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Pages 1 to 33

DISCRETE SEMICONDUCTOR COMPONENTS

ESA/SCC Generic Specification No. 5000



**space components
coordination group**

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 9	June 1999	<i>Sam Mitchell</i>	<i>John</i>
Revision 'A'	December 2000	<i>Sam Mitchell</i>	<i>John</i>

**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 8 and incorporates all modifications defined in Revisions 'A', 'B' and 'C' to Issue 8 and the changes agreed in the following DCRs:- Cover page DCN Para. 8.2.1 : New penultimate paragraph added : New second sentence added to the last paragraph Chart V : "(3)" added to "No failures allowed" : Note 3 added Para. 10.1.2.1 : Item (b), "PDA figure and" deleted from text : Item (c) rewritten Para. 10.1.3.1 : Item (a), "(including PDA figure)" deleted Para. 10.10 : New Item (e) added		None None 21134 21111 21134 21134 21119 21119 21119 21134
'A'	Dec. '00	P1. Cover page P2. DCN P24. Para. 9.17	: First sentence amended to allow "OA" flux	None None 221584

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1. INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification approval, procurement, including lot acceptance testing, and delivery of discrete semiconductor 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 ESA/SCC Basic Specification No. 20100 and the procurement of such components from qualified Manufacturers.

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 placing the purchase order.

2.1 ESA/SCC 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 Despatch of SCC Electronic Components.

No. 20900, Radiographic Inspection

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

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

No. 22800, ESA/SCC 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. 24600, Minimum Quality System Requirements.

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

With the exception of ESA/SCC Basic Specifications Nos. 20100, 21700, 22800 and 24600, where Manufacturers' specifications are equivalent to, or more stringent than, the ESA/SCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the appropriate Qualifying Space Agency.

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

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

2.2 OTHER (REFERENCE) DOCUMENTS

MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-414, Sampling Procedures and Tables for Inspection by Variables for Percent Defective.



MIL-STD-202, Test Methods for Electronic and Electrical Components Parts.

MIL-STD-750, Test Methods for Semiconductor Devices.

MIL-STD-883, Test Methods and Procedures for Micro-electronics.

ESA PSS-01-702, A Thermal Vacuum Test for the Screening of Space Materials.

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) ESA/SCC Detail Specification.
- (b) ESA/SCC Generic Specification.
- (c) ESA/SCC Basic Specification.
- (d) Other documents, if referenced herein.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

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

4. REQUIREMENTS

4.1 GENERAL

The test requirements for qualification approval of a component shall comprise radiation tests (see Para. 5.2.1), final production tests (see Chart II), burn-in and electrical measurements to testing Level 'B' (see Chart III) and qualification testing (see Chart IV).

The test requirements for procurement of components shall comprise radiation tests (see Para. 5.2.1), if specified by the Orderer, final production tests (Chart II), burn-in and electrical measurements to testing Level 'B' or 'C' as required (Chart III) together with, when applicable, a level of lot acceptance testing (see Chart V) to be specified by the Orderer.

If a Manufacturer elects to eliminate a final production test by substituting an in-process control or statistical process control 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.

The qualification status of the procured components shall not be impaired by variations in the level of radiation testing called for in the purchase order.

4.1.1 Specifications

For qualification approval, procurement (including lot acceptance testing) and delivery of components in conformity with this specification, the 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 ESA/SCC 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 Qualifying Space Agency prior to commencing qualification testing, or procurement, to use an approved external facility.



4.1.4 Inspection Rights

The Qualifying Space Agency (for qualification approval or for a procurement) reserves the right to monitor any of the tests and inspections scheduled in the applicable specifications.

4.1.5 Pre-encapsulation Inspection

The Manufacturer shall notify the Orderer at least 2 working weeks before the commencement of pre-encapsulation inspection.

The Orderer shall indicate immediately whether or not he intends to witness the inspection.

4.2 QUALIFICATION APPROVAL REQUIREMENTS ON A MANUFACTURER

To obtain and maintain the qualification approval of a component, or family of components, a Manufacturer shall satisfy the requirements of ESA/SCC Basic Specification No. 20100.

4.3 DELIVERABLE COMPONENTS

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

ESA/SCC qualified components delivered to this specification shall be produced from lots that are capable of passing all tests, and sequences of tests, that are defined in Charts IV and V. 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.

Each delivered component shall be traceable to its production lot. Components delivered to this specification shall have completed satisfactorily all tests to the testing level and lot acceptance level specified in the purchase order (see Para. 4.3.2).

Components failing inspections and tests of the higher testing level (i.e. Level 'B') shall not be supplied against any order for components of the lower testing level.

Components produced from lots where samples have failed the specified level of radiation testing shall not be delivered against orders requiring a lower level of radiation testing, unless data is available to demonstrate that the samples passed that lower level. Should such data not be available, components shall not be delivered against orders requiring a lower level of radiation testing unless a sample is first retested to that lower level.

4.3.1 Lot Failure

Lot failure may occur during final production tests (Chart II), burn-in and electrical measurements (Chart III), qualification testing (Chart IV) or lot acceptance testing (Chart V).

Should such failure occur, the non-conformance procedure shall be initiated in accordance with ESA/SCC Basic Specification No. 22800.

Should such failure occur during procurement, the Manufacturer shall notify the Orderer by telex within 2 working days, giving details of the number and mode of failure and the suspected cause.

In the case where qualification approval has been granted to the components, he shall, at the same time by the same means, inform the Qualifying Space Agency in order that the latter may consider its implications.



No further testing shall be performed on the failed components except on instruction from the Orderer. The Orderer shall inform the Manufacturer and the Qualifying Space Agency within 2 working days of receipt of the telex, by the same means, what action shall be taken.

In the case when lot failure occurs during qualification testing, the Manufacturer shall immediately notify the appropriate Qualifying Space Agency who will define a course of action to be followed. No further testing shall be performed on the failed components.

4.3.2 Testing and Lot Acceptance Levels

This specification defines 6 levels of radiation testing (see ESA/SCC Basic Specification No. 22900), 2 levels of testing severity which are designated by the letters 'B' and 'C' (see Chart I) and 3 levels of lot acceptance testing (see Chart V).

The lot acceptance levels are designated 1, 2 and 3 and are comprised of tests as follows:-

Level 3 (LA3) - Electrical Subgroup.

Level 2 (LA2) - Endurance Subgroup
plus Electrical Subgroup.

Level 1 (LA1) - Environmental and Mechanical Subgroup
plus Endurance Subgroup
plus Electrical Subgroup.

The required level of radiation testing, testing level and lot acceptance level shall both be specified in the purchase order.

4.4 MARKING

All components procured and delivered to this specification from a source qualified according to ESA/SCC Basic Specification No. 20100 shall be marked in accordance with ESA/SCC Basic Specification No. 21700. Thus, they shall bear the ESA symbol to signify their conformance to the ESA/SCC qualification approval requirements and full compliance with the requirements of this specification and the Detail Specification.

Components procured from sources which are not ESA/SCC qualified, provided that they fully comply with the procurement requirements of this specification and the Detail Specification, may bear the SCC marking **with the exception of the ESA symbol.**

4.5 MATERIALS AND FINISHES

All non-metallic materials and finishes, that are not within a hermetically sealed enclosure, of the components specified herein shall meet the outgassing requirements as outlined in ESA PSS-01-702.

Specific requirements for materials and finishes are specified in the Detail Specification.

5. PRODUCTION CONTROL

5.1 GENERAL

The minimum requirements for production control, which are equally applicable to procurement, are defined in ESA/SCC Basic Specification No. 20100, Paras. 5.1 and 5.2.

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5.2 SPECIAL IN-PROCESS CONTROLS

5.2.1 Total Dose Radiation Testing

During qualification and maintenance of qualification:-

If specified in the Detail Specification, components shall be produced from a wafer lot which has been subjected to and successfully met the radiation requirements contained in ESA/SCC Basic Specification No. 22900.

