EVALUATION TEST PROGRAMME FOR OPTICAL FIBRE CONNECTOR SETS

ESCC Basic Specification No. 2263010

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DOCUMENTATION CHANGE NOTICE

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	CHANGE DESCRIPTION
256	Specification upissued to incorporate editorial DCR.

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1. PURPOSE

The purpose of this specification is to establish the procedure to be followed in the evaluation of component capabilities as required for space applications and thereby to anticipate, as far as possible, component behaviour during qualification testing. Therefore, the aim of such testing shall be to overstress specific characteristics of the component concerned with a view to the detection of possible failure modes. Additionally, a detailed constructional analysis shall be performed to detect any design and construction defects which may affect the reliability of the component and to facilitate failure analysis activities.

2. APPLICABLE DOCUMENTS

2.1 GENERAL

The following documents form part of, and shall be read in conjunction with, this specification.

2.2 ESCC SPECIFICATIONS

Basic Specification No. 20400, Internal Visual Inspection
Basic Specification No. 20500, External Visual Inspection.

Unless otherwise stated herein, reference within the text of this specification to “the Detail Specification” shall mean the relevant ESCC Detail Specification.

2.3 OTHER REFERENCE DOCUMENTS

ESCC-Q-70-02	Thermal Vacuum Outgassing Test for the Screening of Space Materials
ESCC-Q-70-21	Flammability Testing for the Screening of Space Materials
ESCC-Q-70-29	The Determination of Off-Gassing Products from Materials and Assembled Articles to be Used in a Manned Space Vehicle Crew Compartment
IEC61300	Fibre Optic Interconnecting Devices and Passive Components - Basic Test and Measurement Procedures

3. PROCEDURE

Standard connector sets shall be selected from a homogeneous lot at the Manufacturer to be evaluated. These components shall not have been submitted to any screening, but must have been manufactured and assembled in conformity with high reliability practice and an established Process Identification Document (PID) or an identifiable process which shall form the basis for the PID.

The tests specified in the programme shall be performed in the sequence shown in Chart I.

All results shall be recorded and failed components submitted to a failure analysis.

Probable failure modes and mechanisms shall be determined.

The evaluation test programme shall be performed, under the supervision of the ESCC Executive for whom the evaluation of the connector set concerned is required, by the Manufacturer or at a test laboratory approved by the ESCC Executive.

4. TEST PROGRAMME SEQUENCE AND SAMPLE DISTRIBUTION

4.1 SELECTION OF COMPONENTS FOR EVALUATION TESTING

The number of components chosen for evaluation testing shall depend upon whether a single component type or a family of parts is evaluated and the number of component types chosen to represent the family.

Not less than 26 specimens shall be used for each test programme.

The component types chosen to represent a family shall cover the range of components to be evaluated and be representative of the different configurations under consideration. They shall also be the most suitable for highlighting those characteristics and parameters that are pertinent to an investigation into failure modes and weaknesses.

The above mentioned quantity shall be submitted to the full evaluation procedure whenever a new technology has been applied to the components concerned, where there is insufficient experience in their production.

4.2 DETAIL SPECIFICATION(S)

Should a Detail Specification(s) for the connector set(s) to be evaluated not exist, the Manufacturer shall prepare such a document(s) in accordance with the established ESCC format and submit it to the appropriate ESCC Executive for provisional approval. This shall then serve as a basis for the ordering and testing of the relevant connector sets.

4.3 INSPECTION RIGHTS

The ESCC Executive reserves the right to inspect at any time the connector sets processed for evaluation purposes. The Manufacturer shall notify the ESCC Executive at least three working days in advance of the date of pre-assembly visual inspection (but see Control During Fabrication).

4.4 CONTROL DURING FABRICATION

The components shall be produced as defined in the Procedure section in this specification. Pre-assembly visual inspections shall be performed on the lot to be tested to the extent that this forms part of the Manufacturer's standard procedures. Progress of the connector sets shall be observed closely and recorded together with an analysis of any rejects. A chart showing the number in/out and failure cause for each fabrication stage shall be submitted to the ESCC Executive.

