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CONNECTORS, ELECTRICAL, FILTERED
CIRCULAR AND RECTANGULAR
ESCC Generic Specification No. 3405

ISSUE 1
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**CONNECTORS, ELECTRICAL, FILTERED
CIRCULAR AND RECTANGULAR
ESA/SCC Generic Specification No. 3405**



**space components
coordination group**

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		SCCG Chairman	ESA Director General or his Deputy
Issue 2	April 1999	<i>Sam Mitchell</i>	<i>[Signature]</i>



DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		<p>This Issue supersedes Issue 1 and incorporates all modifications defined in Revisions 'A', 'B' and 'C' to Issue 1 and the changes agreed in the following DCRs:-</p> <p>Cover Page DCN Para. 8.2.1 : New second sentence added to last paragraph Para. 10.1.2.1 : Item (b), "PDA figure and" deleted from text : Item (c) rewritten</p>		<p>None None 21111 21119 21119</p>



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1. INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification approval, procurement, including lot acceptance, and delivery of mating pairs of Connectors, Electrical, Filtered, Circular and Rectangular, for space application.

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 at the date of placing the purchase order.

2.1 ESA/SCC SPECIFICATIONS

- (a) ESA/SCC Basic Specification No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.
- (b) ESA/SCC Basic Specification No. 20400, Internal Visual Inspection.
- (c) ESA/SCC Basic Specification No. 20500, External Visual Inspection.
- (d) ESA/SCC Basic Specification No. 20600, Preservation, Packaging and Despatch of ESA/SCC Electronic Components.
- (e) ESA/SCC Basic Specification No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.
- (f) ESA/SCC Basic Specification No. 21700, General Requirements for the Marking of SCC Components.
- (g) ESA/SCC Basic Specification No. 22800, ESA/SCC Non-conformance Control System.
- (h) ESA/SCC Basic Specification No. 23500, Requirements for Lead Materials and Finishes for Components for Space Application.
- (i) ESA/SCC Basic Specification No. 24600, Minimum Quality System Requirements.
- (j) ESA/SCC Basic Specification No. 24800, Resistance to Solvents of Marking, Materials and Finishes.
- (k) ESA/SCC Generic Specification No. 3008, Capacitors, Filter, Feedthrough.

With the exception of ESA/SCC Basic Specifications No. 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, reference within the text of this specification to "the Detail Specification" shall mean the relevant ESA/SCC Detail Specification.



2.2 OTHER (REFERENCE) DOCUMENTS

- (a) ESA PSS-01-702, A Thermal Vacuum Test for the Screening of Space Materials.
- (b) ESA PSS-01-708, The Manual Soldering of High-Reliability Electrical Connections.
- (c) IEC Publication No. 68, Basic Environmental Testing Procedures.
- (d) IEC Publication No. 384, Fixed Capacitors for Use in Electronic Equipment.
- (e) IEC Publication No. 410, Sampling Procedures and Tables for Inspection by Attributes.
- (f) IEC Publication No. 512, Electromechanical Components for Electronic Equipment, Basic Testing Procedures and Measuring Methods.
- (g) MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes.
- (h) MIL-STD-414, Sampling Procedures and Tables for Inspection by Variables for Percent Defective.

2.3 ORDER OF PRECEDENCE

For the purpose of interpretation and in the 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 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 final production tests (see Chart II), burn-in and electrical measurements to testing level 'B' (see 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.

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.

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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.

4.2 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.). 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).

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.

4.3.1 Lot Failure

Lot failure may occur during final production tests (Chart II(a)), 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 component, 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 instructions from the Orderer. The Orderer shall inform the Manufacturer and the Qualifying Space Agency within 2 working days from the receipt of the telex, by the same means, what action shall be taken.

In the case where 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 1 level of testing severity which is designated by the letter 'B' (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) - Quality Assurance Subgroup.
- Level 2 (LA2) - Endurance Subgroups
plus Quality Assurance Subgroup.
- Level 1 (LA1) - Environmental and Mechanical Subgroup
plus Endurance Subgroup
plus Quality Assurance Subgroup.

The required lot acceptance level shall be specified in a 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 external materials and finishes 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.

5.2 SPECIAL IN-PROCESS CONTROLS

5.2.1 Visual Inspection

Before assembly, the different elements of the connectors shall be 100% visually inspected in accordance with ESA/SCC Basic Specification No. 20500. Filter elements shall be visually inspected in accordance with ESA/SCC Basic Specification No. 20400.

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5.2.2 Operating Life Test for Filter Elements

50 contacts (which shall not be incorporated in deliverable devices) shall be assembled from each batch of filter element and submitted to a life test as follows:-

(a) Procedure

The contacts shall be subjected to a test of 2000 hours under the conditions defined in Table 5 of the Detail Specification.

(b) Initial and Intermediate Measurements

Electrical measurements in accordance with Table 4 of the Detail Specification shall be performed at 0 and 1 000 \pm 48 hours after a maximum recovery period of 24 hours.

(b) Recovery and Final Measurements

After a maximum of 24 hours at room temperature, electrical measurements in accordance with Table 4 of the Detail Specification shall be performed and the specified limits met. No failures are allowed.

5.2.3 Gold Plate Porosity

A sample of 10 contacts from each plating lot shall be placed in a clean glass container. A solution of 1 part of concentrated nitric acid (specific gravity: 1.42) and 1 part of distilled water at a temperature of +25 \pm 5 °C shall be poured over the contacts. No bubbles shall emanate from the contact surfaces within 15 seconds from application of the solution.

5.2.4 Plating Thickness

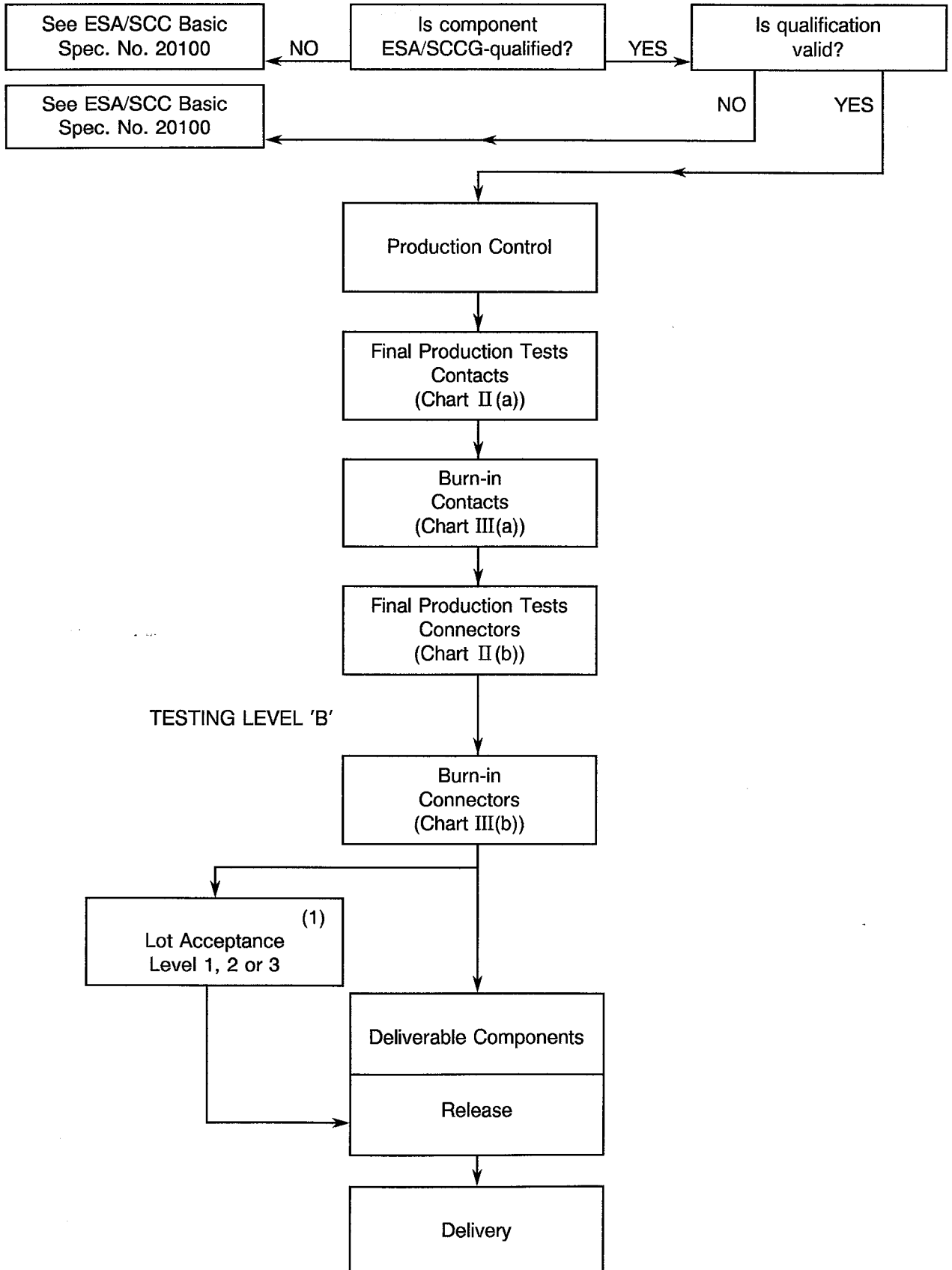
The thickness of the outer gold layer and barrier layers shall be measured on 10 male and 10 female contacts, using a non-destructive method or metallographic cross section on the active part as specified in the Detail Specification. In the event of conflict, the metallographic cross sectioning method shall govern (see the Detail Specification for values).