During procurement:-

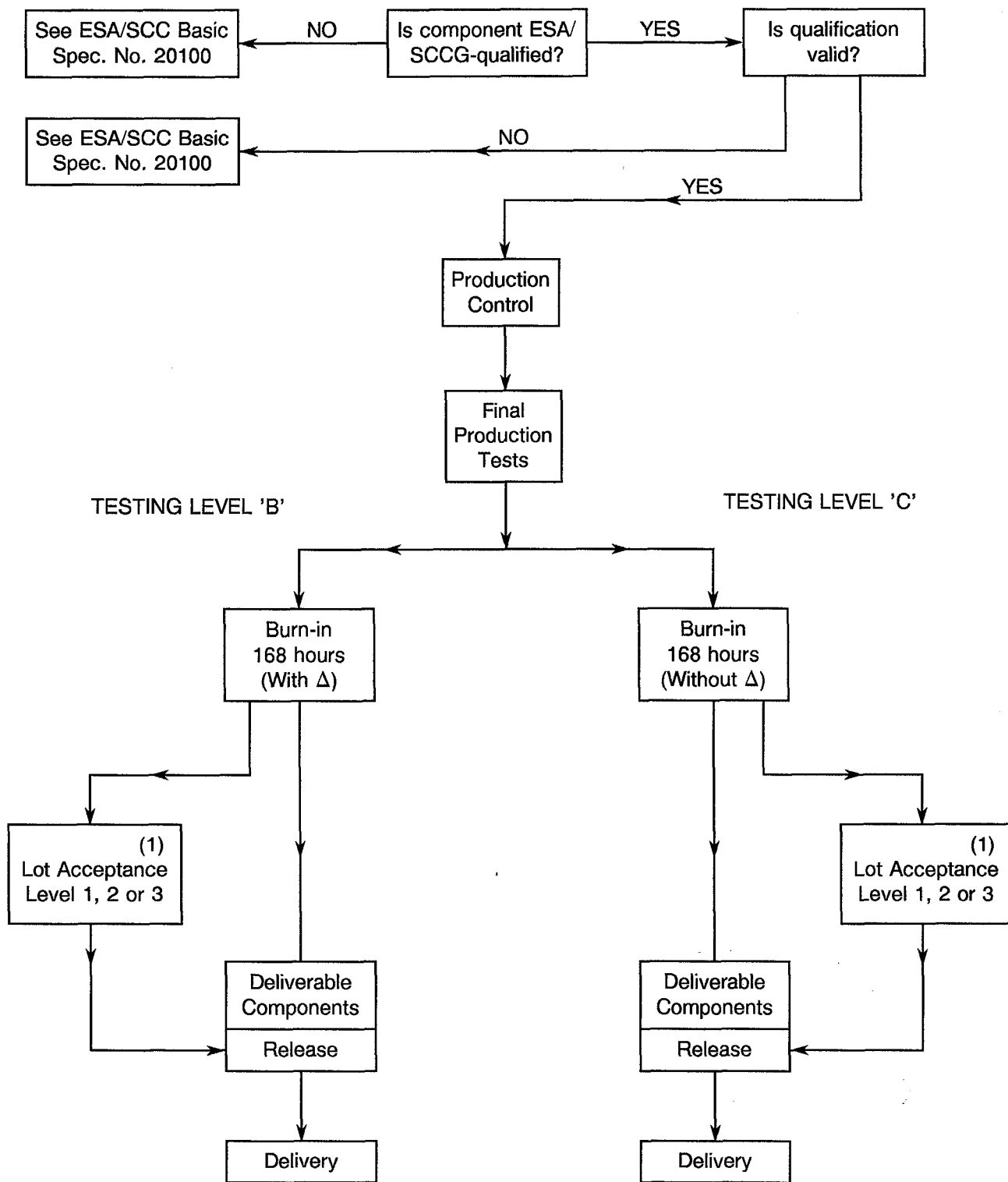
When required by the Purchase Order, components shall be produced from a wafer lot which has been subjected to and successfully met the radiation requirements contained in ESA/SCC Basic Specification No. 22900.

5.2.2 Documentation

Documentation of special in-process controls shall be in accordance with the requirements of Para. 10.5 of this specification.



CHART I - TESTING LEVELS



NOTES

1. When applicable.

**6. FINAL PRODUCTION TESTS****6.1 GENERAL**

Unless otherwise specified in the Detail Specification, all components used for qualification testing and all components for delivery, including those submitted to lot acceptance tests, shall be subjected to tests and inspections in accordance with Chart II.

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

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

6.2 TEST METHODS AND CONDITIONS

The applicable test methods and conditions are specified in the paragraphs referenced in Chart II of this specification.

6.3 DOCUMENTATION

Documentation of final production test data shall be in accordance with the requirements of Para. 10.6 of this specification.

7. BURN-IN AND ELECTRICAL MEASUREMENTS**7.1 GENERAL**

Unless otherwise specified in the Detail Specification, all components used for qualification testing and all components for delivery, including those submitted to lot acceptance tests, shall be subjected to tests and inspections in accordance with Chart III.

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

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

Components of testing Level 'B' shall be serialised prior to the tests and inspections.

7.1.1 Conditions of Test

(a) Where applicable, the test conditions and duration for the high temperature reverse bias (HTRB) burn-in shall be as shown in Table 5 of the Detail Specification.

For the applicable test methods and procedures, see Para. 9.22.

(b) The conditions for burn-in shall be as shown in Table 5 of the Detail Specification.

Unless otherwise specified in the Detail Specification, components of both Levels 'B' and 'C' shall be subjected to a total burn-in period of 168 hours.

For the applicable test methods and procedures, see Para. 9.23.

7.1.2 Data Points

For components of testing Level 'B' undergoing the high temperature reverse bias test, the data points for parameter drift measurements shall be 0 hours (initial) and the test end-point as specified in the Detail Specification.



For components of testing Level 'B' undergoing a total burn-in period of 168 hours, the data points for parameter drift measurement shall be 0 hours (initial) and 168(+ 24 - 0) hours (final).

For components of testing Level 'C', undergoing a total burn-in of 168 hours, the data point for post burn-in electrical measurements shall be 168(+ 24 - 0) hours.

7.2 FAILURE CRITERIA

7.2.1 Parameter Drift Failure

The acceptable delta limits are shown in Table 4 of the Detail Specification. A component of testing Level 'B' shall be counted as a parameter drift failure if the changes during high temperature reverse bias or during burn-in are larger than the delta (Δ) values specified.

7.2.2 Parameter Limit Failure

A component shall be counted as a limit failure if one or more parameters exceed the limits shown in Tables 2 or 3 of the Detail Specification.

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

7.2.3 Other Failures

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

- Mechanical failure.
- Handling failure.
- Lost component.

7.3 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 7.2 of this specification.

7.4 LOT FAILURE

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

7.4.1 Lot Failure during 100% Testing

If the number of components failed on the basis of the failure criteria described in Para. 7.2 exceeds 5% (rounded upwards to the nearest whole number) of the number of components submitted to burn-in and electrical measurements, the lot shall be considered as failed.

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

7.4.2 Lot Failure during Sample Testing

A lot shall be considered as failed if the number of allowable failures during sample testing in accordance with General Inspection Level II of MIL-STD-105 and the applicable AQL, as specified in the Detail Specification, is exceeded.

In the case where an LTPD to MIL-STD-414 is specified in the Detail Specification, a lot shall be considered as failed if the number of failures allowed is exceeded.



If a lot failure occurs in either case, a 100% testing may be performed with the lot failure criteria given in Para. 7.4.1.

7.5 DOCUMENTATION

Data documentation of burn-in and electrical measurements shall be in accordance with Para. 10.7 of this specification.

8. QUALIFICATION APPROVAL AND LOT ACCEPTANCE TESTS

8.1 QUALIFICATION TESTING

8.1.1 General

Qualification testing shall be in accordance with the requirements of Chart IV of this specification. The tests to Chart IV shall be performed on the specified sample, chosen at random from components which have successfully passed the tests in Charts II and III for testing Level 'B'. 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 IV.

The conditions governing qualification testing are given in ESA/SCC Basic Specification No. 20100, Para. 5.3 and, for the extension or renewal of qualification approval, in Paras. 6.3 and 6.4.

8.1.2 Distribution within the Qualification Test Lot

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

The distribution shall be as specified, or agreed with, the Qualifying Space Agency.

8.2 LOT ACCEPTANCE TESTING

8.2.1 General

The sample sizes of the 3 lot acceptance levels are specified in Chart V. All components assigned to a subgroup shall be subjected to all of the tests of that subgroup in the sequence shown.

The tests to Chart V shall be performed on the specified sample which shall have been chosen, whenever possible, at random from the proposed delivery lot (but see Para. 8.2.3(b)).

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

For a qualified Manufacturer, the failure of 1 component shall be permitted when this is completely attributable to a handling or other human error and can be demonstrated to have no bearing on the inherent quality or reliability of the lot. The Manufacturer shall prepare a report justifying this assessment for inclusion in the lot data documentation. The Manufacturer shall also ensure that appropriate measures are taken to prevent a reoccurrence of the error and make objective evidence of these preventative measures available to the relevant Qualifying Space Agency, when requested.

As a minimum for procurement of non-qualified components, lot acceptance level 3 tests shall apply. For procurement of qualified components, lot acceptance testing shall be performed if specified in a purchase order. Procurement lots ordered with a lot acceptance test level shall be delivered only after successful completion of lot acceptance testing.



8.2.2 Distribution within the Sample for Lot Acceptance Testing

Where a Detail Specification covers a range, or series, of components that are considered similar, then it may be necessary that the sample for lot acceptance testing be comprised of component types so selected that they adequately represent all of the various mechanical, structural and electrical peculiarities of that range or series.

The distribution of the component types will normally vary from procurement to procurement and shall be as specified by the Orderer.

8.2.3 Lot Acceptance Level 3 Testing (LA3)

Lot acceptance level 3 tests are designated as the electrical subgroup and comprise electrical measurements of characteristics and tests to prove the assembly capability of the component.