5. INSPECTION

5.1 GENERAL

The connector sets shall be checked to verify their suitability for the Evaluation Test Programme. Defects or deviations from the established ESCC requirements may invalidate the evaluation. For each measurement or inspection performed, the results shall be summarised in terms of quantity tested, quantity passed and quantity rejected. If devices are rejected, the reason shall be clearly identified.

5.2 DIMENSIONS

All connector sets shall be measured in accordance with the Physical Dimensions of the Detail Specification including the surface topology of the ferrule end face and the results recorded together with any non-conformities. Where gauges exist for the performance of measurements, these may be used. Rejected components shall be replaced.

5.3 WEIGHT

All connector sets shall be weighed to an accuracy of 0.1 grammes. Any devices that exceed the weight defined in the Detail Specification shall be rejected and replaced.

5.4 OPTICAL MEASUREMENTS (100%)

All connector sets shall be inspected for optical attenuation test against a reference as defined in the Detail Specification at an ambient temperature of +22 ± 3°C (go-no-go). Connectors and adapters have to be measured using reference components.

Rejected connector sets shall be replaced.

5.5 EXTERNAL VISUAL INSPECTION (100%)

Visual inspections shall be performed with high power illumination under X3 magnification and confirmed at X10 magnification whenever results at the lower magnification are uncertain or there is evidence of deficiencies that require greater resolution. The connector set shall show no evidence of defects or damage such as cracks, breaks, contamination or embedded foreign material.

Rejected connector sets shall be replaced.

5.6 MARKING AND SERIALISATION (100%)

All connector sets shall be marked and serialised in accordance with the standard procedures of the Manufacturer concerned.

5.7 MATERIALS AND FINISHES

All non-metallic materials and finishes of the connector set specified herein shall be tested in accordance with ESCC-Q-70-02 to verify its outgassing requirements, unless relevant data is available.

In addition, all connector sets specified herein shall meet the flammability requirements outlined in ESCC-Q-70-21 and the outgassing requirements outlined in ESCC-Q-70-29

5.8 COMPLETION OF INSPECTION

The completion of inspection shall result in a batch of connector sets that have been verified as to their suitability for the Evaluation Test Programme, i.e. each connector set has satisfied the inspection requirements herein.

6. INITIAL OPTICAL MEASUREMENTS (100% READ AND RECORD)

Optical measurements shall be performed in accordance with Room Temperature Optical Measurements and High and Low Temperature Optical Measurements of the Detail Specification. All characteristics shall be recorded against serial numbers.

7. EVALUATION TEST PROGRAMME

7.1 GENERAL

The evaluation tests shall be performed as specified in Chart I. Quantities and lengths of connector sets required for testing are specified in the paragraphs below. Cable assembly lengths may be revised to suit the sensitivity of instruments available for optical measurements.

All failed connector set samples shall be analysed. The depth of analysis shall depend upon the circumstances in which failure occurred and upon whether useful information may be gained. As a minimum, the failure mode shall be determined in each case. Components not failing catastrophically, i.e. those displaying out-of-tolerance optical parameters, shall not be removed from the test sequence, but monitored to observe degradation trends.

7.2 GROUP 1- CONTROL GROUP

This group shall be retained for comparison purposes. Whenever optical measurements are made on any sample under test, these connector sets shall also be measured.

A minimum of one connector set with 2m long cable and connectors is required for control purposes.

7.3 GROUP 2- DESTRUCTIVE TESTS

7.3.1 Subgroup 2A - Temperature Step Stress

7.3.1.1 General

The step stress sequence performed on this subgroup shall be terminated when optical transmission limits of Optical Measurements and Inspections During and On Completion of Environmental and Endurance Testing of the Detail Specification have been exceeded unless practical reasons prevent this. Each of the tests in this section requires two, 3m long cable assemblies.

7.3.1.2 Initial Measurements

The Optical Attenuation shall be measured in accordance with the requirements of the Detail Specification.

7.3.1.3 Intermediate Measurements

Changes in Optical Transmittance and Return Loss shall be monitored throughout the test in accordance with the requirements of the Detail Specification.

7.3.1.4 Final Measurements

The Optical Attenuation on any surviving connector sets shall be measured in accordance with the requirements of the Detail Specification.