5.3 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 FAILURE CRITERIA**6.3.1 Parameter Drift Failure**

Not applicable.

6.3.2 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.

6.3.3 Other Failures

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

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

6.4 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 6.3 of this specification.

6.5 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.



6.5.1 Lot Failure during 100% Testing

If the number of contacts, failed on the basis of the failure criteria described in Para. 6.3 is greater than 10% (rounded upwards to the nearest whole number) the lot shall be considered as failed.

A lot is composed of groups of components of the same technology as defined in the Detail Specification manufactured under the same conditions and at the same time.

6.5.2 Lot Failure during Sample Testing

Not applicable.

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6.6 DOCUMENTATION

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

7. BURN-IN AND ELECTRICAL MEASUREMENTS (CHART III)

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 Charts III(a) and III(b).

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 Charts III(a) and III(b). Components of testing level 'B' shall be serialised prior to the tests and inspections.

7.1.1 Conditions of Test

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 testing level 'B' shall be subjected to a total burn-in of 168 hours for the contacts and 48 hours for the connectors.

7.1.2 Data Points

For component testing at 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 the contacts and 0 hours (initial) and 48 (+24, 0) hours (final) for the contacts assembled in the insert.

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 burn-in are larger than the delta values (Δ) 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.

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 (when contacts are mounted in connectors the failure criteria refer to contacts), failed on the basis of the failure criteria described in Para. 7.3 is greater than 10% (rounded upwards to the nearest whole number) the lot shall be considered as failed.

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

A lot is composed of groups of components of the same technology as defined in the Detail Specification manufactured under the same conditions and at the same time.

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 IEC Publication No. 410 or MIL-STD-105 and the applicable AQL, as specified in the Detail Specification, is exceeded.

In the case where an LTPD is specified in the Detail Specification, a lot shall be considered as failed if the number of failures allowed is exceeded (see Annex I for LTPD Sampling Plan).

If lot failure occurs in either case, 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 successively passed the tests in Charts II and III. 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

A sample of 16 mated connector sets (this shall comprise 8 connectors with male filtered contacts mated with 8 connectors with female non-filtered contacts and 8 connectors with female filtered contacts mated with 8 connectors with male non-filtered contacts) and 70 contact pairs shall be submitted to Qualification testing (Chart IV). The distribution within the sample shall be as follows:-



The connectors selected for qualification testing shall be representative of the range and termination types to be qualified and include at least the minimum and maximum sizes. The contact sets selected for Qualification testing shall represent the range of contacts (filter types) to be used in the connector series being qualified.

The selected distribution shall be agreed with the QSA.

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

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 Lot 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 specified by the Orderer, following as closely as possible the requirements specified in Para. 8.1.2 of this specification.

8.2.3 Lot Acceptance Level 3 Testing (LA3)

Lot acceptance level 3 tests are designated as the quality assurance subgroup and comprise 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) The tests for LA3 are considered to be non-destructive and therefore components so tested may form part of the delivery lot.
- (c) 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 (quality assurance subgroup) plus tests on an endurance subgroup. For the quality assurance subgroup, the requirements and conditions as for LA3 (see Para. 8.2.3) shall apply. For the endurance subgroup, the following shall apply:-

- (a) The tests in this subgroup are considered destructive and therefore components 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 LA2 (endurance subgroup) and LA3 (quality assurance subgroup) plus tests on an environmental and mechanical subgroup.

For the quality assurance 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 and mechanical subgroup, the following shall apply:-

- (a) The tests in this subgroup are considered to be destructive and therefore components 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:-

- (a) Components which fail during tests for which the pass/fail criteria are inherent in the test method, e.g. solderability, etc.

8.3.2 Electrical Failures

The following shall be counted as component failures:-

- (a) Components which, when subjected to electrical measurement on completion of environmental tests, in accordance with either Table 2 or Table 6, as specified in the Detail Specification, fail one or more of the applicable limits.
- (b) Components which, when subjected to electrical measurement 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 Table 2 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.



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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.

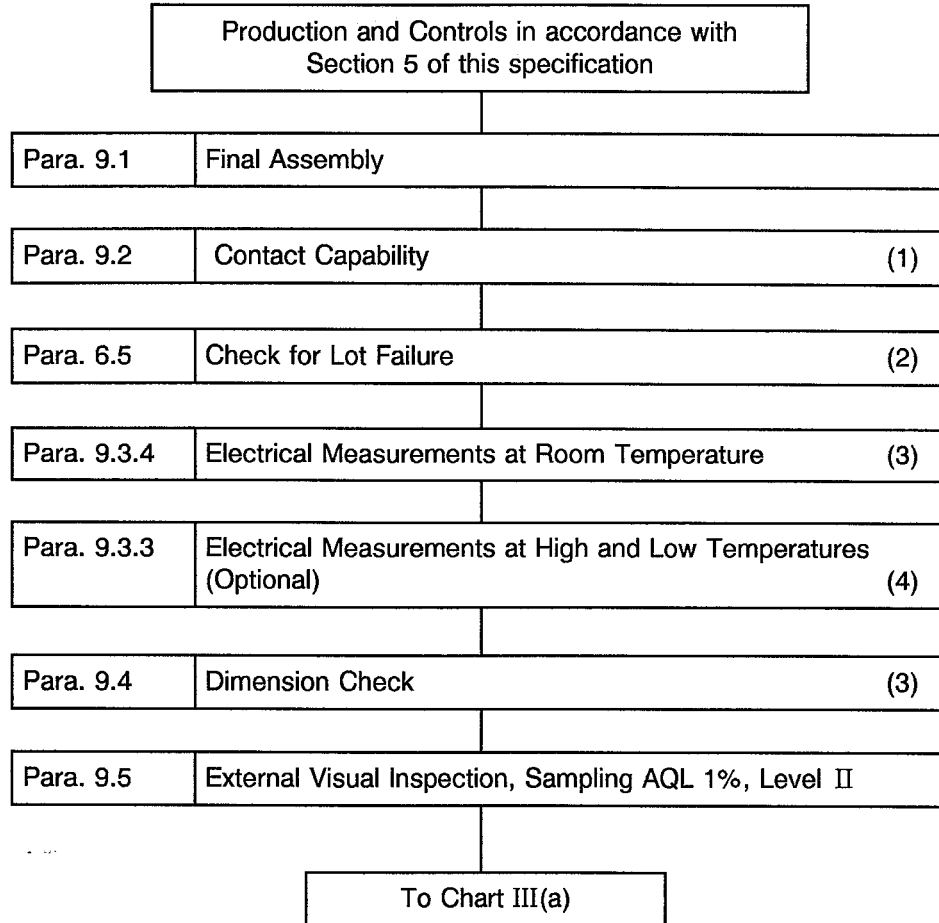
In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.1 of this specification.