For LA3 testing, the following requirements and conditions shall apply:-

- (a) LA3 testing shall be performed by the Manufacturer's quality assurance personnel using dedicated quality assurance equipment whenever possible. LA3 testing shall not be a repetition of routine measurements made by production personnel during final production tests and burn-in and electrical measurements.
- (b) When tests to Tables 2 and 3 of the Detail Specification have been performed on a sample basis, then the components for LA3 testing shall be selected from this sample.
- (c) The electrical measurements for LA3 are considered to be non-destructive and therefore components so tested may form part of the delivery lot.
- (d) The solderability test is considered to be destructive and therefore components so tested shall not form part of the delivery lot. Post burn-in electrical rejects may be used for this test.
- (e) When required in the purchase order, the Manufacturer shall notify the Orderer at least 2 working weeks before the commencement of LA3 testing. The Orderer shall indicate immediately whether or not he intends to witness the tests.

8.2.4 Lot Acceptance Level 2 Testing (LA2)

Lot acceptance level 2 testing shall comprise the tests for LA3 (electrical subgroup) plus tests on an endurance subgroup. For the electrical subgroup, the requirements and conditions as for LA3 (see Para. 8.2.3) shall apply.

For the endurance subgroup, the following shall apply:-

- (a) Components of testing Level 'C', selected for the endurance subgroup, shall be serialised prior to the tests.
- (b) The tests in this subgroup are considered to be destructive and therefore components (of testing Level 'B' or 'C') so tested shall not form part of the delivery lot.

8.2.5 Lot Acceptance Level 1 Testing (LA1)

Lot acceptance level 1 testing shall comprise the tests for LA3 (electrical subgroup) and LA2 (endurance subgroup) plus tests on an environmental and mechanical subgroup. For the electrical and endurance subgroups, the requirements and conditions for LA3 (see Para. 8.2.3) and LA2 (see Para. 8.2.4) respectively shall apply.

For the environmental subgroup, the following shall apply:-

- (a) Components of testing Level 'C', selected for the environmental subgroup, shall be serialised prior to the tests.
- (b) The tests in this subgroup are considered to be destructive and therefore components (of testing Level 'B' or 'C') so tested shall not form part of the delivery lot.



8.3 FAILURE CRITERIA

The following criteria shall apply to qualification testing and to lot acceptance testing.

8.3.1 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, solderability, terminal strength, etc.

8.3.2 Electrical Failures

The following shall be counted as component failures:-

- (a) Components which, when subjected to electrical measurements on completion of environmental tests, in accordance with either Table 2 or Table 6, as specified in the Detail Specification, fail one or more the applicable limits.
- (b) Components which, when subjected to electrical measurements at intermediate and end-points during endurance testing, in accordance with Table 6 of the Detail Specification, fail one or more of the applicable limits.
- (c) Components which, when subjected to measurement of electrical characteristics, in accordance with Tables 2 and 3 of the Detail Specification, fail one or more of the applicable limits.

8.3.3 Other Failures

The following additional failures may also occur during qualification testing or lot acceptance testing:-

- (a) Components failing to comply with the requirements of ESA/SCC Basic Specification No. 20500.
- (b) Lost components.

8.4 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para 8.3 of this specification.

The allowable number of failed components per subgroup, the aggregate failure constraints and the permitted distribution of such failures are shown at the foot of Charts IV and V of this specification.

When requested by the Qualifying Space Agency or the Orderer, failure analysis of failed components shall be performed by the Manufacturer and the results provided.

Failed components from successful lots shall be marked as such and be stored at the Manufacturer's plant for 24 months.

8.5 LOT FAILURE

A lot shall be considered as failed if the allowable number of failures according to Chart IV or V of this specification, as relevant, has been exceeded.

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

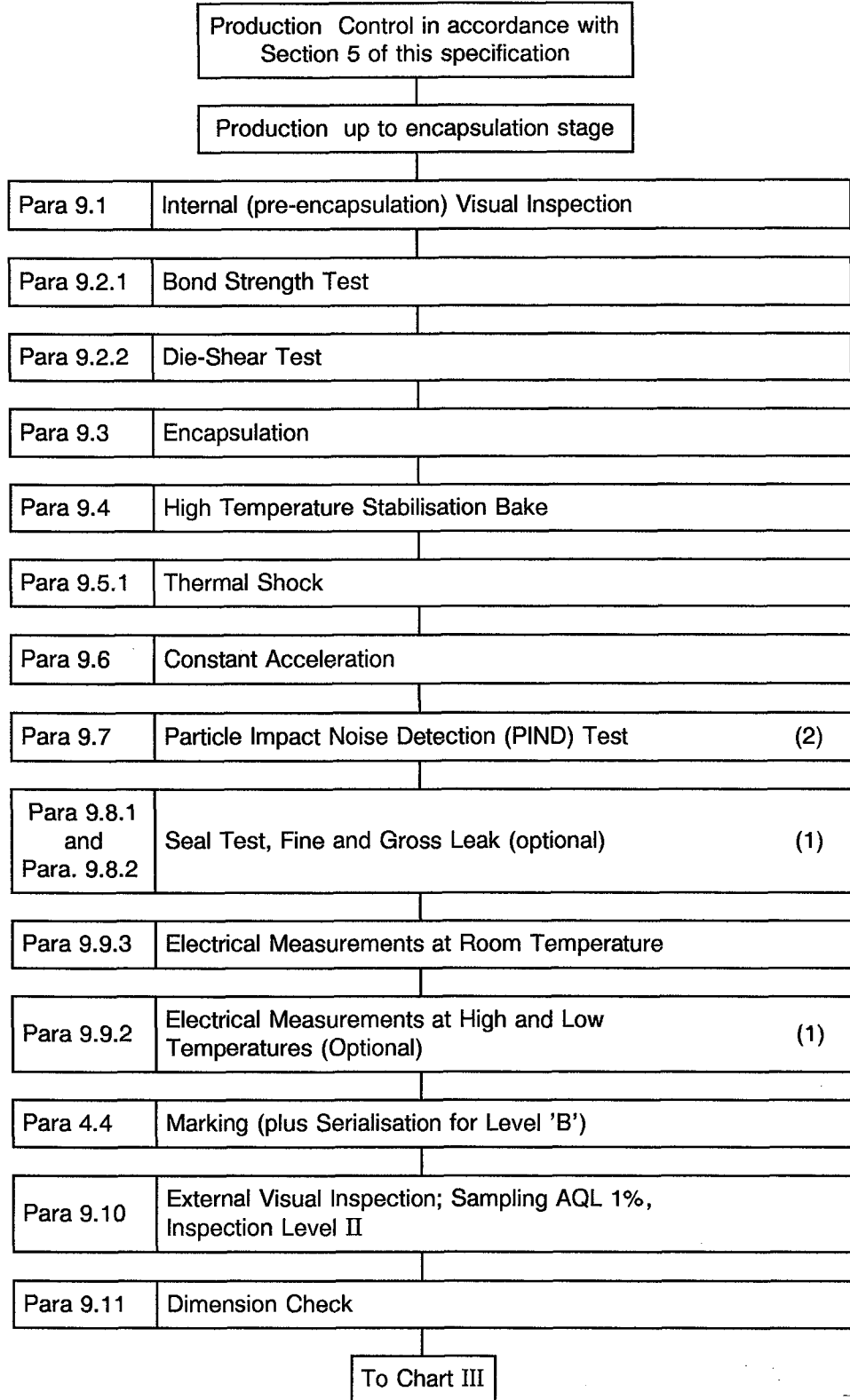
8.6 DOCUMENTATION

For qualification testing, the qualification test data shall be documented in accordance with the requirements of Para. 10.8 of this specification.

In the case of lot acceptance testing, the data shall be documented in accordance with the requirements of Para. 10.9 of this specification.