7.3.1.5 Procedure for High Temperature Step Stress

This test shall be performed as specified in Chart II herein. The starting temperature shall be +80˚C and the temperature shall be increased by 10˚C at each step.

The test shall be stopped when Optical Transmission limits of the Detail Specification have been exceeded.

7.3.1.6 Procedure for Low Temperature Step Stress

This test shall be performed as specified in Chart II herein. The starting temperature shall be -40˚C and the temperature shall be decreased by 10˚C at each step.

The test shall be stopped when Optical Transmission limits of the Detail Specification have been exceeded.

7.3.1.7 Analysis of Temperature Step Stress Test results

The analysis of the Temperature Step Stress test results shall be presented in a graphical form supported by the actual results as follows:

– The optical attenuation shall be monitored, recorded and plotted against time for each temperature level.
– The average drift of the optical attenuation at each temperature level applied shall be plotted against temperature.

7.3.2 Subgroup 2B-Constructional Analysis

The following analysis shall be carried out on virgin components in order to assist in the identification of possible failure modes and to identify any additional test that may be necessary. The Constructional Analysis shall be performed on 2 samples with short pigtails to evaluate the termination integrity.

7.3.2.1 Internal Visual Inspection

Each sample shall be visually inspected in accordance with ESCC Basic Specification No. 20400.

Photographs shall be taken as follows:

– An overall photograph of a disassembled connector
– Photographs of any anomalies found, with magnification where necessary
– Radiographs of metal components to verify absence of internal flaws

Dimensions of all components shall be checked for compliance with the dimensions listed in the Detail Specification. A microsection of the connector set shall be part of this inspection.

7.3.2.2 Materials Analysis

Samples of all materials from the connector sets shall be analysed to confirm that they comply with the material specifications given in the Detail Specification.

7.4 GROUP 3- ASSEMBLY TESTS

This group shall be randomly divided into 2 subgroups in the proportions indicated in Chart I.

7.4.1 Subgroup 3A - Mechanical Endurance Tests

7.4.1.1 Impact

The test shall be performed on 2 cable assemblies with minimum lengths of 2m.

7.4.1.1.1 Procedure

Initial measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

The connector sets shall be subjected to Test “A” of IEC Publication No. 61300-2-12.

The connector sets shall be subjected to 15 falls from a height of 1.5m.

The test equipment and the procedure shall be in accordance with the above specification.

The following information shall be reported for each measurement:

– Result of external visual inspection
– Optical transmittance changes before and after the test.

7.4.1.2 Torsion

The test shall be performed on the samples subjected to Impact test.

7.4.1.2.1 Procedure

Initial measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Intermediate measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

The test shall be performed in accordance with IEC Publication No. 61300-2-5. Insertion loss shall be measured at least once after the load has reached its maximum level in accordance with the requirements of the Detail Specification. The specimens shall be inspected for any evidence of failure of retention of the cable.

The following information shall be reported for each measurement:

– Result of external visual inspection
– Optical transmittance changes during the test.

7.4.1.3 Static Side Load

The test shall be performed on the samples subjected to Impact and Torsion tests.

7.4.1.3.1 Procedure

Initial measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Intermediate measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

The test shall be performed in accordance with IEC Publication No. 61300-2-42. The following information shall be reported for each measurement:

– Result of external visual inspection
– Optical transmittance changes during the test.

7.4.1.4 Tension (Fibre/Cable Retention)

The test shall be performed on the samples subjected to Impact, Torsion and Static side Load tests.

7.4.1.4.1 Procedure

Initial measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Intermediate measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

The test shall be performed in accordance with IEC Publication No. 61300-2-4. The test equipment and procedure shall be in accordance with the above specification. The connector shall be rigidly clamped and a mechanism for smoothly applying a tensile load shall be clamped to the cable 0.3m from the end face of the connector. The tensile load shall be increased at a speed of 5 N/s (for reinforced cables) or 0.5 N/s (for coated fibres) to 10N (for reinforced cables) or 5N (for coated fibres), held for a minimum of 120s (for reinforced cables) or 60s (for coated fibres). The test shall be repeated with increasing steps of 5N (for reinforced cables) or 1N (for coated fibres) until destruction. Insertion loss shall be measured in accordance with the requirements of the Detail Specification at least once after the load has reached its maximum level and been maintained for a minimum period of 30s. The specimen shall be inspected for any evidence of failure of retention of the cable.