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(a) - FINAL PRODUCTION TESTS FOR CONTACTS

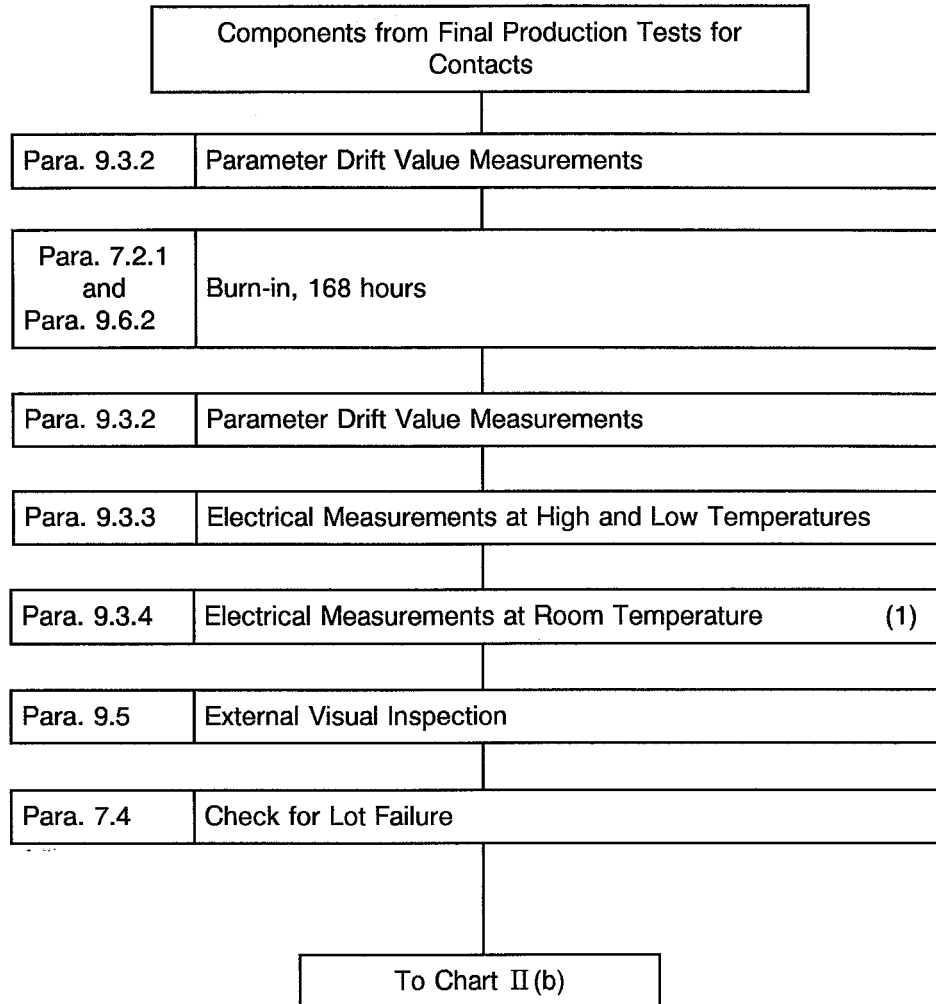


NOTES

1. These tests do not have to be repeated if performed as part of the Manufacturer's standard process. If they are not repeated, the results shall be considered for PDA.
2. Only applicable to Contact Capability.
3. These tests do not have to be repeated if performed as part of the Manufacturer's standard process.
4. The performance of these tests is left to the Manufacturer's discretion.



CHART III(a) - BURN-IN AND ELECTRICAL MEASUREMENTS FOR CONTACTS

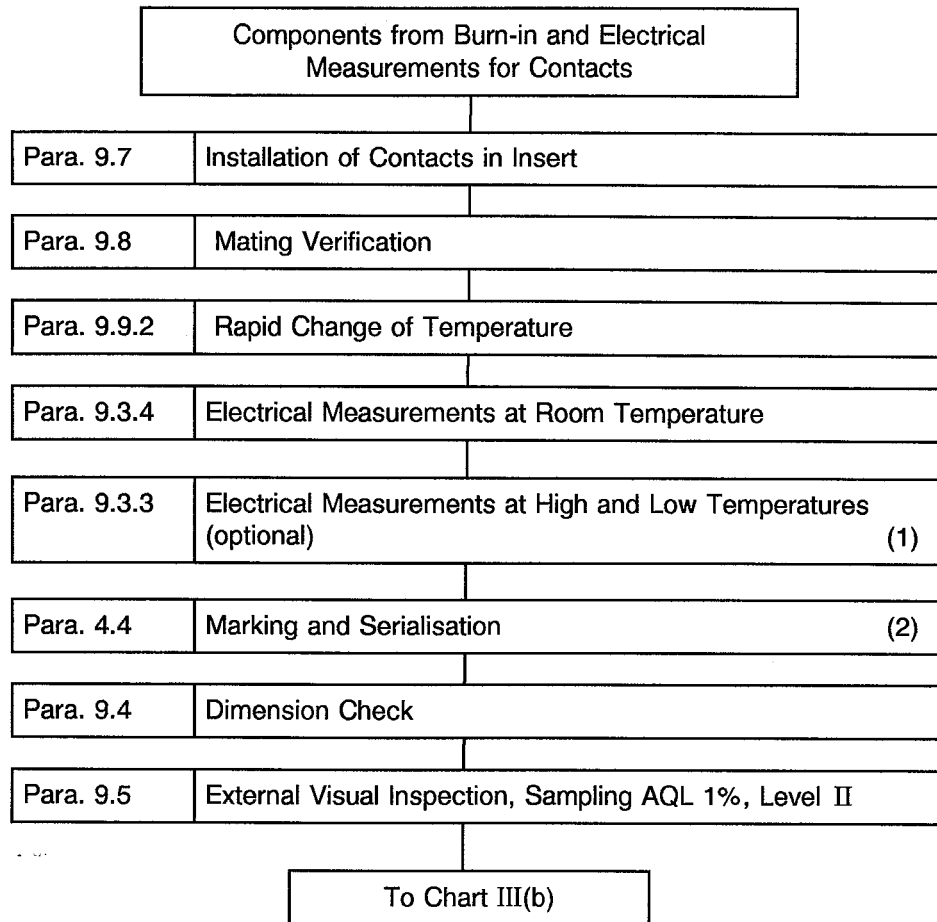


NOTES

1. The measurement of parameters for the calculation of drift value need not be repeated for electrical measurements at room temperature.



CHART II(b) - FINAL PRODUCTION TESTS FOR CONNECTORS

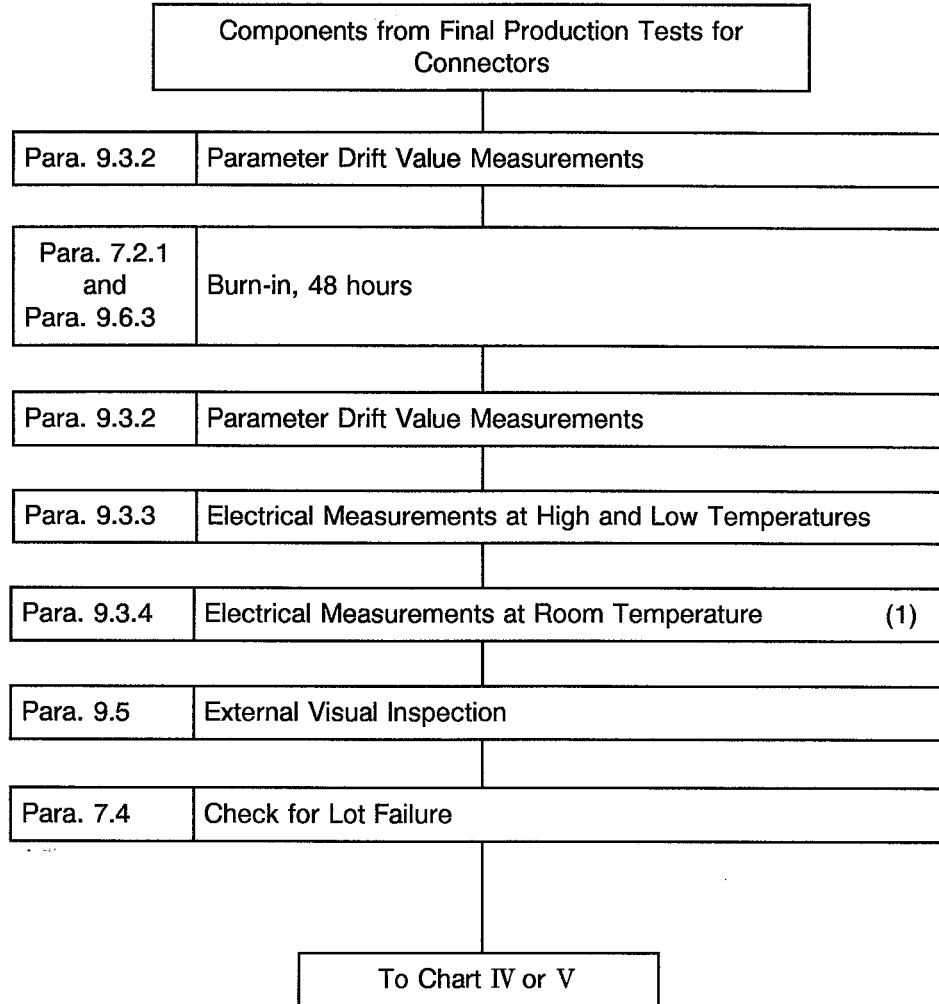


NOTES

1. The performance of these tests is left to the Manufacturer's discretion.
2. Marking and Serialisation may be performed at any place in the test sequence.



CHART III(b) - BURN-IN AND ELECTRICAL MEASUREMENTS FOR CONNECTORS

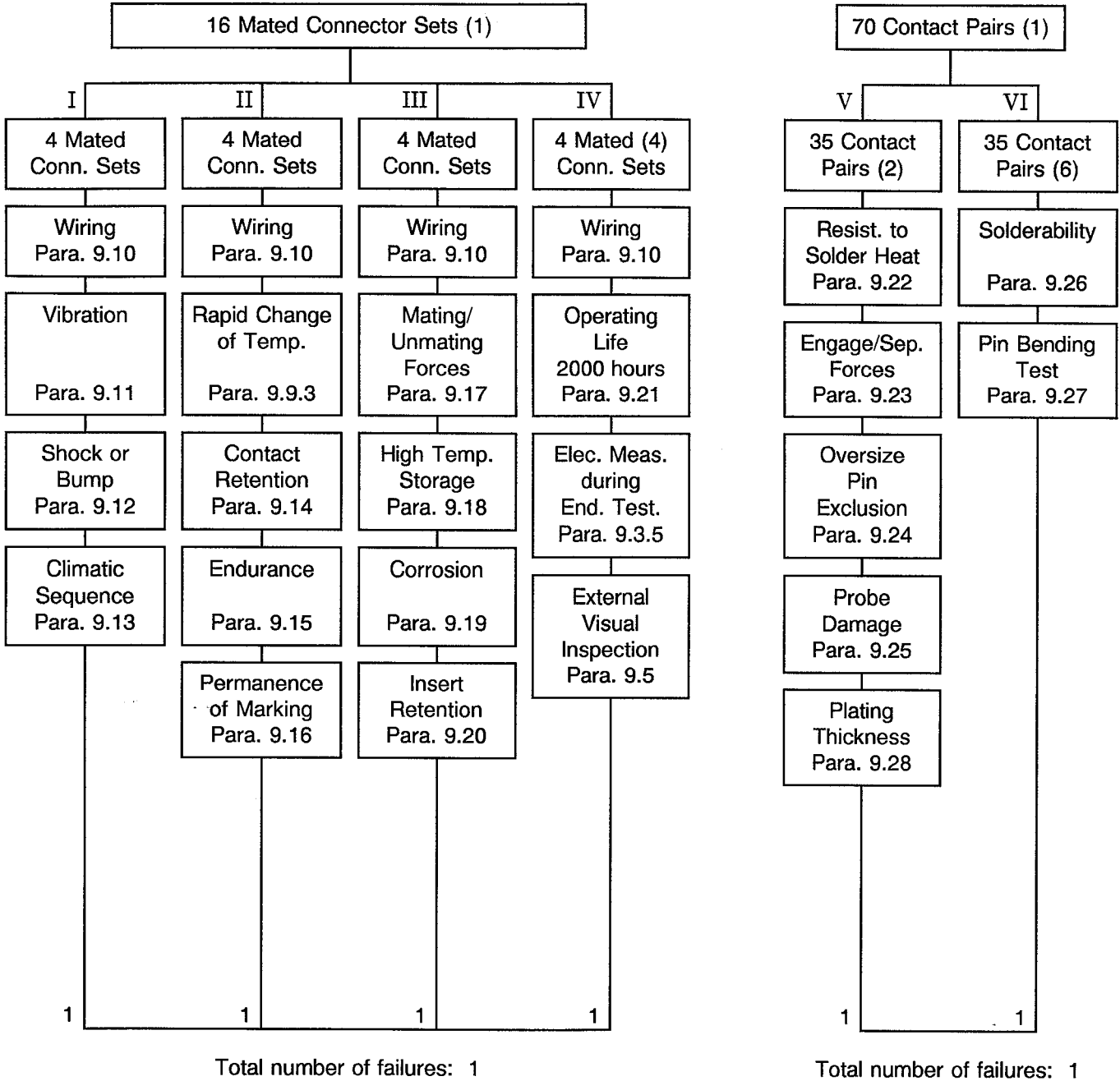


NOTES

1. The measurement of parameters for the calculation of drift value need not be repeated for electrical measurements at room temperature.