CHART II - FINAL PRODUCTION TESTS

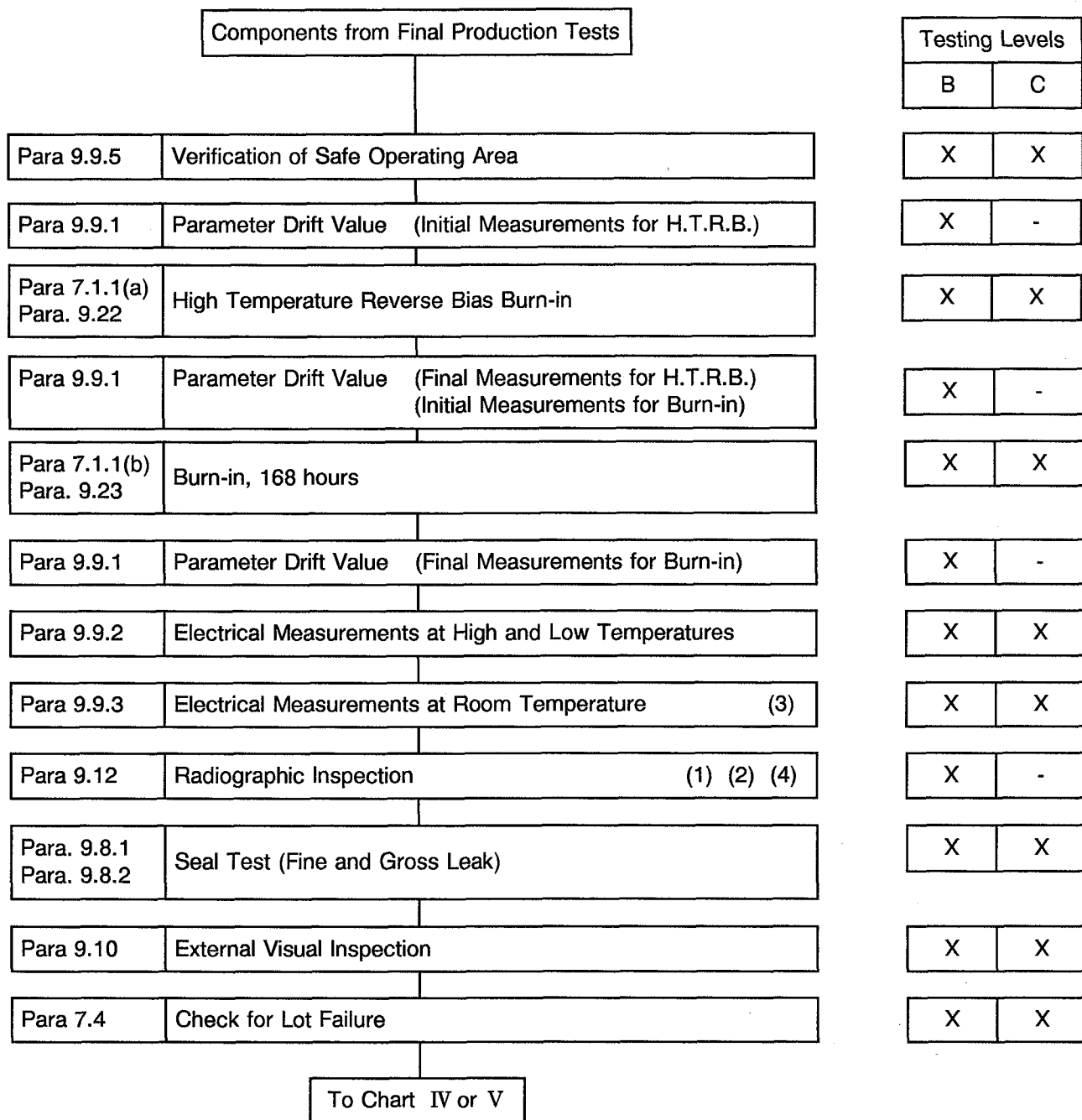


NOTES

1. The performance of these tests is left to the Manufacturer's discretion.
2. For all cavity devices of Testing Level 'B', except Diodes with transparent packages.



CHART III - BURN-IN AND ELECTRICAL MEASUREMENTS

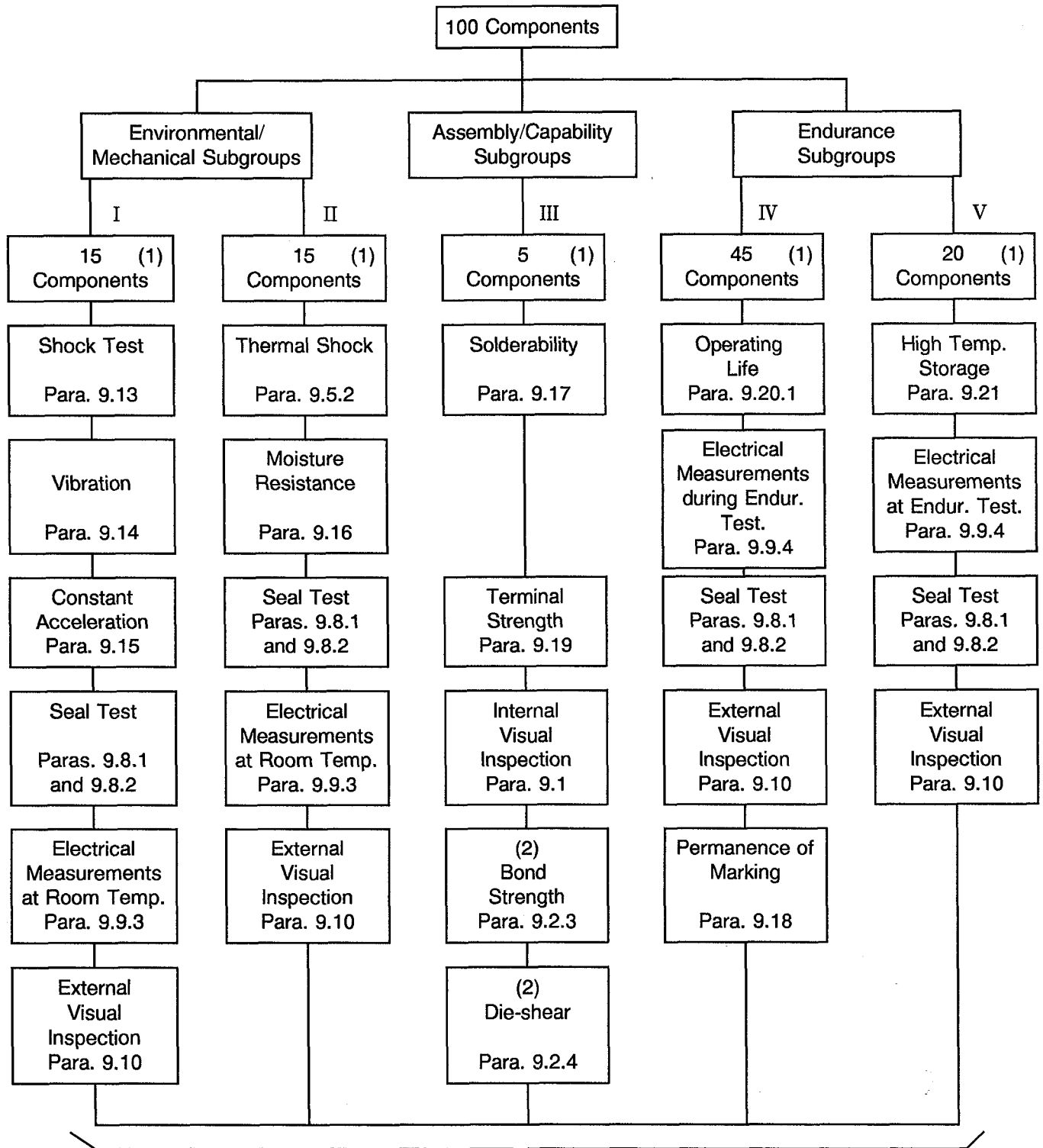


NOTES

1. Radiographic Inspection may be performed at any point during the test sequence shown in this Chart.
2. Radiographic Inspection rejects not to be counted for lot failure.
3. The measurement of parameters for the purpose of drift value measurements need not be repeated for electrical measurements at room temperature.
4. Except Diodes with transparent packages.



CHART IV - QUALIFICATION TESTS



1

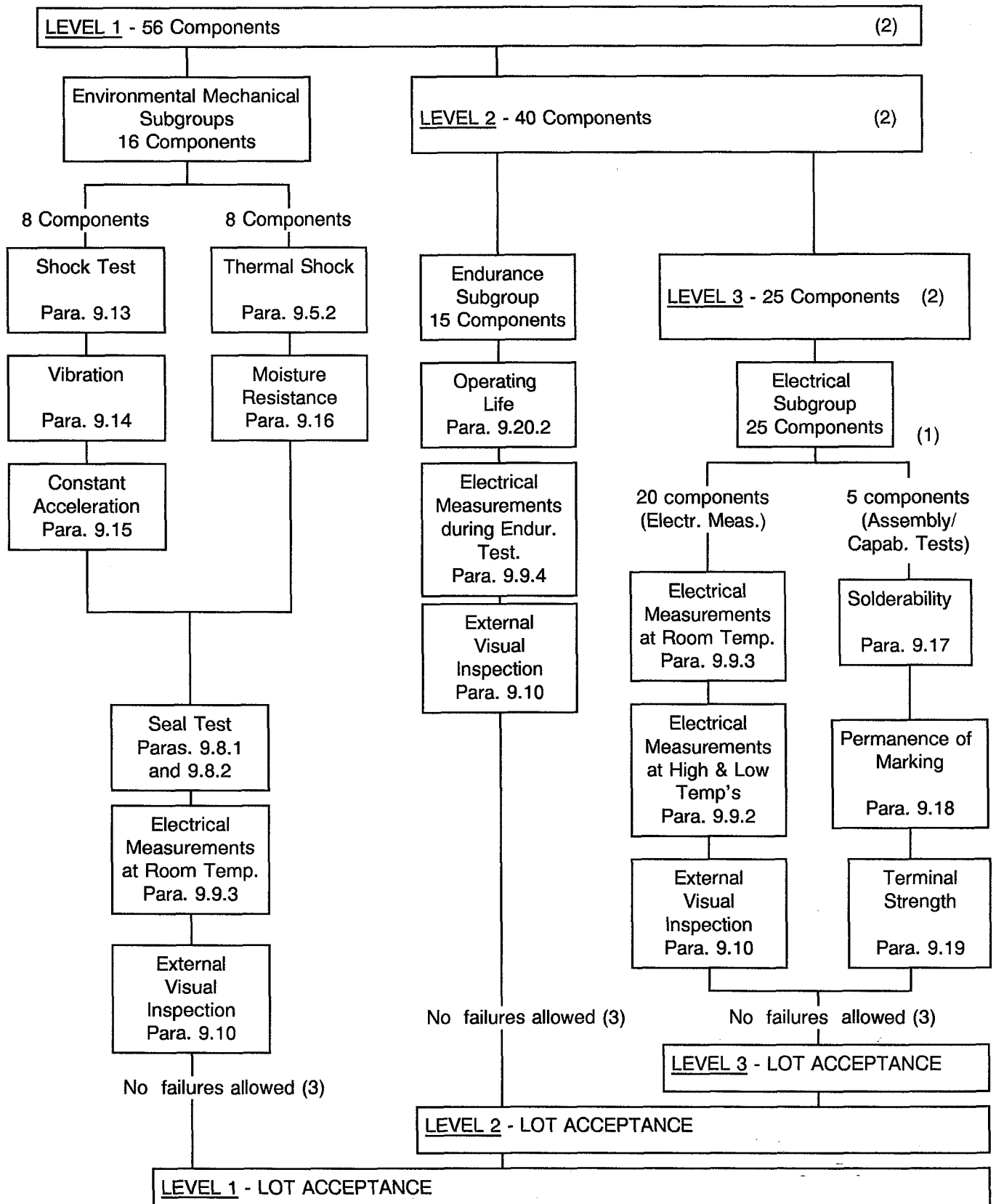
Total allowable number of failed components: 1.

NOTES

1. For distribution within the subgroups, see Para. 8.1.2.
2. No failures allowed for these tests.



CHART V - LOT ACCEPTANCE TESTS



NOTES

1. Post burn-in electrical rejects may be used for this test.
2. For distribution within the sample, see Para. 8.2.2.
3. See Para. 8.2.1.

**9. 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.

Documentation supporting the change shall be approved by the Qualifying Space Agency and retained by the Manufacturer. It shall be copied, when requested, to the Qualifying Space Agency.

The change shall be specified in the Detail Specification and in the P.I.D.

9.1 INTERNAL VISUAL INSPECTION

In accordance with ESA/SCC Basic Specification No. 20400.

9.2 BOND STRENGTH AND DIE-SHEAR TESTS

N.B. These tests are destructive.

9.2.1 Bond Strength Test during Final Production Tests**(a) Test Conditions:**

MIL-STD-750, Test Method 2037, Test Condition 'A' or 'B'.

- Test Condition 'B' shall only be permitted when Test Condition 'A' cannot be used and never for wires of diameter less than 0.005 inch.

(b) Test Procedures:

Test all bonds on 3 components selected at random from the lot accepted after internal visual inspection.

If agreed by the Q.S.A. (for qualification approval) or the Orderer (for a procurement), the components used for this test may have passed the low magnification phase only of the Internal Visual Inspection (Para. 9.1).

N.B.

The low magnification phase of the Internal Visual Inspection is that part of the inspection (at a magnification of <100) that addresses the bonds, bond wires and die mount.

(c) Accept/Reject Criteria:

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

9.2.2 Die-Shear Test during Final Production Tests**(a) Test Conditions:**

MIL-STD-750, Test Method 2017.

(b) Test Procedures:

Perform the test on the components previously submitted to the bond strength test.

(c) Accept/Reject Criteria:

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

9.2.3 Bond Strength Test during Qualification Testing**(a) Test Conditions:**

As per Para. 9.2.1(a).

(b) Test Procedures:

As per Para. 9.2.1(b), but components to be selected from those in Subgroup III of Chart IV.



(c) **Accept/Reject Criteria:**

As per Para. 9.2.1(c).

9.2.4 Die-Shear Test during Qualification Testing

(a) **Test Conditions:**

As per Para. 9.2.2(a).

(b) **Test Procedures:**

Perform the test on the components in Subgroup III of Chart IV previously submitted to the Bond Strength Test.

(c) **Accept/Reject Criteria:**

As per Para. 9.2.2(c).

9.3 ENCAPSULATION

In accordance with the Process Identification Document (P.I.D.).

9.4 HIGH TEMPERATURE STABILISATION BAKE

MIL-STD-750, Test Method 1032, Duration: 48 hours at the maximum storage temperature rating specified in Table 1 or 1(b) of the Detail Specification.

9.5 THERMAL SHOCK

9.5.1 Final Production Tests

(a) **Metal Encapsulation:** MIL-STD-202, Test Method 107, Test Condition 'B'.

(b) **Glass Encapsulation:** MIL-STD-202, Test Method 107, Test Condition 'C', 20 cycles.

9.5.2 Qualification and Lot Acceptance Tests

(a) **Metal Encapsulation:** MIL-STD-202, Test Method 107, Test Condition 'B'.

(b) **Glass Encapsulation:** MIL-STD-750, Test Method 1056, Test Condition 'A', 10 cycles.

9.6 CONSTANT ACCELERATION

MIL-STD-750, Test Method 2006, Test Condition: 20 000g. To be performed in plane Y₁ only.

9.7 PARTICLE IMPACT NOISE DETECTION (PIND)

MIL-STD-750, Test Method 2052, Test Condition 'A'. The use of the same attachment medium for the Sensitivity Test Unit (S.T.U.) and for the components under test (D.U.T.) is not mandatory.

PIND prescreening shall not be performed.

The test frequency shall be selected based on the average internal package height from the graph of Figure 2052-2 of the test method. The average internal package height shall be the distance measured from the floor of the package cavity, excluding the thickness of the die mounted inside the package, to the underside of the package lid. For heights of less than 10mils the test frequency shall be 250Hz and for heights greater than 400mils the test frequency shall be 40Hz.

The lot shall be submitted to the PIND test procedure a maximum of 5 times.

After each PIND test procedure, defective devices shall be removed from the lot.

If the cumulative defective devices exceed 25% of the lot, the lot shall be rejected.



After any of the 5 PIND test procedures, if the number of defective devices does not exceed 1 or is less than 1% of the number of devices submitted to the procedure the lot shall be accepted.

9.8 SEAL TEST

9.8.1 Seal Test, Fine Leak

MIL-STD-750, Test Method 1071, Condition 'H1' or 'H2'.

This test is not applicable to double plug diodes.

9.8.2 Seal Test, Gross Leak

MIL-STD-750, Test Method 1071, Condition 'C' or 'K'.

9.9 ELECTRICAL MEASUREMENTS

9.9.1 Parameter Drift Value Measurements

At each of the relevant data points for components of testing Level 'B', measurements shall be made of all parameters listed in Table 4 of the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated.

9.9.2 Electrical Measurements at High and Low Temperatures

For components of testing Levels 'B' and 'C', the electrical measurements at high and low temperatures shall be made in accordance with Table 3 of the Detail Specification. For testing level 'B', all values obtained shall be recorded against serial numbers. The measurements shall be performed on a sample basis, LTPD7 or lower, noting the requirements of Para. 8.2.3(b).

9.9.3 Electrical Measurements at Room Temperature

For components of testing Levels 'B' and 'C', the measurements of electrical characteristics shall be made in accordance with Table 2 of the Detail Specification. Where sample testing is applied, note the requirements of Para. 8.2.3(b). For testing Level 'B', all values obtained shall be recorded against serial numbers, except during Final Production Tests (Chart II).

9.9.4 Electrical Measurements during Endurance Testing

At each of the relevant data points specified for endurance testing, measurements shall be made of all parameters listed in Table 6 of the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated, if required.

9.9.5 Verification of Safe Operating Area

If required in the Detail Specification, a verification of the safe operating area shall be performed. The specified Test Method(s), specific conditions and limits shall be as given in the Detail Specification. The Test Method(s) shall be selected from the following:-

(a) **Bipolar Transistors:**

Maximum Continuous d.c. : MIL-STD-750, Test Method 3051.
Pulsed : MIL-STD-750, Test Method 3052.
Switching : MIL-STD-750, Test Method 3053. The load conditions shall also be specified.

(b) **Power Mosfets and Insulated Gate Bipolar Transistors (IGBT):**

MIL-STD-750, Test Method 3474.

**(c) Other Devices:**

As specified in the Detail Specification.

9.10 EXTERNAL VISUAL INSPECTION

In accordance with ESA/SCC Basic Specification No. 20500.

9.11 DIMENSION CHECK

In accordance with ESA/SCC Basic Specification No. 20500 and the Detail Specification. To be performed on 5 samples only.

If 1 failure occurs, the complete lot shall be checked.

9.12 RADIOGRAPHIC INSPECTION

In accordance with ESA/SCC Basic Specification No. 20900.

9.13 SHOCK TEST

MIL-STD-750, Test Method 2016, 1 500g, 0.5 milliseconds duration, 5 shocks, planes X1, Y1 and Z1.

9.14 VIBRATION

MIL-STD-750, Test Method 2056, 20g, 10-2 000Hz, cross-over at 50Hz.

9.15 CONSTANT ACCELERATION

MIL-STD-750, Test Method 2006, 20 000g, planes X1, Y1 and Y2.

9.16 MOISTURE RESISTANCE

MIL-STD-750, Test Method 1021.

9.17 SOLDERABILITY

MIL-STD-750, Test Method 2026, to be performed on all terminals.

The use of activated fluxes (RMA and RA or OA) shall be allowed on leadless devices with gold finished terminals. All activated fluxes must be immediately cleaned off after dipping using an acceptable solvent in accordance with Para. 4.3 of ESA/SCC Basic Specification No. 23500.

9.18 PERMANENCE OF MARKING

In accordance with ESA/SCC Basic Specification No. 24800.

9.19 TERMINAL STRENGTH

MIL-STD-883, Test method 2004, Test Condition 'D' for Chip Carrier packages.

MIL-STD-750, Test Method 2036 for all other packages. Test Condition as specified in the Detail Specification.

9.20 OPERATING LIFE**9.20.1 Operating Life During Qualification Testing**

MIL-STD-750, Test Method 1026.

(a) **Duration:** 2 000 hours.

**(b) Test Conditions:**

As specified in the Detail Specification.

(c) Data Points:

Measurements at intermediate and end-points according Table 6 of the Detail Specification at 0, 1 000 ± 48 hours and 2 000 ± 48 hours.

In the case where Table 6 specifies "changes", the drift shall always be related to the 0-hour measurement.

9.20.2 Operating Life During Lot Acceptance Testing

MIL-STD-750, Test Method 1026.

(a) Duration: 1 000 hours.

(b) Test Conditions:

As specified in the Detail Specification.

(c) Data Points:

Measurements at 0 hours and at 1 000 ± 48 hours according to Table 6 of the Detail Specification.

9.21 HIGH TEMPERATURE STORAGE

MIL-STD-750, Test Method 1031.

(a) Duration: 2 000 hours.

(b) Test Conditions:

As specified in the Detail Specification

(c) Data Points:

Measurements at intermediate and end-points according to Table 6 of the Detail Specification at 0, 1 000 ± 48 hours and 2 000 ± 48 hours.

In the case where Table 6 specifies "changes", the drift shall always be related to the 0-hour measurement.

9.22 BURN-IN, HIGH TEMPERATURE REVERSE BIAS**(a) For Diodes and Rectifiers:**

MIL-STD-750, Test Method 1038, Test Condition 'A'.

(b) For Transistors:

MIL-STD-750, Test Method 1039, Test Condition 'A'.

9.23 BURN-IN, STEADY STATE POWER**(a) For Diodes and Rectifiers:**

MIL-STD-750, Test Method 1038, Test Condition 'B'.

(b) For Transistors:

MIL-STD-750, Test Method 1039, Test Condition 'B'.

(c) For Thyristors:

MIL-STD-750, Test Method 1040, Test Condition 'B'.

**10. DATA DOCUMENTATION****10.1 GENERAL**

For the qualification approval records and with each component delivery, a data documentation package is required. Depending on the testing level and lot acceptance level specified for the component, this package shall be compiled from:-

- (a) Cover sheet (or sheets).
- (b) List of equipment (testing and measuring).
- (c) List of test references.
- (d) Special in-process control test data.
- (e) Final production test data (Chart II) (but see Para. 10.6).
- (f) Burn-in and electrical measurement data (Chart III).
- (g) Qualification test data (Chart IV).
- (h) Lot acceptance test data (Chart V) (when applicable).
- (i) Failed components list (see Paras. 7.3 and 8.4) and failure analysis report (see Para. 8.4).
- (j) Certificate of Conformity.
- (k) Radiographic inspection photographs.

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

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

10.1.1 Qualification Approval

In the case of qualification approval, the items listed in Para. 10.1 (a) to (k) less item (h) are required.

10.1.2 Testing Level 'B'**10.1.2.1 Qualified Components**

For deliveries of qualified components, 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).
- (c) Attributes record of measurements, tests and inspections performed in Chart II, Chart III (including PDA figure) and Chart V (where applicable).
- (d) Failed components list.



10.1.2.2 Unqualified Components

For deliveries of unqualified components, the documentation to be supplied shall be in accordance with Para. 10.1.2.1 plus the following:-

- (a) Read and record data from Chart III.
- (b) Special in-process control data (where applicable).
- (c) Failure analysis report on failed components.

10.1.3 Testing Level 'C'

10.1.3.1 Qualified Components

For deliveries of qualified components, the following documentation shall be supplied:-

- (a) Certificate of Conformity.

10.1.3.2 Unqualified Components

For deliveries of unqualified components, the documentation to be supplied shall be in accordance with Para. 10.1.3.1 plus the following:-

- (a) Cover sheet (if all of the information is not included on the Certificate of Conformity).
- (b) Attributes record of all measurements, tests and inspections performed in Charts II, III and V (when applicable).
- (c) Failed components list (including Failure Analysis Report).
- (d) Special in-process control data (when applicable).

10.1.4 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 to the Qualifying Space Agency and the Orderer, if requested, for review. The Manufacturer shall deliver variables Data/Reports to the Orderer if required by the Purchase Order.

10.2 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 ESA/SCC Generic Specification, including issue and date.
- (c) Component type and number.
- (d) Lot identification.
- (e) Range of delivered serial numbers (for components of testing Level 'B').
- (f) Number of purchase order.
- (g) Radiation testing level.
- (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.

**10.3 LIST OF EQUIPMENT USED**

A list of equipment used for tests and measurements shall be prepared, if not in accordance with the data given in the Process Identification Document (P.I.D.). 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.

10.4 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.

10.5 SPECIAL IN-PROCESS CONTROL DATA

Radiation Test Report shall be provided in accordance with the requirements of ESA/SCC Basic Specification No. 22900 (if required).

10.6 FINAL PRODUCTION TEST DATA (CHART II)

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

- Pre-encapsulation internal visual inspection (Para. 9.1).
- Bond strength and die-shear test (Para. 9.2).
- Seal Test (fine and gross leak) (Para. 9.8).
- Environmental Tests (Paras. 9.4, 9.5, 9.6 and 9.7).
- Electrical measurements at high and low temperatures (Para. 9.9.2), (when applicable).
- Electrical measurements at room temperature (Para. 9.9.3).
- External visual inspection (Para. 9.10).
- Dimension check (Para. 9.11).

For the bond strength and die-shear tests, the separation forces and categories shall be recorded.

The final production test data shall form an integral part of the data documentation package, but it is not a mandatory requirement that it be delivered with the qualification lot or delivery lot. However, the data package to be delivered shall contain the information as detailed in Paras. 10.1.2 and 10.1.3 or at least shall contain a list of final production tests actually performed and a certification that the data is available for review.

10.7 BURN-IN AND ELECTRICAL MEASUREMENT DATA (CHART III)**10.7.1 Testing Level 'B'**

For components of testing Level 'B', all data shall refer to the relevant serial numbers. Against these serial numbers, data shall be recorded for the following:-

- (a) H.T.R.B. measurements and Delta values (if applicable).
- (b) 0-hour measurement for burn-in.
- (c) 168-hour measurement for burn-in.
- (d) Delta values after burn-in.
- (e) Values obtained during measurements at high and low temperatures (Table 3 of the Detail Specification).
- (f) Values obtained during measurements of electrical characteristics (Table 2 of the Detail Specification).



- (g) Failures during seal test.
- (h) Failures during external visual inspection.
- (i) Photographs from radiographic inspection, including those of reject components.

10.7.2 Testing Level 'C'

For components of testing Level 'C', a test result summary (i.e. the total number of components subjected to, and the total number rejected from, each of the tests and inspections) shall be prepared.

10.8 QUALIFICATION TEST DATA (CHART IV)

All data shall be referenced to the relevant serial numbers. Detailed records shall be provided of the components submitted to each test in each of the subgroups and of those rejected.

Detailed data shall be provided of all electrical measurements made in accordance with Tables 2 and 6 of the Detail Specification, as and where applicable.

10.9 LOT ACCEPTANCE TEST DATA (CHART V)

10.9.1 Testing Level 'B'

All data shall be referenced to the relevant serial numbers. Detailed records shall be provided of the components submitted to each test in each of the subgroups (as relevant to the lot acceptance level) and of those rejected.

Detailed data shall be provided of all electrical measurements made in accordance with Tables 2, 3 and 6 of the Detail Specification, as and where applicable.

10.9.2 Testing Level 'C'

A test result summary (i.e. the total number of components submitted to, and the total number rejected from, each of the tests and inspections) as relevant to the lot acceptance level, shall be provided.

In the case of lot acceptance 2 testing, all data in respect of electrical measurements made in accordance with Table 6 of the Detail Specification shall be referenced to the relevant serial numbers (see Para. 8.2.4(a)).

In the case of lot acceptance 1 testing, all data in respect of electrical measurements made in accordance with Tables 2 and 6 of the Detail Specification shall be referenced to the relevant serial numbers (see Para. 8.2.5(a)).

10.10 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

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

- (a) The reference number and description of the test or measurement performed as defined in this specification and/or the Detail Specification.
- (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.
- (e) In the case of an allowed failure during Chart V (see Para. 8.2.1), a report shall always be supplied.

**10.11 CERTIFICATE OF CONFORMITY**

A Certificate of Conformity shall be established as defined in ESA/SCC Basic Specification No. 20100.

11. DELIVERY

For qualification approval, the disposition of the qualification test lot and its related documentation shall be as specified in ESA/SCC Basic Specification No. 20100 and the relevant paragraphs of Section 10 of this specification.

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

- (a) The delivery lot.
- (b) The components used for lot acceptance testing, (when applicable), but not forming part of the delivery lot (see Paras. 8.2.3(d), 8.2.4(b) and 8.2.5(b)).
- (c) The relevant documentation in accordance with the requirements of Section 10 of this specification.

In the case of a component for which a valid qualification approval is in force, all data of all components submitted to LA1 and LA2 testing shall also be copied, when requested, to the relevant Qualifying Space Agency.

12. PACKAGING AND DESPATCH

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



ANNEXE I

LTPD SAMPLING PLAN FOR LOT SIZES GREATER THAN 200 DEVICES

Minimum size of sample to be tested to assure with a 90% confidence that a lot whose Percent Defective equals the specified LTPD is not accepted (single sample).

Max. Percent Defective (LTPD) or λ	50	30	20	15	10	7	5	3	2	1.5	1	0.7	0.5	0.3	0.2	0.15	0.1
Acceptance Number (c) (r = c + 1)	MINIMUM SAMPLE SIZES (FOR DEVICE-HOURS REQUIRED FOR LIFE TEST, MULTIPLY BY 1000)																
0	5 (1.03)	8 (0.64)	11 (0.46)	15 (0.34)	22 (0.23)	32 (0.16)	45 (0.11)	76 (0.07)	116 (0.04)	153 (0.03)	231 (0.02)	328 (0.02)	461 (0.01)	767 (0.007)	1152 (0.005)	1534 (0.003)	2303 (0.002)
1	8 (4.4)	13 (2.7)	18 (2.0)	25 (1.4)	38 (0.94)	55 (0.65)	77 (0.46)	129 (0.28)	195 (0.18)	258 (0.14)	390 (0.09)	555 (0.06)	778 (0.045)	1296 (0.027)	1946 (0.018)	2592 (0.013)	3891 (0.009)
2	11 (7.4)	18 (4.5)	25 (3.4)	34 (2.24)	52 (1.6)	75 (1.1)	105 (0.78)	176 (0.47)	266 (0.31)	354 (0.23)	533 (0.15)	759 (0.11)	1065 (0.080)	1773 (0.045)	2662 (0.031)	3547 (0.022)	5323 (0.015)
3	13 (10.5)	22 (6.2)	32 (4.4)	43 (3.2)	65 (2.1)	94 (1.5)	132 (1.0)	221 (0.62)	333 (0.41)	444 (0.31)	668 (0.20)	953 (0.14)	1337 (0.10)	2226 (0.062)	3341 (0.041)	4452 (0.031)	6681 (0.018)
4	16 (12.3)	27 (7.3)	38 (5.3)	52 (3.9)	78 (2.6)	113 (1.8)	158 (1.3)	265 (0.75)	398 (0.50)	531 (0.37)	798 (0.25)	1140 (0.17)	1599 (0.12)	2663 (0.074)	3997 (0.049)	5327 (0.037)	7994 (0.025)
5	19 (13.8)	31 (8.4)	45 (6.0)	60 (4.4)	91 (2.9)	131 (2.0)	184 (1.4)	308 (0.85)	462 (0.57)	617 (0.42)	927 (0.28)	1323 (0.20)	1855 (0.14)	3090 (0.085)	4638 (0.056)	6181 (0.042)	9275 (0.028)
6	21 (15.6)	35 (9.4)	51 (6.6)	68 (4.9)	104 (3.2)	149 (2.2)	209 (1.6)	349 (0.94)	528 (0.62)	700 (0.47)	1054 (0.31)	1503 (0.22)	2107 (0.155)	3509 (0.093)	5267 (0.062)	7019 (0.047)	10533 (0.031)
7	24 (16.6)	39 (10.2)	57 (7.2)	77 (5.3)	116 (3.5)	166 (2.4)	234 (1.7)	390 (1.0)	589 (0.67)	783 (0.51)	1178 (0.34)	1680 (0.24)	2355 (0.17)	3922 (0.101)	5886 (0.067)	7845 (0.051)	11771 (0.034)
8	26 (18.1)	43 (10.9)	63 (7.7)	85 (5.6)	128 (3.7)	184 (2.6)	258 (1.8)	431 (1.1)	648 (0.72)	864 (0.54)	1300 (0.36)	1854 (0.25)	2599 (0.18)	4329 (0.108)	6498 (0.072)	8660 (0.054)	12995 (0.036)
9	28 (19.4)	47 (11.5)	69 (8.1)	93 (6.0)	140 (3.9)	201 (2.7)	282 (1.9)	471 (1.2)	709 (0.77)	945 (0.58)	1421 (0.38)	2027 (0.27)	2842 (0.19)	4733 (0.114)	7103 (0.077)	9468 (0.057)	14206 (0.038)
10	31 (19.9)	51 (12.1)	75 (8.4)	100 (6.3)	152 (4.1)	218 (2.9)	306 (2.0)	511 (1.2)	770 (0.80)	1025 (0.60)	1541 (0.40)	2199 (0.28)	3082 (0.20)	5133 (0.120)	7704 (0.080)	10268 (0.060)	15407 (0.040)
11	33 (21.0)	54 (12.8)	83 (8.3)	111 (6.2)	166 (4.2)	238 (2.9)	332 (2.1)	555 (1.2)	832 (0.83)	1109 (0.62)	1664 (0.42)	2378 (0.29)	3323 (0.21)	5546 (0.12)	8319 (0.083)	11092 (0.062)	16638 (0.042)
12	36 (21.4)	59 (13.0)	89 (8.6)	119 (6.5)	178 (4.3)	254 (3.0)	356 (2.2)	594 (1.3)	890 (0.86)	1187 (0.65)	1781 (0.43)	2544 (0.3)	3562 (0.22)	5936 (0.13)	8904 (0.086)	11872 (0.065)	17808 (0.043)
13	38 (22.3)	63 (13.4)	95 (8.9)	126 (6.7)	190 (4.5)	271 (3.1)	379 (2.26)	632 (1.3)	948 (0.89)	1264 (0.67)	1896 (0.44)	2709 (0.31)	3793 (0.22)	6321 (0.134)	9482 (0.089)	12643 (0.067)	18964 (0.045)
14	40 (23.1)	67 (13.8)	101 (9.2)	134 (6.9)	201 (4.6)	288 (3.2)	403 (2.3)	672 (1.4)	1007 (0.92)	1343 (0.69)	2015 (0.46)	2878 (0.32)	4029 (0.23)	6716 (0.138)	10073 (0.092)	13431 (0.069)	20146 (0.046)
15	43 (23.3)	71 (14.1)	107 (9.4)	142 (7.1)	213 (4.7)	305 (3.3)	426 (2.36)	711 (1.41)	1066 (0.94)	1422 (0.71)	2133 (0.47)	3046 (0.33)	4265 (0.235)	7108 (0.141)	10662 (0.094)	14216 (0.070)	21324 (0.047)
16	45 (24.1)	74 (14.0)	112 (9.7)	150 (7.2)	225 (4.8)	321 (3.37)	450 (2.41)	750 (1.44)	1124 (0.96)	1499 (0.72)	2249 (0.48)	3212 (0.337)	4497 (0.241)	7496 (0.144)	11244 (0.096)	14992 (0.072)	22487 (0.048)
17	47 (24.7)	79 (14.7)	118 (9.86)	158 (7.36)	236 (4.93)	338 (3.44)	473 (2.46)	788 (1.48)	1182 (0.98)	1576 (0.74)	2364 (0.49)	3377 (0.344)	4728 (0.246)	7880 (0.148)	11819 (0.098)	15759 (0.074)	23639 (0.049)
18	50 (24.9)	83 (15.0)	124 (10.0)	165 (7.54)	248 (5.02)	354 (3.51)	496 (2.51)	826 (1.51)	1239 (1.0)	1652 (0.75)	2478 (0.50)	3540 (0.351)	4956 (0.251)	8260 (0.151)	12390 (0.100)	16520 (0.075)	24780 (0.050)
19	52 (25.5)	86 (15.4)	130 (10.2)	173 (7.76)	259 (5.12)	370 (3.58)	518 (2.56)	864 (1.53)	1296 (1.02)	1728 (0.77)	2591 (0.52)	3702 (0.358)	5183 (0.256)	8638 (0.153)	12957 (0.102)	17276 (0.077)	25914 (0.051)
20	54 (26.1)	90 (15.6)	135 (10.4)	180 (7.82)	271 (5.19)	386 (3.65)	541 (2.60)	902 (1.56)	1353 (1.04)	1803 (0.78)	2705 (0.52)	3864 (0.364)	5410 (0.260)	9017 (0.156)	13526 (0.104)	18034 (0.078)	27051 (0.052)
26	65 (27.0)	109 (16.1)	163 (10.8)	217 (8.08)	326 (5.38)	466 (3.76)	652 (2.69)	1086 (1.61)	1629 (1.08)	2173 (0.807)	3259 (0.538)	4656 (0.376)	6518 (0.269)	10863 (0.161)	16295 (0.108)	21726 (0.081)	32589 (0.054)

NOTES

1. Sample sizes are based upon the Poisson exponential binomial limit.
2. The minimum quality (approximate AQL) required to accept (on the average) 19 of 20 lots is shown in parentheses for information only.