The following information shall be reported for each measurement:

– Result of external visual inspection
– Optical transmittance changes during the test

7.4.2 Subgroup 3B - Mechanical Endurance Tests

7.4.2.1 Strength of Coupling Mechanism

The test shall be performed on 1 cable assembly with minimum length of 3m.

7.4.2.1.1 Procedure

Initial measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Intermediate measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation and changes in optical transmittance in accordance with the requirements of the Detail Specification.

The test shall be performed in accordance with IEC Publication No. 61300-2-6.

The following information shall be reported for each measurement:

– Result of external visual inspection
– Optical transmittance changes during the test

7.5 GROUP 4 - ENVIRONMENTAL TESTS

This group shall be randomly divided into 3 subgroups in the proportions indicated in Chart I.

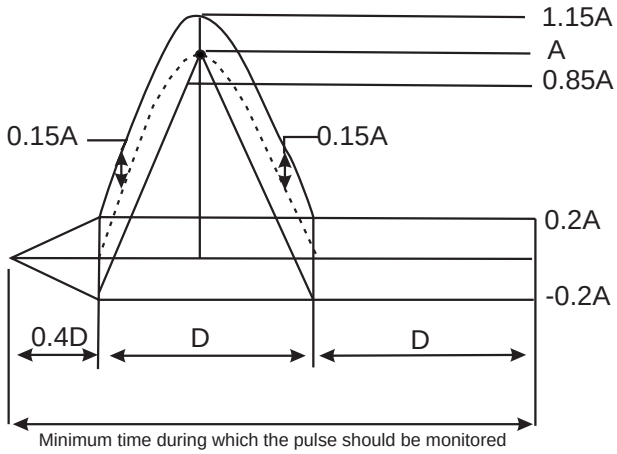
7.5.1 Subgroup 4A - Shock

The test shall be performed on 2 cable assemblies each with a minimum length of 3m.

7.5.1.1 *Procedure*

The connector set shall be placed on a reel with wraps sufficiently tight to prevent movement during the test.

The shock generator shall be capable of generating a sawtooth pulse approximating the nominal acceleration versus time curve given by the dotted curve in the figure below. Peak acceleration of the nominal pulse, A, shall be 75g. Duration of the nominal pulse, D, shall be 11ms.



Initial measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

Changes in optical transmittance shall be monitored throughout the test.

Final measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

The test samples shall be subjected to nine shocks along each of three orthogonal directions. On completion, an external visual examination shall be performed to identify any damage caused by the Shock test.

The following information shall be reported for each measurement:

– Details of the cable/connector support mechanism
– Initial and final optical attenuation and return loss
– Optical transmittance changes during the test
– Result of external visual inspection
– Description of all key equipment
– Dates of latest calibration of measurement equipment

7.5.2 Subgroup 4B - Vibration

Random Vibration Testing. The test shall be performed on 2 cable assemblies each with a minimum length of 3m.

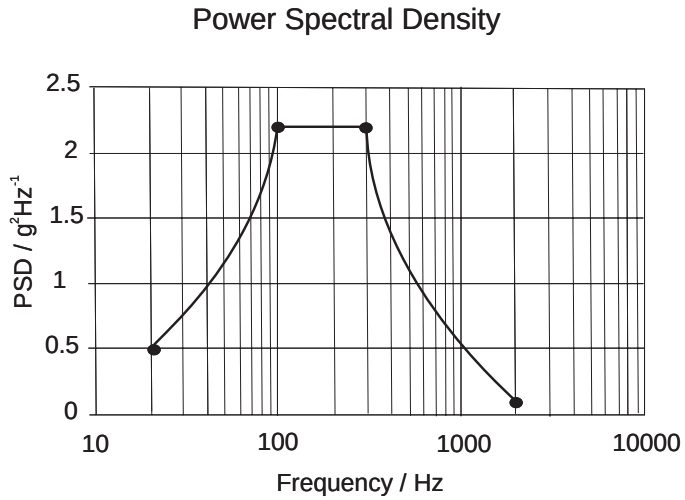
7.5.2.1 *Procedure*

The connector set shall be placed on a reel with wraps sufficiently tight to prevent movement during the test.

A random vibration generator shall be used to vibrate the test samples according to the Power Spectral

Density (PSD) requirements given in the table and figure below.

	PSD g^2Hz^{-1}	
20 - 100	+3dB/Oct	35.4
100 - 300	2.2	
300 - 2000	-5dB/Oct	



Initial measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

Changes in optical transmittance shall be monitored throughout the test.

Final measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

Random vibration of the test samples shall be carried out along each axis of three orthogonal directions for a period of 7.5 minutes each.

An external visual examination shall be performed to identify any damage caused by the Vibration test.

The following information shall be reported for each measurement:

– Details of the cable/connector support mechanism
– Initial and final optical attenuation and return loss
– Changes in optical transmittance and return loss during the test
– Result of external visual inspection
– Description of all key equipment
– Dates of latest calibration of measurement equipment

7.5.3 Subgroup 4C - Temperature Cycling

Temperature Cycling shall be performed on 6 cable assemblies each with a minimum length of 3m. Following this test the samples shall be equally divided for the subsequent tests (Rapid Change of Temperature, Salt Mist and Rapid Depressurisation).

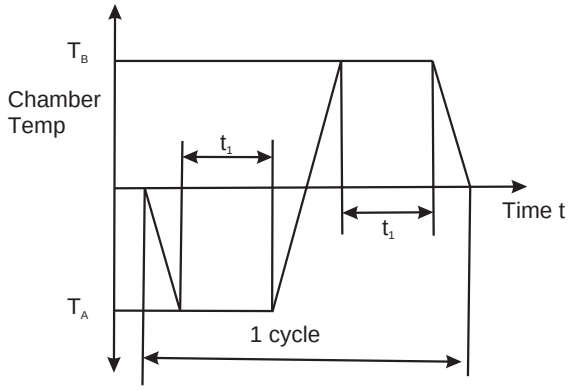
7.5.3.1 Procedure

Initial measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

Changes in optical transmittance shall be monitored throughout the test.

Final measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

The connector set shall be placed within the thermal chamber and connected to the optical measuring equipment outside the chamber. The sample shall be subjected to repetitive temperature cycles. Continuous measurements of connector power transmission shall be made throughout test. The temperature cycle profile and the time held at each temperature are as detailed below with T_A = minimum operating temperature, T_B = maximum operating temperature (as given in the Maximum Ratings table of the Detail Specification), t_1 = 15 minutes and the rate of temperature change = 2˚C min^{-1}. This shall be repeated for 100 cycles.



On completion of the test, the temperature shall be returned to 22 ± 3˚C and the connector set sample removed from the chamber. A visual inspection shall be carried out to identify any damage or other anomalies.

The following information shall be reported for each measurement:

– Optical transmittance during the test
– Result of external visual inspection

7.5.4 Rapid Change in Temperature

This test shall be performed on 2 cable assemblies previously used for Thermal Cycling test.

7.5.4.1 Procedure

Initial measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

Changes in optical transmittance shall be monitored throughout the test (including during sample transfer).

Final measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

The sample shall first be placed in the hot chamber for 30 minutes at the maximum operating temperature specified in the Detail Specification then transferred to the cold chamber at the minimum operating temperature specified in the Detail Specification where it is left for an equal amount of time. The time taken to transfer the sample between temperature chambers shall not exceed 30 seconds. The sample shall be subjected to 10 cycles as defined above.

On completion of the test, the temperature of the connector set shall be returned to room temperature. The sample shall undergo an external visual examination to look for any signs of damage.

The following information shall be reported for each measurement:

– Optical transmittance and return loss before and after the test
– Optical transmittance changes during the test
– Result of external visual inspection

7.5.5 Salt Mist

This test shall be performed on 2 cable assemblies previously used for Thermal Cycling test.

7.5.5.1 Procedure

The test shall be performed in accordance with IEC Publication No. 61300-2-26. The test equipment and procedure shall be in accordance with the above specification.

Initial measurements of attenuation and return loss shall be performed in accordance with the requirements of the Detail Specification. Final measurements of attenuation and return loss shall be performed in accordance with the requirements of the Detail Specification.

The test shall be performed only on mated connector sets, which shall be exposed for 96 hours to the following conditions:

• Salt concentration: 5% NaCI
• pH 6.5 to 7.2

After the test, an external visual inspection shall be carried out to identify any damage or other anomalies.

The following information shall be reported:

– Result of external visual inspection
– Duration
– Mist density
– Specimen optically functioning or non functioning
– Pre-conditioning procedure
– Recovery procedure
– Optical transmittance and return loss before and after the test.

7.5.6 Rapid Depressurisation

This test shall be performed on 2 cable assemblies previously used for Thermal Cycling test.

7.5.6.1 Procedure

Initial measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification. The physical dimensions of the connector sets shall be measured in accordance with the Detail Specification.

Intermediate measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification. The physical dimensions of the connector sets shall be measured in accordance with the detail specification.

The sample shall be placed in the thermal vacuum chamber and connected to the optical measuring equipment outside the chamber via bare vacuum feed-throughs. For evaluation of the connector sets, the vacuum feed-throughs shall be formed from bare fibre with connectors matching those being evaluated.

The chamber pressure shall be reduced from atmospheric pressure to a stable pressure of not more than 1333 Pa in a time not exceeding 5 seconds. The chamber shall then be returned to normal atmospheric pressure.

The samples shall undergo 5 cycles as defined above.

On completion of the test, the connector set shall be removed from the chamber. A visual inspection shall be carried out to identify any damage or other anomalies in the connector structure.

The following information shall be reported:

– Optical transmittance throughout the test and return loss before and after the test
– External dimensions before and after the test
– Results of external visual inspection

7.6 GROUP 5 - ENDURANCE TESTS

This group shall be randomly divided into 2 subgroups in the proportions indicated in Chart I

7.6.1 Subgroup 5A - Mating

The test shall be performed on 2 cable assemblies each with a minimum length of 3m.

7.6.1.1 Procedure

Initial measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Intermediate measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation in accordance with the requirements of the Detail Specification.

The test shall be performed in accordance with IEC Publication No. 61300-2-2. One end of the cable assembly shall be mated and unmated with a matching connector on a cable connected to the optical test equipment. This process shall be repeated for 200 cycles. Changes in optical transmittance shall be monitored as described in the Detail Specification. An external visual inspection shall be carried out on completion of the test.

The following information shall be reported:

– Optical transmittance changes during the test

– Results of external visual inspection

7.6.2 Subgroup 5B - Temperature Life

The test shall be performed on 4 cable assemblies each with a minimum length of 3m.

7.6.2.1 Procedure

Initial measurements shall be optical attenuation and return loss in accordance the requirements of the Detail Specification.

Intermediate measurements shall be changes in optical transmittance in accordance with the requirements of the Detail Specification.

Final measurements shall be optical attenuation and return loss in accordance with the requirements of the Detail Specification.

The test shall be performed in accordance with IEC Publication No. 61300-2-18.

The connector set shall be placed in a gravity convected air oven, connected through suitable ports in the oven wall to the measuring equipment outside, and shall remain there for a period of 2000 hours at the maximum operating temperature specified in the Maximum Ratings of the Detail Specification. Changes in optical transmittance at the intended operating wavelength shall be monitored throughout the test.

After the test, a visual inspection shall be carried out to identify any damage or other anomalies in the connectors.

The following information shall be reported:

– Optical transmittance and return loss throughout the test
– Results of external visual inspection

8. DATA DOCUMENTATION

8.1 GENERAL REQUIREMENTS

An evaluation test report shall be established. This shall comprise the following:

(a) Cover sheet (or sheets)
(b) List of equipment (testing and measuring)
(c) List of test references
(d) Sample identification
(e) Production data
(f) Inspection data
(g) Initial optical measurements data
(h) Group 1 - Control Group data
(i) Subgroup 2A - Temperature Step Stress data
(j) Subgroup 2B - Constructional Analysis data
(k) Subgroup 3A - Impact data
(l) Subgroup 3A - Torsion data
(m) Subgroup 3A - Static Side Load data
(n) Subgroup 3A - Tension data

(o) Subgroup 3B - Strength of Coupling mechanism data
(p) Subgroup 4A - Mechanical Shock data
(q) Subgroup 4B - Vibration data
(r) Subgroup 4C - Temperature Cycling data
(s) Subgroup 4C - Rapid Change in Temperature data
(t) Subgroup 4C - Salt Mist data
(u) Subgroup 4C - Rapid Depressurisation data
(v) Subgroup 5A - Mating data
(w) Subgroup 5B - Temperature Life data
(x) Failure Analysis results
(y) Summary of results and conclusion

Items (a) to (y) inclusive shall be grouped, preferably as sub-packages, and for identification purposes, each page shall include the following information:

– Manufacturer's/test house's name
– Lot identification
– Date of establishment of the document
– Page number

8.2 COVER SHEET(S)

The cover sheet (or sheets) of the evaluation test report shall include as a minimum:

(a) Reference to this document, including issue and date
(b) Connector set type and number
(c) Lot identification
(d) Manufacturer's/test house's name and address
(e) Location of the manufacturing plant/test house
(f) Signature on behalf of the manufacturer/test house
(g) Total number of pages of the evaluation report

8.3 LIST OF EQUIPMENT USED

A list of equipment used for tests and measurements shall be included in the evaluation test report. Where applicable, this list shall contain the inventory number, Manufacturer type number, serial number, calibration status etc. This list shall indicate for which test such equipment was used.

8.4 LIST OF TEST REFERENCES

This list shall include all references or codes that are necessary to correlate the test data provided with the applicable tests.

8.5 SAMPLE IDENTIFICATION

This shall identify the criteria used for the selection of the particular connector set used for the tests when evaluating a range of components by means of representative samples or evaluating a capability domain for manufacture of connector sets.

8.6 PRODUCTION DATA

The progress of the connector sets through the normal manufacturing processes shall be documented.

The connector sets failing a particular process step shall be detailed, together with the reason for their removal.

8.7 INSPECTION DATA

The number of connector sets subjected to each test shall be identified together with the number and reason for any rejects.

8.8 INITIAL OPTICAL MEASUREMENTS

All data shall be recorded against serial numbers. A histogram of parameters shall be produced.

8.9 GROUP 1 - CONTROL GROUP DATA

All data shall be recorded against serial numbers.

8.10 GROUP 2 DESTRUCTIVE TESTS DATA

8.10.1 Subgroup 2A - Temperature Step-Stress Data

All data shall be recorded against serial numbers. This shall include:

(a) Starting temperature
(b) Temperature steps
(c) Optical measurements tabulated for each step
(d) Graphical output as defined in Analysis of Temperature Step Stress Test Results
(e) Analysis of any failed connector sets
(f) Optical transmittance measurements from all specimens

8.10.2 Subgroup 2B - Constructional Analysis Data

All data shall be recorded against serial numbers. This shall include:

(a) Results of internal visual examination
(b) Photographs as specified in Internal Visual Inspection
(c) Radiographic images of metal components
(d) Results of materials analysis
(e) Dimensions of connector set components
(f) Results of microsection analysis

8.11 GROUP 3 - ASSEMBLY TEST DATA

8.11.1 Subgroup 3A - Impact Data

All data shall be recorded against serial numbers. This shall include:

(a) Patchcord length
(b) Initial optical measurements
(c) Final optical measurements
(d) Change in optical transmittance before and after the test
(e) Result of external visual inspection

8.11.2 Subgroup 3A - Torsion Data

All data shall be recorded against serial numbers. This shall include:

(a) Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Result of external visual inspection

8.11.3 Subgroup 3A - Static Side Load Data

All data shall be recorded against serial numbers. This shall include:

(a) Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Result of external visual inspection

8.11.4 Subgroup 3A Tension Data

All data shall be recorded against serial numbers. This shall include:

(a) