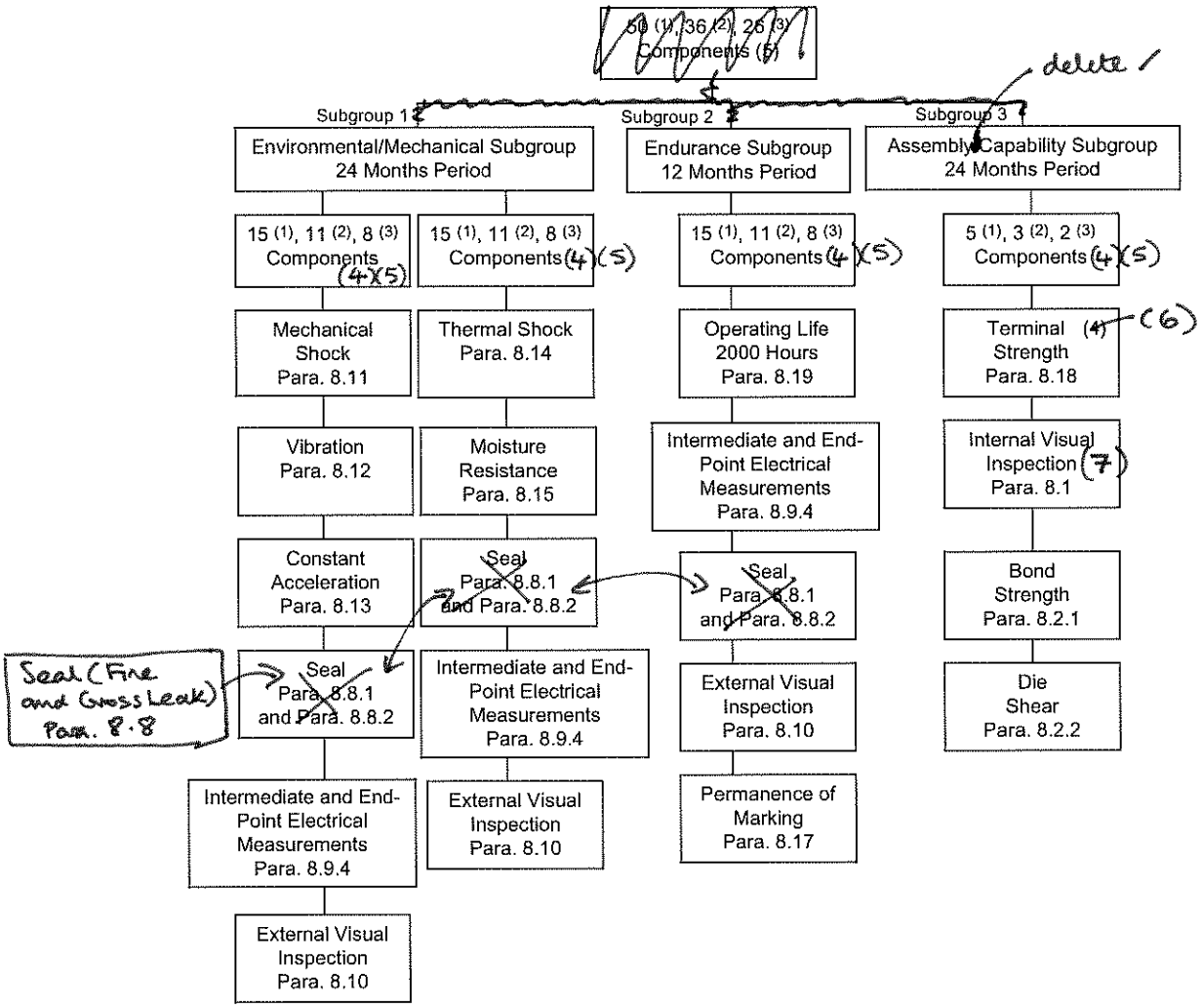
NOTES:

1. All components shall be serialised prior to Screening Tests.
2. The lot failure criteria of Para. 6.4 apply to this test.
3. 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.