CHART IV - QUALIFICATION TESTS

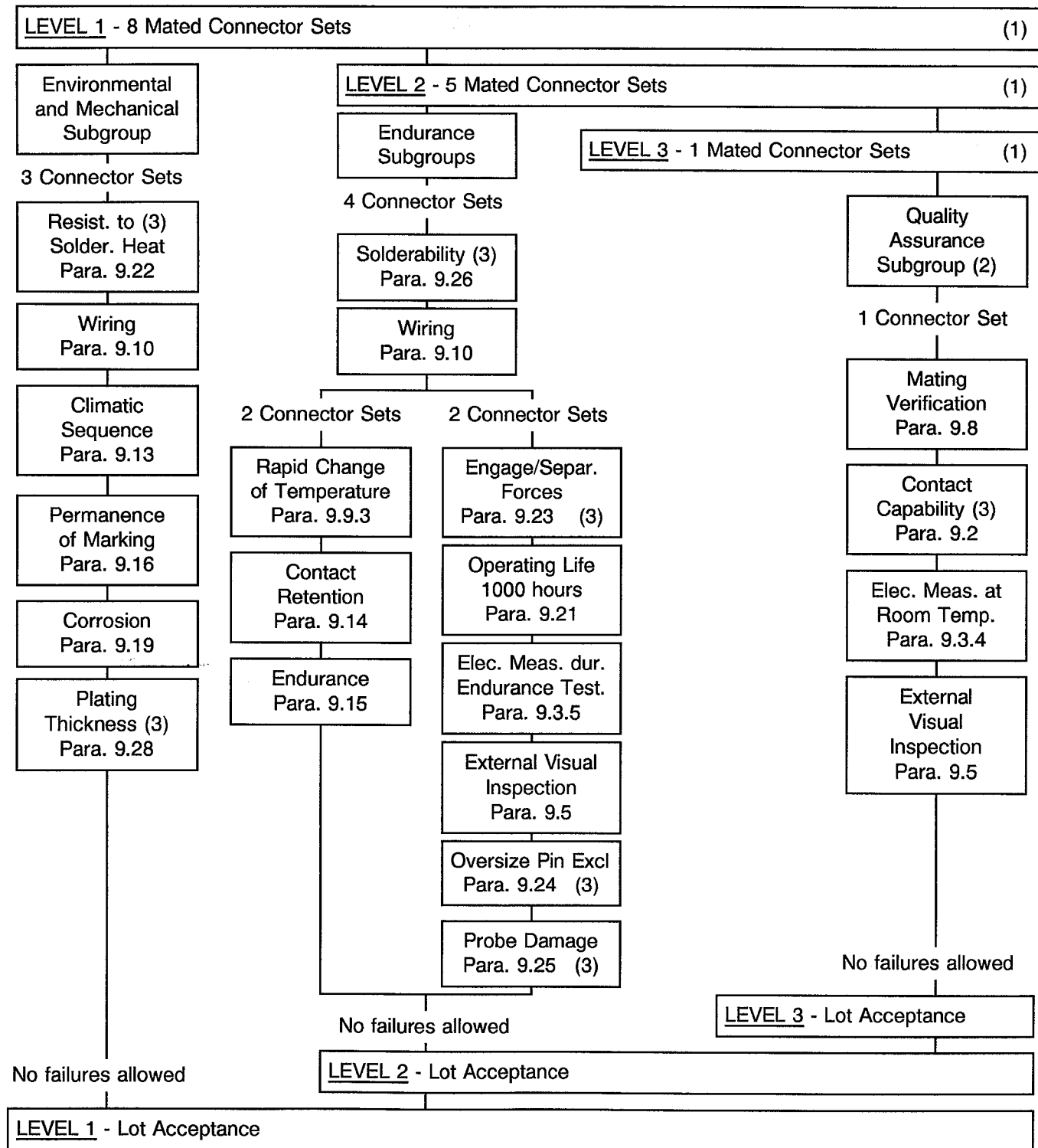


NOTES

1. For distribution within the subgroups, see Para. 8.1.2.
2. Subgroup V shall be repeated for each variation of female contact engagement end (functional part) technology.



CHART V - LOT ACCEPTANCE TESTS



NOTES

1. For distribution within the sample, see Para. 8.2.2.
2. The tests in this subgroup are considered to be non-destructive and therefore components so tested shall form part of the delivery lot.
3. To be performed on 10 randomly selected contact pairs.



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 FINAL ASSEMBLY

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

9.2 CONTACT CAPABILITY

(a) **Applicability**

This test is applicable to female contacts or to male contacts where the male contact deforms to make and retain electrical contact.

(b) **Procedure**

The contacts shall pick up the minimum weight and drop the maximum weight. These weights shall be as specified in the Detail Specification.

9.3 ELECTRICAL MEASUREMENTS

9.3.1 Electrical Test Methods

9.3.1.1 Insulation Resistance

The insulation resistance shall be measured between each contact and the shell in accordance with ESA/SCC Generic Specification No. 3008, Para. 9.4.1.3. The test voltage shall be as specified in the Detail Specification. The measurement results shall exceed the values specified in the Detail Specification.

9.3.1.2 Voltage Proof

The voltage proof test shall be performed between each contact and the shell in accordance with ESA/SCC Generic Specification No. 3008, Para. 9.4.1.2 under standard conditions. The test voltage shall be as specified in the Detail Specification and it shall be applied for 5 seconds minimum for final production tests and 1 minute minimum for qualification and lot acceptance tests.

9.3.1.3 Contact Resistance

(a) **Definition**

Contact Resistance (R_C) at low level and rated current is defined in Figure I and shall be measured at the emergence of the contact rear part from the insert.

Contact resistance may be measured by either the d.c. or the a.c. method. In case of dispute the d.c. method shall govern.

(b) **Test Conditions**

(i) **Low Level Current**

d.c. method:

Maximum Potential Across Sample : 20mV.

Maximum Applied Current : 10mA.

Two measurements shall be performed with opposite polarity. The average of the 2 readings shall be considered as indicative of the low level resistance value. R_C shall be expressed in milliohms.



a.c. method:

Maximum Potential Across Sample : 20mVrms.
Maximum Measuring Frequency : 2.0KHz.
Maximum Applied Current : 10mA rms.

R_C shall be expressed in milliohms.

(ii) Rated Current

The test shall not be performed until thermal stability has been achieved. Thermal stability will have been reached when no change in resistance is observed between 2 successive measurements taken at 15 minutes interval.

d.c. method:

Potential Across Sample : from 1.0V to 60V.
Maximum Applied Current : as specified in the Detail Specification.

Two measurements shall be performed with opposite polarity. The average of the two readings shall be considered as indicative of the resistance value. R_C shall be expressed in milliohms.

a.c. method:

Potential Across Sample : from 1.0V to 60Vrms.
Maximum Applied Current : as specified in the Detail Specification (rms).
Maximum Measuring Frequency : 2.0KHz.

R_C shall be expressed in milliohms.

(c) Sampling

This sampling is applicable only to measurements of contacts mounted in connectors.

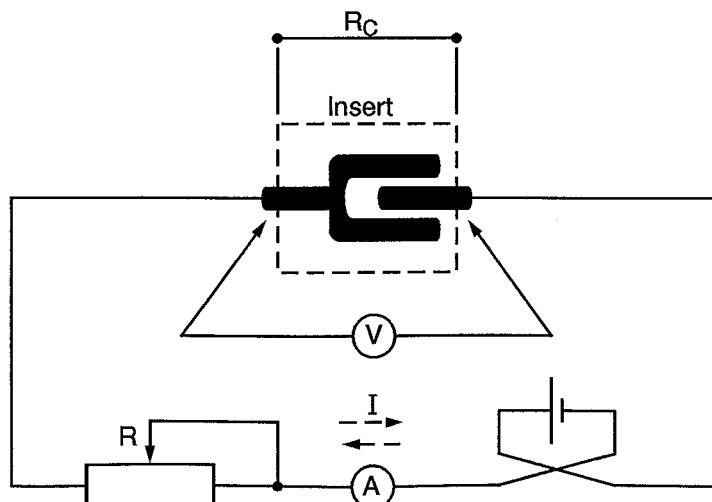
Number of contacts in connector equal to, or less than, 4

Measure all contacts.