SCC

ANNEXE I

LTPD SAMPLING PLAN FOR LOT SIZES LESS THAN, OR EQUAL TO, 200 DEVICES

C=0												
N	10	20	30	40	50	60	80	100	120	150	160	200
n	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD
2	2.2 65	2.5 66	2.5 67	2.5 67	2.5 67	2.5 68	2.5 68	2.5 68	2.5 68	2.5 68	2.5 68	2.5 68
4	1.2 36	1.2 40	1.2 42	1.2 42	1.3 42	1.3 43	1.3 43	1.3 43	1.3 43	1.3 43	1.3 44	1.3 44
5	1.0 29	1.0 33	1.0 34	1.0 35	1.0 35	1.0 35	1.0 36	1.0 36	1.0 37	1.0 37	1.0 37	1.0 37
8	0.5 15	0.6 20	0.6 22	0.6 23	0.6 23	0.6 23	0.6 24	0.7 24	0.7 24	0.7 24	0.7 24	0.7 25
10		0.4 15	0.5 17	0.5 19	0.5 19	0.5 19	0.5 20	0.5 20	0.5 20	0.5 20	0.5 20	0.5 20
16		0.2 6.9	0.25 10	0.25 11	0.3 11	0.3 12	0.3 12	0.3 13	0.3 13	0.3 13	0.3 13	0.3 13
20			0.2 6.8	0.2 8.0	0.25 8.7	0.25 9.0	0.25 9.4	0.25 10	0.25 10	0.25 10	0.25 10	0.25 11
25			0.15 4.3	0.15 5.7	0.2 6.4	0.2 6.9	0.2 7.4	0.2 7.5	0.2 7.6	0.2 7.7	0.2 7.8	0.2 7.9
32				0.1 3.7	0.1 4.4	0.1 5.0	0.1 5.5	0.1 5.9	0.15 6.0	0.15 6.2	0.15 6.3	0.15 6.3
40					0.1 3.0	0.1 3.4	0.1 4.0	0.1 4.5	0.1 4.6	0.1 4.9	0.1 5.0	0.15 5.0
50						0.1 2.3	0.1 2.9	0.10 3.3	0.10 3.5	0.10 3.7	0.10 3.7	0.10 3.9
64							0.08 1.7	0.08 2.2	0.08 2.5	0.08 2.7	0.08 2.8	0.08 2.9
80								0.07 1.5	0.07 1.7	0.07 2.0	0.07 2.1	0.07 2.2
100									0.05 1.1	0.05 1.5	0.05 1.5	0.05 1.7
125										0.04 0.8	0.04 0.9	0.04 1.2
128											0.04 0.8	0.04 1.1
160											0.04 0.9	0.03 0.7
C=1												
N	10	20	30	40	50	60	80	100	120	150	160	200
n	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD
2	27 95	24 95	24 95	23 95	23 95	23 95	23 95	23 95	23 95	22 95	22 95	22 95
4	15 62	12 66	12 66	11 67	11 67	10 67	10 67	10 67	10 67	9.8 67	9.7 67	9.7 68
5	13 51	10 55	8.8 56	8.5 57	8.4 57	8.1 58	7.9 58	7.6 58	7.5 58	7.5 58	7.5 58	7.5 58
8	11 28	7.2 35	6.2 38	5.8 38	5.4 39	5.0 39	4.7 39	4.5 39	4.3 39	4.3 40	4.2 40	4.2 40
10		6.2 30	5.0 30	4.6 31	4.2 32	4.2 32	4.2 32	3.9 33	3.5 33	3.3 33	3.3 33	3.3 33
16		5.6 15	4.2 18	3.8 18	3.4 20	3.0 20	2.9 21	2.6 21	2.5 21	2.3 21	2.3 22	2.2 22
20			4.0 13	3.2 15	2.8 16	2.5 16	2.4 16	2.3 16	2.1 17	2.0 17	2.0 17	2.0 18
25			3.8 9.2	3.1 11	2.5 12	2.2 13	2.0 13	1.8 13	1.7 13	1.6 14	1.6 14	1.6 14
32				3.1 7.4	2.4 8.2	2.1 9.0	1.8 9.9	1.6 10	1.5 10.5	1.4 11	1.3 11	1.3 11
40					2.4 5.9	2.1 6.8	1.6 7.6	1.4 7.8	1.3 8.2	1.2 8.3	1.2 8.4	1.2 8.6
50						1.7 4.6	1.4 5.6	1.2 6.1	1.2 6.4	1.0 6.5	0.9 6.7	0.9 6.7
64							1.3 3.8	1.1 4.4	1.0 4.7	0.8 5.0	0.8 5.0	0.7 5.2
80								1.1 3.0	1.0 3.4	0.8 3.7	0.7 3.8	0.6 4.0
100									0.9 2.5	0.7 2.8	0.7 2.8	0.6 3.0
125										0.7 1.9	0.7 2.0	0.5 2.2
128										0.7 1.7	0.7 1.9	0.5 2.2
160											0.7 1.9	0.5 1.5
C=2												
N	10	20	30	40	50	60	80	100	120	150	160	200
n	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD	AQL LTPD
4	33 82	28 83	27 84	27 85	27 85	26 85	26 85	26 86	26 86	25 86	25 86	25 86
5	27 69	23 73	21 74	20 74	20 74	20 75	20 75	19 75	19 75	19 75	19 75	19 75
8	22 42	15 49	14 49	13 52	13 52	13 52	12 53	12 53	12 53	11 53	11 53	11 53
10		13 39	11 42	11 42	10 43	10 43	9.6 43	9.2 44	9.1 44	8.9 44	8.9 44	8.7 44
16		11 22	8.6 25	6.9 27	6.8 27	6.4 27	6.0 28	6.0 29	5.9 29	5.9 29	5.7 29	5.5 30
20			7.7 19	6.2 21	5.9 22	5.6 22	5.1 23	4.8 23	4.8 23	4.6 23	4.5 24	4.5 24
25			7.4 13	6.0 16	4.9 17	4.5 17	4.3 18	4.1 18	3.9 18	3.7 18	3.7 19	3.7 19
32				5.5 11	4.8 12	4.3 13	3.6 14	3.4 14	3.2 14	3.0 14.5	3.0 15	2.9 15
40					4.6 8.9	3.9 9.8	3.1 11	2.8 12	2.6 12	2.4 12	2.4 12	2.3 12
50						3.5 6.9	2.8 8.1	2.4 8.4	2.3 8.6	2.1 9.0	2.1 9.3	2.0 9.5
64							2.6 5.7	2.2 6.2	2.0 6.6	1.8 7.1	1.7 7.1	1.6 7.4
80								2.1 4.5	1.8 4.9	1.6 5.4	1.5 5.4	1.4 5.6
100									1.8 3.5	1.4 3.9	1.4 4.0	1.2 4.4
125										1.4 2.8	1.3 2.9	1.1 3.3
128										1.4 2.6	1.3 2.9	1.1 3.2
160											1.3 2.9	1.1 2.3

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This table gives the AQL and LTPD values associated with certain single sampling plans (Acceptance Number 'C', Sample Size "n" and Lot Size "N"). The table has the following features:-

- (a) Calculations are based upon the hyper-geometric distribution (exact theory) for lot sizes of 200 devices or less.
- (b) The AQL of a sampling plan is defined as the interpolated Percent Defective for which there is 0.95 probability of acceptance under the plan. The AQL so defined need not be a realisable Lot Percent Defective for the lot size involved (e.g., 12 percent is not a realisable Percent Defective for a lot size of 20 devices).
- (c) The LTPD of a sampling plan is defined as the interpolated Percent Defective for which there is a 0.10 probability of lot acceptance under the plan. The LTPD so defined need not be a realisable Lot Percent Defective for the lot size involved.
- (d) The sequence of sample sizes and lot sizes are generated by taking products of preceding numbers in the respective sequences and the numbers 2 and 5.