4. Measurements of Parameter Drift Values need not be repeated in Room Temperature Electrical Measurements.
5. Check for Lot Failure shall take into account all electrical parameter failures that may occur during Screening Tests in accordance with Para. 8.9.1, 8.9.2, 8.9.3 subsequent to HTRB Burn-in.
6. Performed on a sample basis.

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. Per type for three or more types selected (see Para. 7.1.2.2)
6. May be done at the beginning or the end of the subgroup, depending on package configuration.
5. No failures are permitted.
4. For distribution within the subgroups see Para. 7.1.2 for Qualification and qualification maintenance and Para. 7.4 for Lot Validation Testing.
7. The components shall be decapsulated using suitable means to facilitate Internal Visual Inspection, Bond Strength and Die Shear.

INTEGRATED CIRCUITS, MONOLITHIC, HERMETICALLY SEALED

ESCC Generic Specification No. 9000

Issue 5 Draft C	May 2009

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

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2009. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

– copied in whole, in any medium, without alteration or modification.
– copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
400	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 hermetically sealed monolithic integrated circuit components 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.
- Qualification of a component within an approved capability domain per ESCC Basic Specification No. 24300.
- 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. 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. 24300, Requirements for the Capability Approval of Electronic Component Technologies for Space Application.
- No. 25400, Requirements for the Technology Flow Qualification of Electronic Components for Space Application.
- No. 24600, Minimum Quality System Requirements.
- No. 24800, Resistance to Solvents of Marking, Materials and Finishes.

For qualification and qualification maintenance or procurement of qualified components, with the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800, 24300, 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 applicable ESCC Basic Specifications listed above, they may be used in place of the latter subject to the approval of the Orderer.

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

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

2.2 OTHER (REFERENCE) DOCUMENTS

– ECSS-Q-ST-70-02, Thermal Vacuum Test for the Screening of Space Materials.
– 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 approval of a capability domain and the qualification of a component (type approval testing) within an approved domain shall be in accordance with ESCC Basic Specification No. 24300.

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-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 Die Shear). 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 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 in a capability approved domain, a Manufacturer

shall satisfy the requirements of ESCC Basic Specification No. 24300.

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.

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. 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.

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.

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. 8.3.

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 in accordance with Para. 8.4 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 in accordance with Para. 8.4 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.

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 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.

5.3.4 Weight

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

5.3.5 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. 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, Solderability, 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 High Temperature Reverse Bias Burn-in or during Power 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 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 HTRB 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 High Temperature Reverse Bias Burn-in (or Power Burn-in if HTRB Burn-in is not being performed) 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.

No failures are allowed for the Solderability test.

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, 24300 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

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 (e.g. the same diffusion schedules, method of metallisation, etc.) 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 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 CAPABILITY APPROVED DOMAIN

The qualification of a component within a capability approved domain shall be in accordance with ESCC Basic Specification No. 24300.

7.3 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.

7.4 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 within a capability approved domain is maintained by maintenance of the approval of the capability domain itself in accordance with ESCC Basic Specification No. 24300.

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.

7.5 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.

7.6 FAILURE CRITERIA

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

7.6.1 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.

7.6.2 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.

7.6.3 Other Failures

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

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

7.7 FAILED COMPONENTS

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

detailed in Para. 7.6.

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.

7.8 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. 7.6.

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. 7.6.

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

7.9 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.

7.10 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.

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 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 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 SCANNING ELECTRON MICROSCOPE INSPECTION

ESCC Basic Specification No. 21400.

8.4 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.

8.5 HIGH TEMPERATURE STABILISATION BAKE

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

8.6 TEMPERATURE CYCLING

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

8.7 PARTICLE IMPACT NOISE DETECTION (PIND)

Only applicable to devices with cavities.

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

8.8 SEAL

8.8.1 Seal, Fine Leak

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

8.8.2 Seal, Gross Leak

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

8.9 ELECTRICAL MEASUREMENTS

8.9.1 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.

8.9.2 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.

8.9.3 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.

8.9.4 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.

8.10 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.

8.11 MECHANICAL SHOCK

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

8.12 VIBRATION

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

8.13 CONSTANT ACCELERATION

MIL-STD-883, Test Method 2001, Test Condition: E (resultant centrifugal acceleration to be in the Y1 axis only). For components which have a package weight of 5 grammes or more, or whose inner seal or cavity perimeter is more than 5 cm, Condition D shall be used.

8.14 THERMAL SHOCK
MIL-STD-883. Test Method 1011, Test Condition C.

8.15 MOISTURE RESISTANCE
MIL-STD-883, Test Method 1004.

8.16 SOLDERABILITY
For procurement lots: 5 samples. A single failure shall be cause for lot failure.

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.

Solderability testing is classed as destructive and therefore components so tested shall not form part of the delivery lot.

8.17 PERMANENCE OF MARKING
ESCC Basic Specification No. 24800.

8.18 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.

8.19 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.

8.20 HIGH TEMPERATURE REVERSE BIAS BURN-IN
– MIL-STD-883, Test Method 1015, Test Condition A.

– Duration and Test Conditions
As specified, where applicable, in High Temperature Reverse Bias Burn-in in the Detail

Specification.

– Data Points
As specified in the 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.

8.21 POWER 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 Power Burn-in period of 240 (+24 -0) hours.

– Test Conditions
As specified in Power 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 T (+24 -0) hours (where T is the specified duration).

If High Temperature Reverse Bias Burn-in is not being performed, the 0 hours (initial) measurement is also required. Drift shall be related to the initial measurement for Power Burn-in.

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) Radiation testing 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.

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, 24300 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.

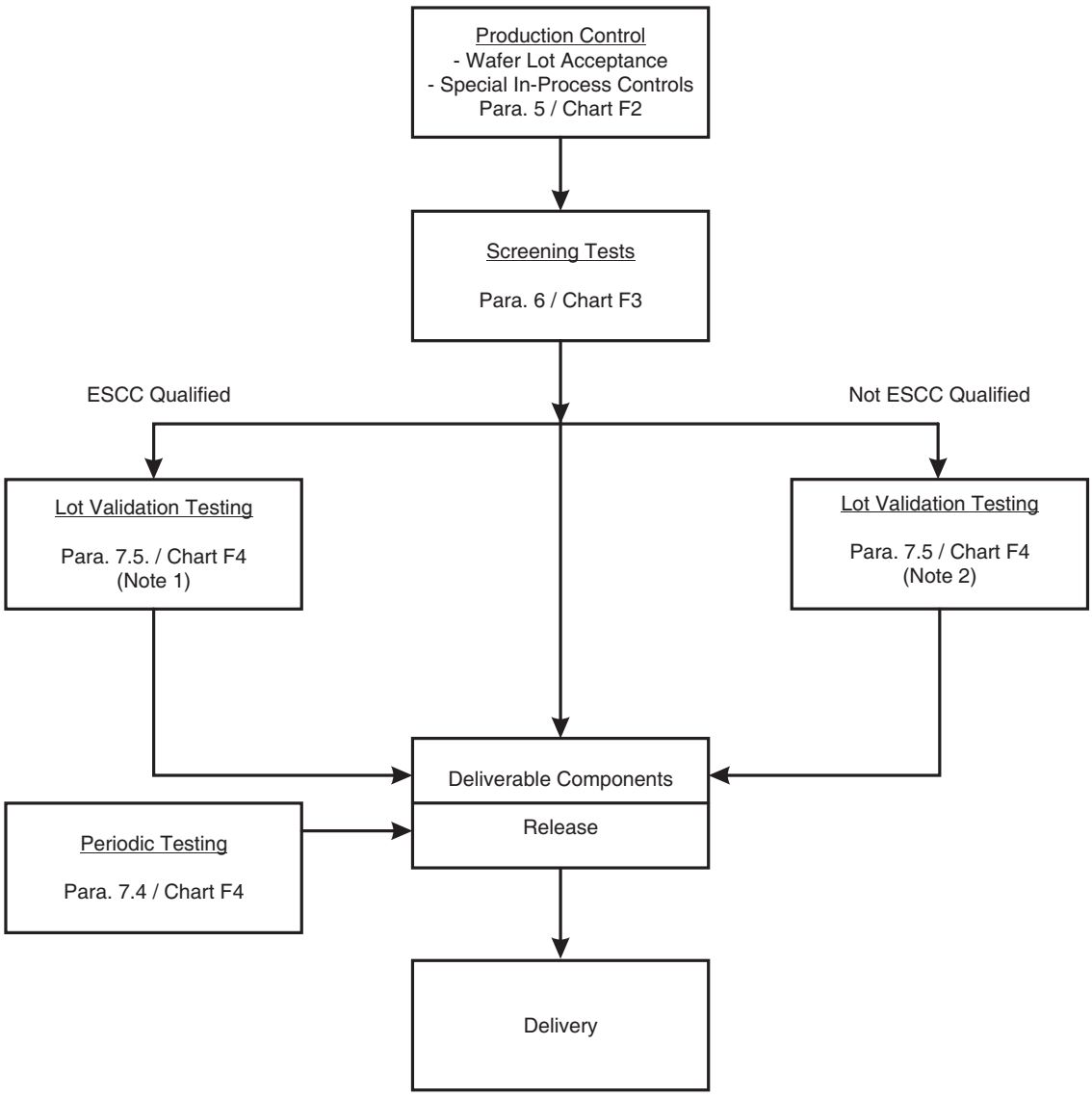
For qualification or qualification maintenance, the disposition of the Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification Nos. 20100, 24300 or 25400 and the relevant paragraphs of Section 9 of this specification.

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

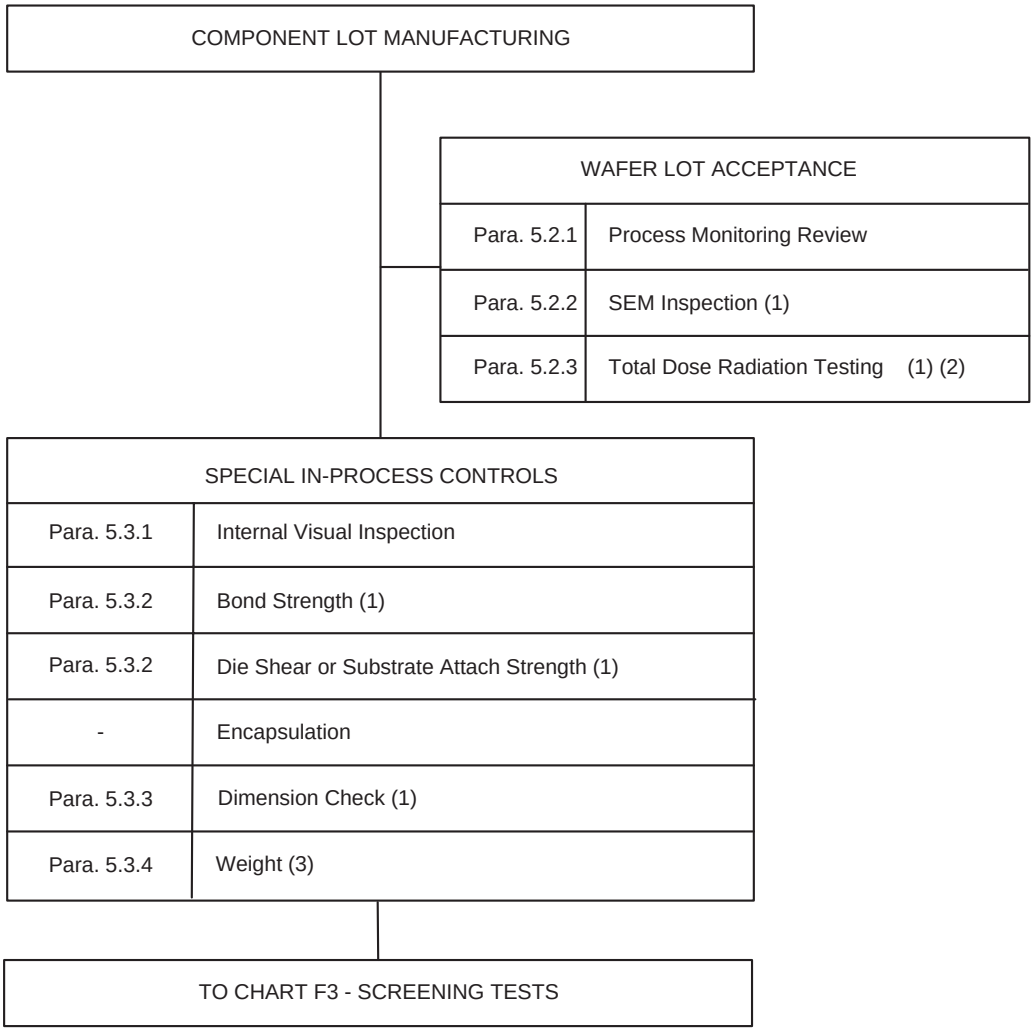


NOTES:

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

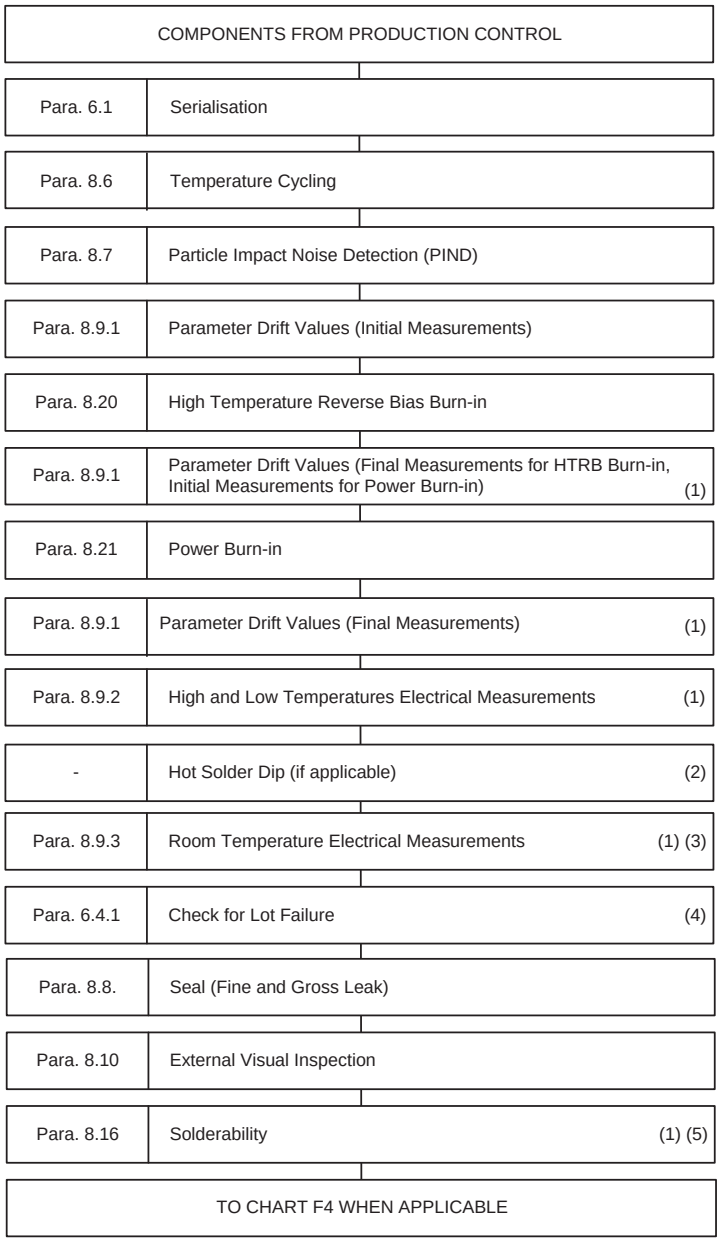
and the required testing shall be as stipulated in the Purchase Order (ref. ESCC Basic Specification No. 23100).

12.2 CHART F2 - PRODUCTION CONTROL



NOTES:
1. Performed on a sample basis.
2. If specified in the Detail Specification and stipulated in the Purchase Order.
3. Guaranteed but not tested.

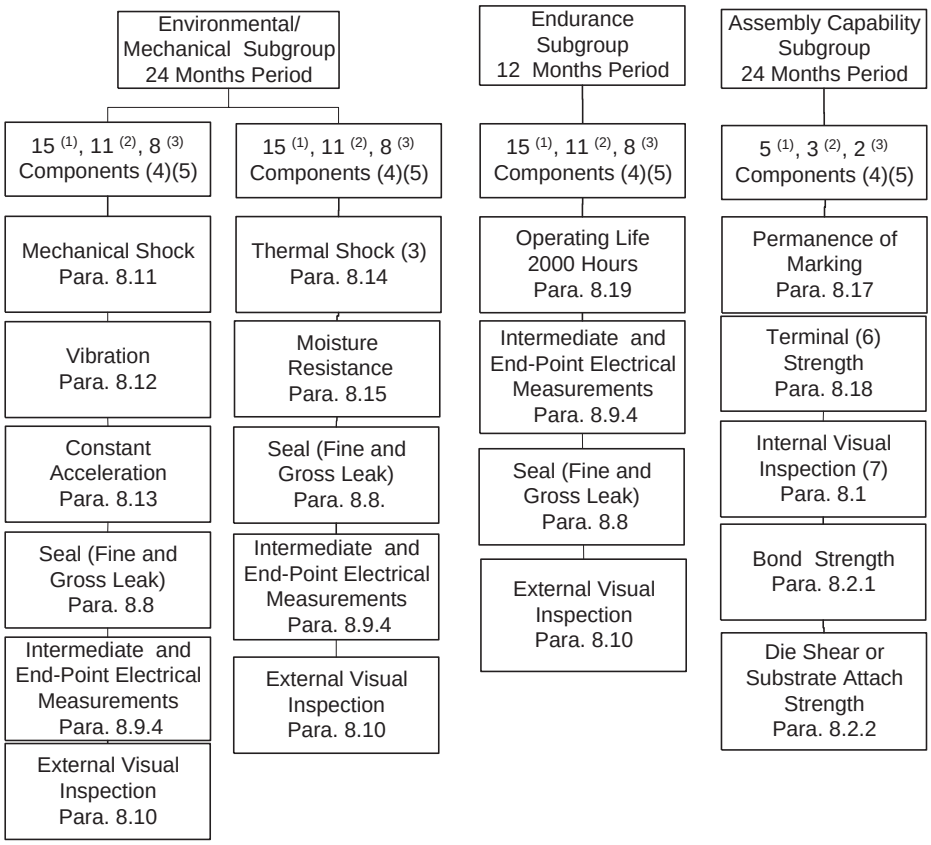
12.3 CHART F3 - SCREENING TESTS



NOTES:

1. The lot failure criteria of Para. 6.4 apply to this test.
2. 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 Para. 8.9.1, 8.9.2, 8.9.3 subsequent to HTRB Burn-in.
5. Performed on a sample basis.

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. Per type for three or more types selected (see Para. 7.1.2.2)
4. For distribution within the subgroups, see Para. 7.1.2 for qualification and qualification maintenance, and Para. 7.5 for Lot Validation Testing.
5. No failures are permitted.
6. May be done at the beginning or the end of the subgroup, depending on package configuration.
7. The components shall be deencapsulated using suitable means to facilitate Internal Visual Inspection, Bond Strength and either Die Shear or Substrate Attach Strength.