Number of contacts in connector more than 4

Measure 20% of the contacts, but not less than 4 contacts.

FIGURE I - CONTACT RESISTANCE MEASUREMENT DIAGRAM





9.3.1.4 Mated Shell Conductivity

(a) Test Conditions

Unless otherwise specified in the Detail Specification, a test current of $1.0 \pm 0.1A$ (d.c. or a.c. rms) at a maximum voltage of 1.5V (d.c. or a.c. rms), shall be used.

(b) Procedure

The resistance of the mated, assembled connectors shall be measured from a point on the rear accessory thread (or body, if no thread is present) of the plug to the mounting flange of the receptacle.

The point of measurement on a square flange receptacle shall be adjacent to the mounting holes.

The point of measurement on a single hole mount receptacle shall be adjacent to the "O" ring on the front or mounting side of the flange.

Probes with spherical ends of 0.13mm minimum radius shall be used to make the measurements.

9.3.1.5 Ground Resistance

(a) Definition

Ground resistance (R_{cg}) is the ohmic resistance measured from the emergence of the grounded contact rear part from the insert, to a point on the rear accessory thread (or body, if no thread is present) for a plug, or to a point on the mounting flange for a receptacle.

The point of measurement on a square flange receptacle shall be adjacent to the mounting holes.

The point of measurement on a single hole mount receptacle shall be adjacent to the "O" ring on the front or mounting side of the flange.

Probes with spherical ends of 0.13mm radius shall be used to make the measurements.

Ground resistance shall be measured by either the d.c. or the a.c. method, in case of dispute the d.c. method shall govern.

(b) Test Conditions

- d.c. method

Maximum potential across sample : 20mV.
Maximum applied current : 10mA.

Two measurements shall be performed with opposite polarity. The average of the 2 readings shall be considered as indicative of the low level resistance value. R_C shall be expressed in milliohms.

- a.c. method

Maximum potential across sample : 20mVrms.
Maximum Measuring Frequency : 2.0kHz.
Maximum Applied current : 10mA rms.

R_C shall be expressed in milliohms.



(c) Sampling

This sampling is applicable only to measurements of grounded contacts mounted in connectors.

- Number of grounded contacts in connector equal to, or less than 4
Measure all grounded contacts.
- Number of grounded contacts in connector more than 4
Measure 20% of the grounded contacts, but not less than 4.

9.3.1.6 Capacitance

In accordance with ESA/SCC Generic Specification No. 3008, Para. 9.4.1.1.

9.3.1.7 Insertion Loss

In accordance with ESA/SCC Generic Specification No. 3008, Para. 9.4.1.4.

9.3.2 Parameter Drift Value Measurements

At each of the relevant data points for component 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.

9.3.3 Electrical Measurements at High and Low Temperatures

For components of testing level 'B', 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 shall be recorded against serial numbers.

9.3.4 Electrical Measurements at Room Temperature

For components of testing level 'B', 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.

9.3.5 Electrical Measurements during Endurance Testing

At each of the relevant data points specified for endurance testing, measurements shall be made of the 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.

9.4 DIMENSION CHECK

in accordance with ESA/SCC Basic Specification No. 20500 and the Detail Specification, on 5 samples only. If a failure occurs, the complete lot shall be checked.

9.5 EXTERNAL VISUAL INSPECTION

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

9.6 BURN-IN

9.6.1 General

The test shall be conducted in accordance with IEC Publication No.384-1, Clause 4.23. At the end of burn-in and while still at the high temperature, the devices shall be subjected to an insulation resistance measurement in accordance with Para. 9.3.16 and shall comply with the limits defined in Table 3 of the Detail Specification.



9.6.2 Burn-in of Contacts

The contacts shall be burnt in for a total of 168 hours under the conditions defined in Table 5 of the Detail Specification.

9.6.3 Burn-in of Connectors

The connectors shall be burnt in for a total of 48 hours under the conditions defined in Table 5 of the Detail Specification.

9.7 INSTALLATION OF CONTACTS INTO INSERT

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

9.8 MATING VERIFICATION

The connectors shall be mated and unmated once with their counterparts to verify the proper functioning of the coupling mechanism.

9.9 RAPID CHANGE OF TEMPERATURE

9.9.1 General

The wired, mated connector sets shall be subjected to 5 cycles of the test in accordance with IEC Publication 512-6, Test 11d with temperature extremes as defined in steps 1 and 3 below.

Alternatively, the test in accordance with IEC Publication 68-2-14, Test Nb may be used, with temperature extremes as defined in steps 1 and 3 below. The chamber shall be capable of a transfer time of no more than 5 minutes between the temperature extremes and 5 cycles shall be performed.

9.9.2 Rapid Change of Temperature during Final Production Tests (Chart II)

The following steps shall be used:-

1. Minimum Operating Temperature as defined in Table 1(b) of the Detail Specification: 30 minutes.
2. $T_{amb} = +25(+10 - 5) ^\circ\text{C}$: 5 minutes (max.).
3. Maximum Operating Temperature as defined in Table 1(b) of the Detail Specification: 30 minutes.
4. $T_{amb} = +25(+10 - 5) ^\circ\text{C}$: 5 minutes (max.).

9.9.3 Rapid Change of Temperature during Qualification Tests (Chart IV) and Lot Acceptance Tests (Chart V)

The following steps shall be used:-

1. Minimum Storage Temperature as defined in Table 1(b) of the Detail Specification: 30 minutes.
2. $T_{amb} = +25(+10 - 5) ^\circ\text{C}$: 5 minutes (max.).
3. Maximum Storage Temperature as defined in Table 1(b) of the Detail Specification: 30 minutes.
4. $T_{amb} = +25(+10 - 5) ^\circ\text{C}$: 5 minutes (max.).

Following the test the connectors shall be visually examined. There shall be no damage detrimental to the operation of the connectors. The insertion loss, capacitance, insulation resistance and voltage proof, shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

**9.10** WIRING**(a) Choice of Wire**

The wire shall be of the minimum and maximum gauge that the solder bucket is designed to accept. The insulation shall be capable of surviving, without any degradation in performance, the same maximum temperature as the connector. Additionally, ESA PSS-01-708 shall be used to aid the selection of wire.

(b) Attachment of Wire

The wires shall be soldered to the contacts, as closely as practicably, in accordance with the requirements of ESA PSS-01-708. Half of the contacts shall be equipped with wire of the maximum gauge and half with the minimum gauge.

(c) Inspection of Soldered Joints

The soldered joints shall be examined in accordance with, and meet the requirements of, the visual inspection criteria of ESA PSS-01-708.

(d) Electrical Measurements

The insertion loss shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

9.11 VIBRATION**9.11.1** General

The connectors shall be subjected to Sinusoidal Vibration Testing (see Para 9.11.2) and Random Vibration Testing (see Para. 9.11.3). The order of performance of the tests shall be at the discretion of the Manufacturer.

(a) Method of Mounting

Mated, wired connector sets shall be mounted on the vibration table by their normal mounting means or by a suitable clamping arrangement. The wires shall be clamped to a non-vibrating point which is at least 20cm away from the connectors such that resonance of the wires is avoided. The screw(s) of connectors with a screw coupling mechanism shall be torqued and released 50 times to the value specified in the Detail Specification and the unlocking torque shall be recorded on the last operation.

(b) Measurement during Vibration

The series-wired contacts shall be monitored as specified in IEC Publication No. 512-2, Test 2e, with a maximum contact disturbance time of 1.0 μ s.

