CONNECTORS, RF COAXIAL

ESCC Generic Specification No. 3402

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DCR No.	CHANGE DESCRIPTION
1453	Specification upissued to incorporate changes per DCR.

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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 RF coaxial connectors 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 components qualified in accordance with ESCC Basic Specification No. 20100. It is also primarily applicable to the procurement of components so qualified.

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

2 APPLICABLE DOCUMENTS

The following documents form part of, and shall be read in conjunction with, this specification. The relevant issues shall be those in effect on the date of starting qualification or placing the Purchase Order.

2.1 ESCC SPECIFICATIONS

- No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.
- No. 20500, External Visual Inspection.
- No. 20600, Preservation, Packaging and Dispatch of ESCC Components.
- No. 21001, Destructive Physical Analysis of EEE Components.
- No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.
- No. 21700, General Requirements for the Marking of ESCC Components.
- No. 22600, Requirements for the Evaluation of Standard Electronic Components for Space Application.
- No. 22800, ESCC Non-Conformance Control System.
- No. 23100, Recommendations on the use of the ESCC Specification System for the Evaluation and Procurement of Unqualified Components.
- No. 24600, Minimum Quality System Requirements.

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

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

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

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

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

2.2 OTHER (REFERENCE) DOCUMENTS

- ECSS-Q-ST-70-37, Determination of the Susceptibility of Metals to Stress-corrosion Cracking.
- MIL-STD-202, Test Method Standard - Electronic and Electrical Component Parts.
- IEC Publication No. 60068 Part 2, Basic Environmental Testing Procedures.
- IEC Publication No. 61726, Cable Assemblies, Cables, Connectors and Passive Microwave Components - Screening Attenuation Measurement by the Reverberation Chamber Method.

2.3 ORDER OF PRECEDENCE

For the purpose of interpretation and in case of conflict with regard to documentation, the following order of precedence shall apply:

(a) ESCC Detail Specification.
(b) ESCC Generic Specification.
(c) ESCC Basic Specification.
(d) Other documents, if referenced herein.

3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

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

4 REQUIREMENTS

4.1 GENERAL

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

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

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

4.1.1 Specifications

For qualification, qualification maintenance, procurement and delivery of components in conformity with this specification, the applicable specifications listed in Section 2 of this document shall apply in total unless otherwise specified herein or in the Detail Specification.

4.1.2 Conditions and Methods of Test

The conditions and methods of test shall be in accordance with this specification, the ESCC Basic Specifications referenced herein and the Detail Specification.

4.1.3 Manufacturer's Responsibility for Performance of Tests and Inspections

The Manufacturer shall be responsible for the performance of tests and inspections required by the applicable specifications. These tests and inspections shall be performed at the plant of the Manufacturer of the components unless it is agreed by the ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components), to use an approved external facility.

4.1.4 Inspection Rights

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

4.2 QUALIFICATION AND QUALIFICATION MAINTENANCE REQUIREMENTS ON A MANUFACTURER

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

4.3 DELIVERABLE COMPONENTS

4.3.1 ESCC Qualified Components

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

4.3.2 ESCC Components

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

- be traceable to its production lot.
- have satisfactorily completed all the tests required by the relevant issues of the applicable specifications.
- be produced from lots that are considered by the Manufacturer to be capable of passing all applicable tests, and sequences of tests, that are defined in Chart F4. The Manufacturer shall not knowingly supply components that cannot meet this requirement. In the event that, subsequent to delivery and prior to operational use, a component is found to be in a condition such that, demonstrably, it could not have passed these tests at the time of manufacture, this shall be grounds for rejection of the delivered lot.

4.3.3 Lot Failure

Lot failure may occur during Special In-Process Controls (Chart F2), Screening Tests (Chart F3) or Qualification, Periodic Testing and Lot Validation Testing (Chart F4).

Should such failure occur during qualification, qualification maintenance or procurement of qualified components the Manufacturer shall initiate the non-conformance procedure in accordance with ESCC Basic Specification No. 22800. The Manufacturer shall notify the Orderer and the ESCC Executive by any appropriate written means, within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing or analysis shall be performed on the failed components until so instructed by the ESCC Executive.

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

4.4 MARKING

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

4.5 MATERIALS AND FINISHES

Specific requirements for materials and finishes are specified in the Detail Specification. Where a definite material or finish is not specified, a material or finish shall be used so as to ensure that the component meets the performance requirements of this specification and the Detail Specification. Acceptance or approval of any constituent material or finish does not guarantee acceptance of the finished product.

All materials and finishes of the components specified in the Detail specification shall comply with the restrictions on materials specified in ESCC Basic Specification No. 22600.

All metallic materials shall meet stress-corrosion resistance Class 1 or Class 2 of ECSS-Q-ST-70-37.