(c) Examination after Testing

Mated connector sets shall be retained in full engagement. Screw unlocking torque shall be measured and the drift with respect to the value recorded before the start of the test shall meet the requirements of Table 6 of the Detail Specification. Connectors, accessories and locking devices, as applicable, shall not be damaged and there shall be no loosening of parts caused by vibration.

9.11.2 Sinusoidal Vibration Testing

The connectors shall be submitted to vibration testing in accordance with IEC Publication No. 512-4, Test 6d. Sweep frequency: 10-2 000-10Hz. The entire frequency range of 10 to 2 000Hz and return to 10Hz shall be traversed in 30 minutes. The vibration amplitude shall be 1.5mm or 20g whichever is less. This cycle shall be performed once in each of the 3 mutually perpendicular directions so that the motion is applied for a total period of approximately 90 minutes.

**9.11.3 Random Vibration Testing**

The connectors shall be submitted to random vibration testing in accordance with IEC Publication No. 68-2-35, test Fda with $f_1 = 20\text{Hz}$, $f_2 = 2\ 000\text{Hz}$, an Acceleration Spectral Density (ASD) of $0.2\text{g}^2/\text{Hz}$, a total test period of 30 minutes and high reproducibility. This cycle shall be performed once in each of the 3 mutually perpendicular directions so that the motion is applied for a total period of approximately 90 minutes.

9.12 SHOCK OR BUMP**9.12.1 Shock**

The connectors shall be submitted to mechanical shock in accordance with IEC Publication No. 512-4, Test 6c. Shape of shock pulse: half-sine. A peak acceleration of 50g with an 11ms duration pulse shall be used. 3 shocks in each direction along the 3 mutually perpendicular directions (i.e. 18 in total) shall be applied.

(a) Method of Mounting

As per Para. 9.11.1(a), the word 'vibration' to be replaced by 'shock'. The screw coupling torquing and releasing shall not be repeated.

(b) Measurement during Shock

As per Para. 9.11.1(b).

(c) Examination after Testing

As per Para. 9.11.1(c), the word 'vibration' to be replaced by 'shock'.

9.12.2 Bump

The connectors shall be submitted to bump in accordance with IEC Publication No. 512-4, Test 6b. Peak acceleration: 390m/s^2 . Number of bumps: 4000 ± 10 .

(a) Method of Mounting

As per Para. 9.11.1(a), the word 'vibration' to be replaced by 'bump'. The screw coupling torquing and releasing shall not be repeated.

(b) Measurement during Bump

As per Para. 9.11.1(b).

(c) Examination after Testing

As per Para. 9.11.1(c), the word 'vibration' to be replaced by 'bump'.

9.13 CLIMATIC SEQUENCE**9.13.1 Dry Heat**

The mated connectors shall be subjected to Test 'Ba' of IEC Publication No. 68-2-2. Duration: 2 hours. Maximum storage temperature as prescribed in Table 1(b) of the Detail Specification.

9.13.2 Damp Heat, Accelerated, First Cycle

Unless otherwise specified in the Detail Specification, the mated connectors shall be subjected to Test 'Db', severity b, variant 2 of IEC Publication No. 68-2-30, 1 cycle. After recovery, the components shall be subjected immediately to the cold test.



9.13.3 Cold Test

The mated connectors shall be subjected to Test 'Aa' of IEC Publication No. 68-2-1. Duration: 2 hours. Minimum storage temperature as specified in Table 1(b) of the Detail Specification.

9.13.4 Low Air Pressure

The components shall be subjected to Test 'M' of IEC Publication No. 68-2-13 under the following conditions:-

- Half the number of connectors shall be mated, the other half unmated.
- Maximum (simulated) altitude, as defined in Figure 1 of the Detail Specification.
- Temperature: $T_{amb} = +15$ to $+35$ °C.
- Duration: 1 hour.

While still at the specified low pressure and during the last 5 minutes of the 1 hour period a voltage proof test (as specified in Para. 9.3.1.2) shall be performed using 125% of rated voltage (Table 1(b) of the Detail Specification). During and after this test, there shall be no sign of electrical breakdown, flashover, corona discharge, or current leakage in excess of 1.0mA.

9.13.5 Damp Heat, Accelerated, Remaining Cycles

The mated connectors shall be subjected to Test 'Db', severity B, variant 2 of IEC Publication No. 68-2-30, 5 cycles. Immediately after the test the insulation resistance shall be measured as specified in Table 6 of the Detail Specification and the value shall be within the specified limits.

9.13.6 Recovery and Final Inspection

After a recovery period of 1 to 24 hours, the components shall be visually inspected according to ESA/SCC Basic Specification No. 20500.

9.13.7 Final Measurements

The insertion loss, capacitance, insulation resistance and voltage proof shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

9.14 CONTACT RETENTION (IN INSERT)

The connectors shall have all contacts in place and the accessory rear hardware removed during the test. The force shall be applied to the engagement end of the contact either directly or by using an appropriate adaptor at a rate not exceeding 5N per second until the force specified in the Detail Specification is reached. This force shall be maintained for a minimum period of 5 seconds. A minimum of 20%, but not less than 5 of the contacts in each connector, shall be tested. The axial displacement of the contact shall be measured after the force has been removed from the contact and shall not exceed 0.3mm.

9.15 ENDURANCE

(a) **Initial Measurements**

The mating-unmating forces, low level contact resistance (all points), mated shell conductivity (if specified in the Detail Specification), capacitance and insulation resistance shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

(b) **Procedure**

Mating, wired connector sets shall be mated and unmated 500 times for qualification and 100 times for lot acceptance. A cycle is defined as one mating and one unmating. The coupling means shall be operated in a manner to simulate actual service. The plug and receptacle shall be



completely separated during each cycle. The mating/unmating speed shall be 5mm/second maximum and the cycling rate shall be 8 cycles/minute maximum.

(c) Final Inspection

The components shall be visually examined, except for contact wear, the connectors shall show no evidence of physical damage.

(d) Final Measurements

Cleaning of the connectors is not permitted before any electrical measurements.

After a recovery period of 2 hours minimum, the mating-unmating forces, low level contact resistance drift, mated shell conductivity (if specified in the Detail Specification), insertion loss, capacitance drift, insulation resistance drift and voltage proof shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

9.16 PERMANENCE OF MARKING

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

9.17 MATING AND UNMATING FORCES

The connectors with wired contacts installed shall be mated and unmated four times with force applied gradually and distributed equally about the connector. The mating and unmating forces shall be measured on the first and last cycles and shall not exceed the requirements of the Detail Specification.

9.18 HIGH TEMPERATURE STORAGE

(a) Initial Measurements

The low level contact resistance (all points), mated shell conductivity (if specified in the Detail Specification), capacitance and insulation resistance shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

(b) Procedure

The wired, mated connector sets shall be subjected to the test in accordance with IEC Publication No. 512-6, Test 11i, for 1 000 hours. The temperature shall be the maximum storage temperature specified in Table 1(b) of the Detail Specification.

(c) Final Inspection

The components shall be visually examined and shall show no evidence of physical damage.

(d) Final Measurements

The mating-unmating forces, the drift of low level contact resistance drift, capacitance drift, mated shell conductivity (if specified in the Detail Specification), insertion loss, insulation resistance drift and voltage proof shall be measured and shall meet the requirements of Table 6 of the Detail Specification.

The contacts shall be submitted to the contact retention test as specified in Para. 9.14.

9.19 CORROSION

(a) Applicability

This test is not applicable to PCB connector families where both parts are intended for PCB mounting.



(b) Procedure

Unmated connectors shall be subjected to the test in accordance with IEC Publication No. 68-2-11, Test Ka, for 48 hours. Connectors shall be suspended in the chamber in a horizontal position.

(c) Final Inspection

The connectors shall be visually examined, no base metal shall be exposed on the interfaces or mating surfaces.

9.20 INSERT RETENTION (IN SHELL)

Connector rear accessories, if applicable, shall be removed for this test. Inserts with or without contacts shall be submitted to axial loads in directions tending to push them out of the shell. Half of the devices shall be subjected to load applied from the front and half to load applied from the rear. The load shall be applied and increased gradually at an approximate rate of 0.7kg/cm² per second until the maximum load as specified in the Detail Specification is reached. The maximum load shall be maintained for 5 seconds. The portion of the load-applying device that touches the surface of the insert may be shaped to clear the contacts if installed on any raised areas on the inserts (bosses, barriers or identifiers).

The connector inserts shall not be dislodged from their normal position within their shells.

9.21 OPERATING LIFE

(a) Initial Measurements

The capacitance and insulation resistance shall be measured.

(b) Duration

2 000 hours during qualification testing (Chart IV).

1 000 hours during lot acceptance testing (Chart V).

(c) Procedure

The temperature and voltage shall be as specified in Table 5 of the Detail Specification.

The voltage shall be applied to the contacts individually through a resistor in such a manner that the charging current does not exceed 50 μ A/pF for $C \leq 1\ 000$ pF or 0.05A for $C > 1\ 000$ pF.

If a.c. rated filters are tested, the value of the series resistor shall be such that the voltage appearing across the filter is not less than 95% of the applied voltage.

A voltage source shall be used which is capable of supplying at least 1.0 Ampere when a filter is short-circuited.

A method shall be provided to indicate short-circuits or leakage currents of 1.0mA or greater.

(d) Intermediate and End Data Points

Prior to the intermediate and end measurements an insulation resistance test, at the high temperature extreme, shall be performed and shall meet the requirements of Table 6 of the Detail Specification. The insertion loss, capacitance drift, insulation resistance drift and voltage proof (at 90% of rated voltage) shall be measured at 1 000 \pm 48 hours (Charts IV and V testing) and 2 000 \pm 48 hours (Chart IV testing only) and shall meet the requirements of Table 6 of the Detail Specification. A maximum recovery period of 24 hours is allowed prior to performance of the intermediate and end measurements.

In cases where Table 6 specifies "changes", the drift shall always be related to the initial measurement.

**9.22 RESISTANCE TO SOLDERING HEAT**

In accordance with ESA/SCC Generic Specification No. 3008, Para. 9.17.

9.23 ENGAGEMENT AND SEPARATION FORCES**(a) Applicability**

As per Para. 9.2(a).

(b) Procedure

10, or all, whichever is less, of the contacts shall be tested as follows:-

A gradually increasing force with displacement not exceeding 1mm/second shall be applied until the test pin, or sleeve, properly engages with, or separates from, the contact. The test pin, or sleeve, shall be made of hardened tool steel with a surface roughness of 0.1 to 0.25 μ m and a minimum hardness of 650 VPN. Test pins shall have spherical ends. The diameter of the test pin, or sleeve, shall be as specified in the Detail Specification.

The maximum diameter test pin, or minimum diameter test sleeve, shall be engaged to 70% of the depth of the female mating cavity or length of the engagement end of a male contact, and then separated 3 times. The engagement and separation forces shall be measured on the third engagement and separation. Subsequently, the minimum diameter test pin, or maximum diameter test sleeve, shall be engaged and separated once to measure the separation force.

9.24 OVERSIZE PIN EXCLUSION

A hardened steel pin of the dimensions specified in the Detail Specification shall be placed in the centre of the female contact and parallel to its axis. A force as specified in the Detail Specification shall be applied, aimed at forcing the test pin into the female contact. The test pin shall not enter the female contact.

9.25 PROBE DAMAGE

Female contacts shall be submitted to the test in accordance with IEC Publication No. 512-8, Test 16a. The dimensions of the test pin and the bending moment to be applied shall be as specified in the Detail Specification. Subsequently, the contact separation force shall be measured and shall meet the requirements of the Detail Specification.

9.26 SOLDERABILITY**9.26.1 Solder Contacts**

The contacts shall be submitted to the test in accordance with IEC Publication No. 512-6, Test 12b. The size of soldering iron (A or B) shall be as specified in the Detail Specification.

9.26.2 PCB Contacts

The contacts shall be submitted to the test in accordance with IEC Publication No. 512-6, Test 12a. The contacts shall be immersed to a depth such that all of the termination is covered.

9.27 PIN BENDING TEST (MALE ONLY)

The contacts shall be mounted into the insulator and the rear end shall be bent 90° to touch the insulator. They shall then be straightened. A break of the contact body is allowed, but there shall be no evidence of fracture on the filter and the capacitance and insulation resistance shall meet the requirements of Table 6 of the Detail Specification.

9.28 PLATING THICKNESS

The test shall be performed as specified in Para. 5.2.4 of this specification.

**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 (Charts II(a) and II(b)) (but see Para. 10.6).
- (f) Burn-in and electrical measurements data (Charts III(a) and III(b))
- (g) Qualification test data (Chart IV).
- (h) Lot acceptance test data (Chart V) (when applicable).
- (i) Failed component list (see Para's. 6.4 and 8.4), and failure analysis report (see Para. 8.4).
- (j) Certificate of Conformity.

Items (a) to (j) inclusive shall be grouped, preferable 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 (j) 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"

Not 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 (or sheets) 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) Number of purchase order.
- (f) Information relative to any additions to this specification and/or the Detail Specification.
- (g) Manufacturer's name and address.
- (h) Location of the manufacturing plant.
- (i) Signature on behalf of the Manufacturer.
- (j) 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 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

Results of the plating thickness shall be provided.

Results from the operating life test for filter elements shall be provided.

10.6 FINAL PRODUCTION TEST DATA (CHARTS II(a) AND II(b))

A test result summary shall be compiled showing the total number of components submitted to, and the total number rejected after, each test, measurement and inspection of Charts II(a) and II(b).

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 Para. 10.1.2 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 (CHARTS III(a) AND III(b))****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 of the following:-

- (a) 0 hour measurement for burn-in.
- (b) 168 hour measurement for burn-in (Chart III(a)).
- (c) 48 hour measurement for burn in (Chart III(b)).
- (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 at room temperature (Table 2 of the Detail Specification).
- (g) Failures during external visual inspection.

10.7.2 Testing Level 'C'

Not applicable.

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, 3 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'

Not applicable.

10.10 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

The failed component 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 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) A detailed failure analysis, if requested.

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. 8.2.4(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 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)


- (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.



ANNEXE I

LTPD SAMPLING PLAN 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	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	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 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	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 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	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	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 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 7.8	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	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	0.1 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	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	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	0.07 2.2
100									0.05 1.1	0.05 1.5	0.05 1.5	0.05 1.7	0.05 1.7
125										0.04 0.8	0.04 0.9	0.04 0.9	0.04 1.2
128										0.04 0.8	0.04 0.9	0.04 1.1	0.04 1.1
160												0.03 0.7	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0.6 4.0
100									0.9 2.5	0.7 2.8	0.7 2.8	0.6 3.0	0.6 3.0
125										0.7 1.9	0.7 2.0	0.5 2.2	0.5 2.2
128										0.7 1.7	0.7 1.9	0.5 2.2	0.5 2.2
160												0.5 1.5	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	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	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	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	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	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	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	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	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	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	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	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	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	1.4 5.6
100									1.8 3.5	1.4 3.9	1.4 4.0	1.2 4.4	1.2 4.4
125										1.4 2.8	1.3 2.9	1.1 3.3	1.1 3.3
128										1.4 2.6	1.3 2.9	1.1 3.2	1.1 3.2
160												1.1 2.3	1.1 2.3

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ANNEXE I

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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 a 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.