5 PRODUCTION CONTROL

5.1 GENERAL

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

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

The applicable test requirements are detailed in the paragraphs referenced in Chart F2.

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

5.2 SPECIAL IN-PROCESS CONTROLS

Before assembly, the different elements of the connectors shall be submitted to the following tests and inspections.

5.2.1 Contact Engagement and Separation Forces

A sample of 13 female centre contacts shall be tested for Contact Engagement and Separation Forces as defined in Para. 8.1. If any failure occurs, the lot of contacts shall be rejected.

5.2.2 Gold Plate Porosity

A sample of 10 contacts from each plating lot shall be tested for Gold Plate Porosity as defined in Para. 8.2. If any failure occurs the plating lot shall be rejected.

5.2.3 Plating Thickness Verification

The following samples shall be tested in accordance with Para. 8.3:

- Contacts: 10
- Coupling Nuts: 3
- Shells: 3
- Ferrules/Accessories: 3

It is not necessary to verify the thickness of underlayers that are not barrier layers.

If any failure occurs, the lot shall be rejected.

5.2.4 Crimping Capability

Only applicable to connectors with crimp connections.

3 sample bodies/ferrules/contacts shall be assembled and crimped to the cable as specified in the Detail Specification using the Manufacturer's approved crimping tools and cabling procedure. The assembled samples shall meet the requirements of Para. 8.4. If any failure occurs, the lot shall be rejected.

5.2.5 Solderability

Only applicable to connectors with solder connections.

3 sample bodies/ferrules/contacts shall be assembled and soldered to the cable as specified in the Detail Specification in accordance with IEC Publication No, 60068-2-20, Method 2 (with soldering iron size B). The assembled samples shall meet the requirements of Para. 8.5. If any failure occurs, the lot shall be rejected.

5.2.6 Pre-Assembly Inspection

Pre-Assembly Inspection shall consist of external visual inspection of all the different elements of the components in accordance with Para. 8.6. All failures shall be rejected.

5.2.7 Dimension Check

Dimension Check shall be performed after assembly on 3 samples in accordance with Para. 8.7. In the event of any failure, a 100% Dimension Check shall be performed.

5.2.8 Weight

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

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

6 SCREENING TESTS

6.1 GENERAL
Unless otherwise specified herein or in the detail specification, all lots of components used for qualification and qualification maintenance, Lot Validation Testing, and for delivery, shall be subjected to tests and inspections in accordance with Chart F3 in the sequence shown.

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

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

6.2 FAILURE CRITERIA

6.2.1 Environmental and Mechanical Test Failure
The following shall be counted as component failures:

- Components which fail during tests for which the pass/fail criteria are inherent in the test method, e.g. Temperature Cycling, Seal, etc.

6.2.2 Parameter Limit Failure
A component shall be counted as a parameter limit failure if one or more parameters exceed the limits shown in Room Temperature Electrical Measurements in the Detail Specification.

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

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

6.3 FAILED COMPONENTS
A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 6.2.

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

6.4.1 Lot Failure during 100% Testing
If the number of components failed on the basis of the failure criteria specified in Para. 6.2 exceeds 10% (rounded upwards to the nearest whole number) of the components submitted to Chart F3 testing, the lot shall be considered as failed.

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

6.4.2 Lot Failure during Sample Testing

A lot shall be considered as failed if the number of allowable failures during sample testing, as specified herein or in the Detail Specification, is exceeded.

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

6.5 DOCUMENTATION

Documentation of Screening Tests shall be in accordance with Para. 9.6.

7 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING

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

7.1 QUALIFICATION TESTING

7.1.1 General

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

The applicable test requirements are detailed in the paragraphs referenced in Chart F4. All components shall be subjected to all of the tests in the sequence shown.

Components shall be serialised prior to Chart F4 testing

The conditions governing qualification testing are specified in ESCC Basic Specification No. 20100.

7.1.2 Distribution within the Qualification Test Lot

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

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

If considered necessary to adequately represent the range or series of component types, the quantity of components included in the Qualification Test Lot may be increased as specified by, or agreed with, the ESCC Executive.

7.2 QUALIFICATION MAINTENANCE (PERIODIC TESTING)

Qualification is maintained through periodic testing and the test requirements of Para. 7.1 shall apply. Unless otherwise specified, all test components shall be subjected to all of the tests in the sequence shown. The applicable test requirements are detailed in the paragraphs referenced in Chart F4. The period between successive testing shall be as specified in Chart F4.

The conditions governing qualification maintenance are specified in ESCC Basic Specification No. 20100.

7.3 LOT VALIDATION TESTING

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

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

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

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

7.4 FAILURE CRITERIA

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

7.4.1 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. Random Vibration, Mechanical Shock, Temperature Cycling, etc.

7.4.2 Electrical Failures

The following shall be counted as component failures:

- Components which fail one or more of the applicable limits at each of the relevant data points specified for testing in Room Temperature Electrical Measurements in the Detail Specification.

7.4.3 Other Failures

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

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

7.5 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 7.4.

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

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

7.6 LOT FAILURE

For qualification and qualification maintenance, the lot shall be considered as failed if one component in any subgroup of Chart F4 is a failed component based on the criteria specified in Para. 7.4.

For procurement, the lot shall be considered as failed if one component in any test specified for Lot Validation Testing is a failed component based on the criteria specified in Para. 7.4.

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

7.7 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING SAMPLES

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

7.8 DOCUMENTATION

Documentation of Qualification, Periodic Testing and Lot Validation Testing shall be in accordance with Para. 9.7.

8 TEST METHODS AND PROCEDURES

If a Manufacturer elects to eliminate or modify a test method or procedure, the Manufacturer is still responsible for delivering components that meet all of the performance, quality and reliability requirements defined in this specification and the Detail Specification.

For a qualified component, documentation supporting the change shall be approved by the ESCC Executive and retained by the Manufacturer. It shall be copied, when requested, to the ESCC Executive. The change shall be specified in an appendix to the Detail Specification and in the PID.

For an unqualified component the change shall be approved by the Orderer. The change may be specified in an appendix to the Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

When necessary for testing purposes, the components under test shall be mated with suitable mating counterparts.

8.1 CONTACT ENGAGEMENT AND SEPARATION FORCES

The female centre contacts shall be tested as follows:

- A force which is gradually increased shall be applied with force speed not exceeding 1mm/s until the steel test pin properly engages with, or separates from, the female contact. The polished steel test pins shall be as specified in the ESCC Detail Specification.

  The oversize test pin shall be engaged and separated from each female contact 3 times and then the Engagement Force shall be measured with the maximum diameter test pin.

  Subsequently, the minimum diameter test pin shall be engaged and separated once to measure the Separation Force.

  The Engagement Force and the Separation Force shall meet the limits specified in the ESCC Detail Specification.

8.2 GOLD PLATE POROSITY

Contacts 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 ±5°C shall be poured over the contacts. No bubbles shall emanate from the contact surfaces within 15 seconds from application of the solution.

8.3 PLATING THICKNESS VERIFICATION

Plating thickness shall be measured and verified using either a non-destructive method or by microsectioning. In the event of conflict, the microsectioning method shall govern. The plating thickness requirements specified in the Detail Specification shall apply.

Hermetic components shall be broken to free the contacts or shall be microsectioned along centre contacts in order to determine the plating thickness.

8.4 CRIMPING CAPABILITY

Connectors crimped to cable (see Para. 5.2.4) shall be subjected to the following examinations and electrical measurements:

- All crimps shall be examined under x10 magnification and shall be free from cracks.
- Connector interface and external dimensions shall conform to those specified in the Detail Specification.
- Insulation Resistance and Voltage Proof shall be measured as specified in Room Temperature Electrical Measurements in the Detail Specification.

8.5 SOLDERABILITY

Connectors soldered to cable (see Para. 5.2.5) shall be subjected to the following examinations and electrical measurements:

- All solder joints shall be examined under x10 magnification. They shall be bright and show good wetting.
- Connector interface and external dimensions shall conform to those specified in the Detail Specification.
- Insulation Resistance and Voltage Proof shall be measured as specified in Room Temperature Electrical Measurements in the Detail Specification

8.6 PRE-ASSEMBLY INSPECTION

Prior to assembly, the different elements of the components shall be inspected in accordance with the requirements of ESCC Basic Specification No. 20500.

8.7 DIMENSION CHECK

Dimension Check shall be performed in accordance with ESCC Basic Specification No. 20500 and the Detail Specification.

8.8 TEMPERATURE CYCLING

Components shall be subjected to Temperature Cycling with the following conditions:

- Number of cycles:
  (a) For Screening Tests (Chart F3):
  3 cycles with 15 minutes at each storage temperature extreme as specified in Maximum Ratings in the Detail Specification. The temperature transfer slope between the extremes shall not exceed 10°C/minute.
  (b) For Qualification Testing, Periodic Testing and Lot Validation Testing (Chart F4):
  5 cycles with 15 minutes at each storage temperature extreme as specified in Maximum Ratings in the Detail Specification. The temperature transfer slope between the extremes shall not exceed 10°C/minute. Components shall be mated to suitable mating counterparts during testing.

- Data Points
  On completion of testing and after a recovery period of 24 ±2 hours at room temperature conditions, the components shall be visually examined and there shall be no evidence of damage or loosening of parts.

  During Qualification, Periodic Testing and Lot Validation Testing (Chart F4) only, electrical measurements as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification shall be performed. If parameter drift is specified, initial measurements also shall be performed.

8.9 ELECTRICAL MEASUREMENTS

8.9.1 General

8.9.2 Insulation Resistance

Insulation Resistance shall be performed in accordance with MIL-STD-202, Test Method 302 and as follows:

(a) Test Voltage: 500Vdc.
(b) Points of Measurement: Between the connector centre contact and the body.
(c) Measurement shall be read after 1 minute of voltage application.
(d) Insulation Resistance shall meet the limits specified in the Detail Specification.

8.9.3 Voltage Proof

Voltage Proof shall be performed in accordance with MIL-STD-202, Test Method 301 and as follows:

(a) Relative Humidity: ≤ 50%.
(b) The test voltage and points of application of the test voltage shall be as specified in the Detail Specification.
(c) The test voltage shall be applied for 1 minute.
(d) There shall be no evidence of flashover or breakdown. Precautions shall be taken to prevent air-gap breakdowns.

8.9.4 Contact Resistance

Contact Resistance shall be performed in accordance with MIL-STD-202, Test Method 307 and as follows. Components shall be mated to suitable mating counterparts during testing.

- Contacts to be tested:
  - Centre contact.
  - Outer contact.
  - For cabled connectors: the contact resistance between the cable braid or outer conductor and the connector at the point of contact.
- Test current and voltage: as specified in the Detail Specification.

8.9.5 Voltage Standing Wave Ratio (VSWR)

VSWR shall be measured using an appropriate test method employing a suitable coaxial test set-up, across the full frequency range by a swept frequency. The following conditions shall apply:

- Applied Power: Low level RF power as specified in the Detail Specification.
- Operating Frequency: Over the full operating frequency range as specified in the Detail Specification.
- VSWR shall meet the limits specified in the Detail Specification.

8.9.6 Insertion Loss

Insertion Loss shall be measured using an appropriate test method employing a suitable coaxial test set-up, across the full frequency range either by a swept frequency technique or, alternatively, at a minimum of 7 fixed frequencies equally spaced across the frequency range. The following conditions shall apply:

- Operating Frequency: Over the full operating frequency range as specified in the Detail Specification.
- Insertion Loss shall meet the limits specified in the Detail Specification.

8.9.7 Room Temperature Electrical Measurements (Chart F3)

At each of the relevant data points during Screening Tests (Chart F3), Room Temperature Electrical Measurements shall be performed as specified in the Detail Specification. Unless otherwise specified, for connectors, Insulation Resistance and Voltage Proof shall be measured, and for adaptors, Insulation Resistance, Voltage Proof, VSWR and Insertion Loss Measurements shall be measured. Measurements shall be performed at T_{amb} = +22 ±3°C.

8.9.8 Intermediate and End-Point Electrical Measurements (Chart F4)

At each of the relevant data points during Qualification, Periodic Testing and Lot Validation Testing (Chart F4), Intermediate and End-Point Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated if specified.

8.9.9 Electrical Measurements at Room Temperatures (Chart F4)

At each of the relevant data points during Qualification, Periodic Testing and Lot Validation Testing (Chart F4), unless otherwise specified, Voltage Proof, Insulation Resistance, Contact Resistance, VSWR and Insertion Loss shall be measured as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification. Measurements shall be performed at T_{amb} = +22 ±3°C. All values obtained shall be recorded against serial numbers

8.10 COUPLING PROOF TORQUE

The component under test shall be engaged with the applicable mating gauge as specified in the Detail Specification, and the coupling nut shall be tightened to the torque specified in the Detail Specification. After 1 minute, the connected pair shall be disconnected.

For Screening Tests (Chart F3), Coupling Proof Torque shall be performed on 13 samples selected at random from the lot. In the event of any failure, a 100% test shall be performed.

- Data Points:
  On completion of testing, the component shall be visually inspected. The coupling mechanism shall not be dislodged and the interface dimensions of the component shall remain as specified in the Detail Specification.

8.11 MATING AND UNMATING FORCES

The component under test shall be mated with its mating gauge as specified in the Detail Specification. During the entire mating/unmating cycle (until the component is fully mated or unmated), the necessary torque/force shall not exceed the value specified in the Detail Specification.

For Screening Tests (Chart F3), Mating and Unmating Forces shall be performed on 13 samples selected at random from the lot. In the event of any failure, a 100% test shall be performed.

For Qualification, Periodic Testing and Lot Validation Testing (Chart F4): Unless otherwise specified, the number of mating/unmating cycles shall be 50.

8.12 CENTRE CONTACT RETENTION

Axial and rotational forces as specified in the Detail Specification shall be applied, first in one direction and then in the other, to the centre contact of an assembled and un-cabled connector, using an appropriate method.

- Data Points:
  The inner contact shall be inspected after the forces have been applied in one direction and again after the forces have been applied in the opposite direction to determine if the contact has been displaced from the specified interface dimensions in the Detail Specification.

8.13 SEAL

Only applicable to to hermetically sealed, barrier-sealed or panel-sealed components.

Seal shall be performed in accordance with MIL-STD-202, Test Method 112 with the following conditions:

(a) For hermetically sealed components: Test conditions as specified in the Detail specification. The leakage rate shall not exceed 10^{-8} cm^3/s of helium under a vacuum of 1.3mPa.

(b) For barrier-sealed components: Connectors shall be subjected to an air pressure of $2.1kg/cm^2$ applied to one end, and the whole assembly immersed in water or isopropyl alcohol at a temperature of +15 to +25°C.

The connectors shall remain immersed for 2 minutes maximum; there shall be no bubbles emanating from the other end.

(c) For panel-sealed components: Connectors shall be mounted in a normal manner in a suitable test jig. The mating end of the connectors shall be sealed with the appropriate mating connector and the whole assembly immersed in water or isopropyl alcohol at a temperature of +15 to +25°C.

An air pressure of $2.1kg/cm^2$ shall be applied to one end of the assembly for 2 minutes maximum; there shall be no bubbles emanating from the connectors.

8.14 EXTERNAL VISUAL INSPECTION

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

8.15 RANDOM VIBRATION

Random Vibration shall be performed in accordance with MIL-STD-202, Test Method 214 with the following conditions:

- Random Vibration Test Curve:
  - 50grms overall
  - 10 to 50Hz: +3dB/octave
  - 50 to 1000Hz: 1.5g2/Hz
  - 1000 to 2000Hz: -3dB/octave
- Duration: 180s in each of the 3 mutually perpendicular axes
- Mounting:
  The components shall be mechanically connected to the vibration generator either directly or by means of a fixture. Mounting fixtures shall enable the components to be vibrated in 3 mutually perpendicular axes in turn, which should be so chosen that faults are most likely to be revealed.

  If the component is provided with specific means of mounting, they shall be used as specified in the Detail Specification and any additional restraining straps should be avoided. Unless otherwise specified, components not provided with specific means of mounting shall be clamped by the body. If external connections, necessary for measuring and supply purposes, are specified in the Detail Specification, they should add the minimum restraint and mass.

- Data Points:
  On completion of testing, the components shall be visually inspected and there shall be no evidence of damage or loosening of parts.

  Electrical measurements as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification shall be performed. If parameter drift is specified initial measurements also shall be performed.

8.16 MECHANICAL SHOCK

Mechanical Shock shall be performed in accordance with Test Ea of IEC Publication No. 60068-2-27. The following conditions shall apply:

- Shape of shock pulse: Half-sine.
- Peak acceleration: 100g.
- Duration of pulse: 6ms.
- Number of shocks: 18 (3 shocks in each direction along the 3 perpendicular axes of the test specimen).
- Mounting: The components shall be mechanically connected to the shock machine either directly or by means of a fixture. Mounting fixtures shall enable the components to be shocked in 3 mutually perpendicular axes in turn, which should be so chosen that faults are most likely to be revealed.

  If the component is provided with specific means of mounting, they shall be used as specified in the Detail Specification and any additional restraining straps should be avoided. Unless otherwise specified, components not provided with specific means of mounting shall be clamped by the body. If external connections, necessary for measuring and supply purposes, are specified in the Detail Specification, they should add the minimum restraint and mass.

- Data Points:
  On completion of testing, the components shall be visually inspected and there shall be no evidence of damage or loosening of parts.

  Electrical measurements as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification shall be performed. If parameter drift is specified initial measurements also shall be performed.

8.17 THERMAL STABILITY OF INSERTION LOSS

Only applicable to connector transition, adaptor and connecting piece components.

Components shall be subjected to temperature cycling with the following conditions:

- Number of Temperature Cycles: 3 cycles with 15 minutes minimum at each operating temperature extreme as specified in Maximum Ratings in the Detail Specification.
- Temperature transfer slope: 3 ±1°C/minute
- Power Applied During Cycling: 0dBm minimum.
- Operating Frequency: the maximum operating frequency as specified in the Detail Specification, unless otherwise specified.

- Data Points:
  During temperature transitions, Insertion Loss shall be continuously monitored and recorded once every 500ms as a minimum or alternatively an analogue recorder may be used. The following acceptance criteria shall apply:
  - No single Insertion loss discontinuity, step or spike shall exceed 0.1dB.

    NOTE: In order for any observed glitch to be considered as a single Insertion Loss discontinuity, step or spike, it shall be evident on more than one temperature cycle. Otherwise it may be ignored.

8.18 SHIELDING EFFECTIVENESS

Only applicable to connector transition, adaptor and connecting piece components.

Shielding Effectiveness (SE) shall be measured in accordance with IEC Publication No. 61726 and the following requirements:

(a) Maximum frequency range of the reverberant chamber shall not be less than the maximum operating frequency of the test vehicles.

(b) Number of measurement points: 100 points/decade.

(c) Shielding Effectiveness shall meet the limits specified in Intermediate and End-Point Electrical Measurements in the Detail Specification.

The Shielding Effectiveness (SE) is calculated using the following formula:

SE (dB) = (Pi/Pt) (dB) - Xc

Where :

- Pi is the incident power (from the generator)
- Pt is the transmitted power to the test vehicles
- Xc is the cage loss (dB). Xc is measured with an additional matched antenna in the reverberation chamber.

8.19 ENDURANCE

The components shall be subjected to a specified number of mating and unmating cycles at a specified rate using a suitable mating counterpart.

Unless otherwise specified, the number of cycles shall be 50 and the rate shall be no more than 12 cycles per minute. During each cycle the components shall be fully mated to the specified torque as specified in the ESCC Detail Specification, and then fully unmated.

Unless otherwise specified, the threads of rotational parts shall not be lubricated before or during endurance testing. Solvents and tools shall not be used for cleaning.

- Data Points:
  On completion of testing, Mating and Unmating Forces shall be measured in accordance with Para. 8.11, and Contact Resistance shall be measured as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification. The components shall be visually inspected and there shall be no evidence of physical damage. Any wear to the contacts or threads as a result of the endurance testing shall not be considered as physical damage.

8.20 DESTRUCTIVE PHYSICAL ANALYSIS (DPA)

ESCC Basic Specification No. 21001.

9 DATA DOCUMENTATION

9.1 GENERAL

For the qualification, qualification maintenance and procurement for each lot a data documentation package shall exist in a printed or electronic form.

This package shall be compiled from:

(a) Cover sheet (or sheets).
(b) List of equipment (testing and measuring).
(c) List of test references.
(d) Special In-Process Controls data (Chart F2).
(e) Screening Tests data (Chart F3).
(f) Qualification, Periodic Testing and Lot Validation Testing (when applicable) data (Chart F4).
(g) Failed components list and failure analysis report (when applicable).
(h) Certificate of Conformity.

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

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

Whenever possible, documentation should preferably be available in electronic format suitable for reading using a compatible PC. The format supplied shall be legible, durable and indexed. The preferred storage medium is CD-ROM and the preferred file format is PDF.

9.1.1 Qualification and Qualification Maintenance

In the case of qualification or qualification maintenance, the items listed in Para. 9.1(a) to (h) are required.

9.1.2 Component Procurement and Delivery

For all deliveries of components procured to this specification, the following documentation shall be supplied:

(a) Cover sheet (if all of the information is not included on the Certificate of Conformity).
(b) Certificate of Conformity.

9.1.3 Additional Documentation

The Manufacturer shall deliver additional documentation containing data and reports to the Orderer, if stipulated in the Purchase Order.

9.1.4 Data Retention/Data Access

If not delivered, all data shall be retained by the Manufacturer for a minimum of 5 years during which time it shall be available for review, if requested, by the Orderer or the ESCC Executive (for qualified components).

9.2 COVER SHEET(S)

The cover sheet(s) of the data documentation package shall include as a minimum:

(a) Reference to the Detail Specification, including issue and date.
(b) Reference to the applicable ESCC Generic Specification, including issue and date.
(c) ESCC Component Number and the Manufacturer's part type number.
(d) Lot identification.
(e) Number of the 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 Manufacturer.
(j) Total number of pages of the data package.

9.3 LIST OF EQUIPMENT USED

A list of equipment used for tests and measurements shall be prepared. Where applicable, this list shall contain inventory number, Manufacturer's type number, serial number, etc. This list shall indicate for which tests such equipment was used.

9.4 LIST OF TEST REFERENCES

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

9.5 SPECIAL IN-PROCESS CONTROLS DATA (CHART F2)

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

For Plating Thickness Verification and Contact Engagement and Separation Forces, the measurements shall be recorded.

9.6 SCREENING TESTS DATA (CHART F3)

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

9.7 QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING DATA (CHART F4)

9.7.1 Qualification Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test. Data shall include all results recorded during each test. Component serial numbers shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test, the drift calculation shall be recorded against component serial number. For Destructive Physical Analysis, a DPA report shall be produced in accordance with ESCC Basic Specification No. 21001.

9.7.2 Periodic Testing for Qualification Maintenance

A test result summary shall be compiled showing the components submitted to and the number rejected after each test. Data shall include all results recorded during each test. Component serial numbers shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test, the drift calculation shall be recorded against component serial number. For Destructive Physical Analysis, when applicable, a DPA report shall be produced in accordance with ESCC Basic Specification No. 21001.

In addition to the full test data a report shall be compiled to act as the most recent Periodic Testing summary. These reports shall include a list of all tests performed, the ESCC Component Numbers and quantities of components tested, a statement confirming all the results were satisfactory, the date the tests were performed and a reference to the full test data.

9.7.3 Lot Validation Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test (as applicable). Data shall include all results recorded during each test. Component serial numbers shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test, the drift calculation shall be recorded against component serial number. For Destructive Physical Analysis, a DPA report shall be produced in accordance with ESCC Basic Specification No. 21001

9.8 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

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

(a) The reference and description of the test or measurement performed as defined in this specification and/or the Detail Specification during Special In-Process Controls, Screening Tests and Qualification, Periodic Testing and Lot Validation Testing.

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

(c) The failed parameter and the failure mode of the component.

(d) Detailed failure analysis (if requested by the ESCC Executive or Orderer).

9.9 CERTIFICATE OF CONFORMITY

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

10 DELIVERY

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

(a) The delivery lot.

(b) The components used for Lot Validation Testing (as applicable), but not forming part of the delivery lot, if stipulated in the Purchase Order.

(c) The relevant documentation in accordance with the requirements of Paras. 9.1.2 and 9.1.3.

In the case of a component for which a valid qualification is in force, all data of all components submitted to Lot Validation Testing shall also be copied, when requested, to the ESCC Executive.

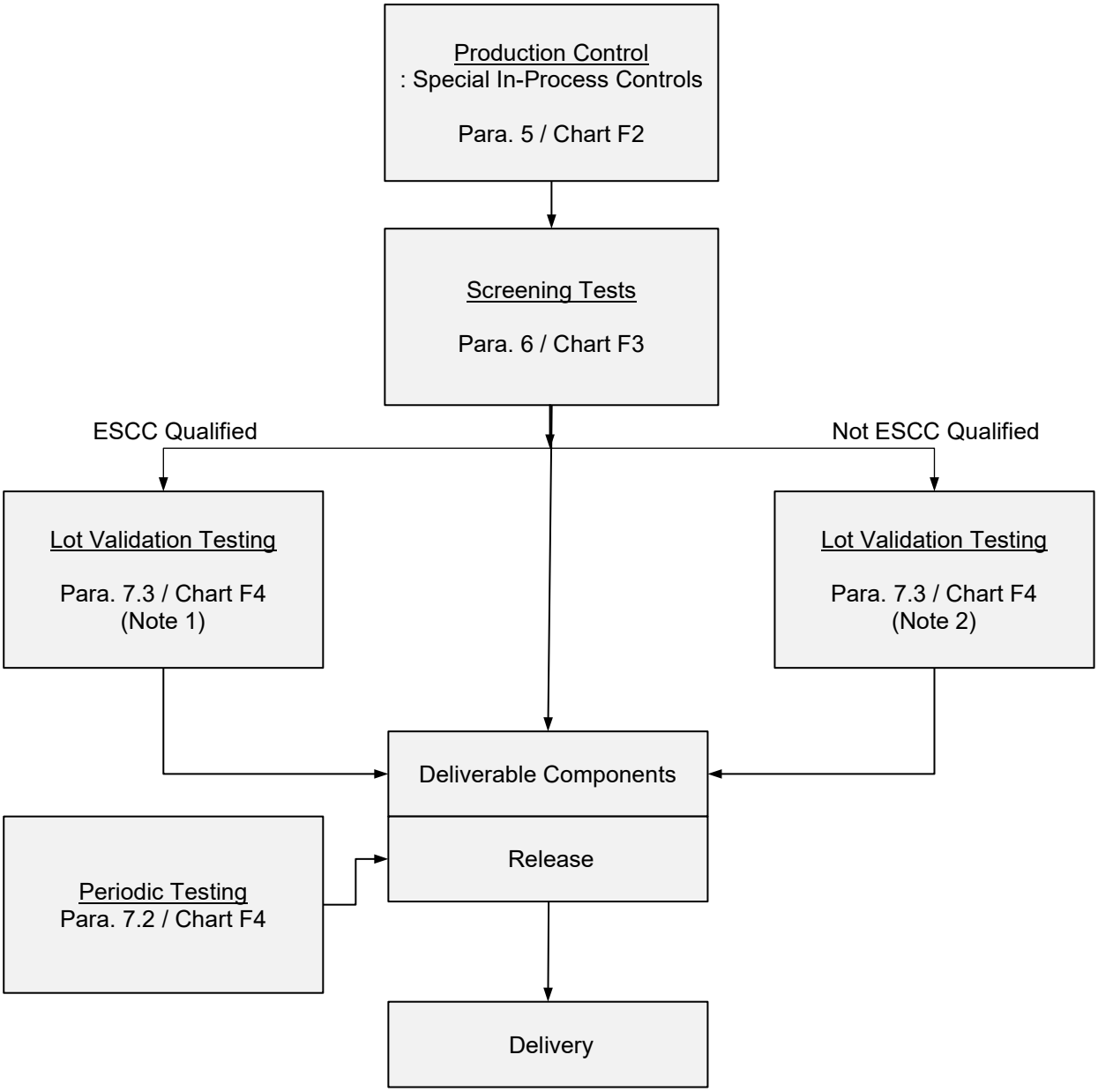
For qualification or qualification maintenance, the disposition of the Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification No. 20100 and the relevant paragraphs of Section 9 of this specification.

11 PACKAGING AND DISPATCH

The packaging and dispatch of components to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 20600.

12 CHARTS

12.1 CHART F1 - GENERAL FLOW FOR PROCUREMENT



NOTES:

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

12.2 CHART F2 - PRODUCTION CONTROL

COMPONENT LOT MANUFACTURING	
SPECIAL IN-PROCESS CONTROLS	
Para. 5.2.1	Contact Engagement and Separation Forces (1) (2)
Para. 5.2.2	Gold Plate Porosity (1) (2)
Para. 5.2.3	Plating Thickness Verification (1) (2)
Para. 5.2.4	Crimping Capability (1) (2)
Para. 5.2.5	Solderability (1) (2)
Para. 5.2.6	Pre-Assembly Inspection
-	Assembly
Para. 5.2.7	Dimension Check (1) (3)
Para. 5.2.8	Weight (4)
TO CHART F3 – SCREENING TESTS	

NOTES:

1. Performed on a sample basis.
2. Test may be performed at any point prior to Pre-Assembly Inspection.
3. Test may be performed at any point after assembly.
4. Guaranteed but not tested.

12.3 CHART F3 - SCREENING TESTS

COMPONENTS FROM PRODUCTION CONTROL	
Para. 8.8	Temperature Cycling (1)
Para. 8.9.7	Room Temperature Electrical Measurements (1)
Para. 8.10	Coupling Proof Torque (2)
Para. 8.11	Mating and Unmating Forces (2)
Para. 8.12	Centre Contact Retention
Para. 8.13	Seal (3)
Para. 8.14	External Visual Inspection
Para. 6.4	Check for Lot Failure (4)
TO CHART F4 WHEN APPLICABLE	

NOTES:

1. Not applicable to components where the centre contact and insulator are not mounted in the connector for delivery.
2. Performed on a sample basis.
3. Only applicable to hermetically sealed, barrier-sealed or panel-sealed components.
4. Check for Lot Failure shall take into account all failures that may occur during Screening Tests.

12.4 CHART F4 - QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING

Testing Subgroup 24 Months Period	
4 Components (1) (2) (3) plus 1 Control Sample (4)	
Para. 8.11	Mating and Unmating Forces
Para. 8.15	Random Vibration
Para. 8.16	Mechanical Shock (5)
Para. 8.8	Temperature Cycling
Para. 8.17	Thermal Stability of Insertion Loss (6)
Para. 8.18	Shielding Effectiveness (6)
Para. 8.9.9	Electrical Measurements at Room Temperature (Chart F4)
Para. 8.19	Endurance
Para. 8.13	Seal (7)
Para. 8.10	Coupling Proof Torque
Para. 8.14	External Visual Inspection
2 Components (5, 8)	
Para. 8.20	Destructive Physical Analysis (5, 8)

NOTES:

1. For distribution, see Para. 7.1.2 for qualification and qualification maintenance and Para. 7.3 for Lot Validation Testing.
2. No failures are allowed.
3. When necessary for testing purposes, the components under test shall be mated with suitable mating counterparts.
4. A control sample shall be used for reference purposes. Whenever electrical measurements are made on any component under test, the control sample shall also be measured.
5. Not required for Periodic Testing for extension of qualification. Required only for Qualification Testing and for Periodic Testing for renewal of qualification after lapse.
6. Only applicable to connector transition, adaptor and connecting piece components.
7. Only applicable to hermetically sealed, barrier-sealed or panel-sealed components.
8. 2 of the components subjected to testing above shall be selected at random for DPA.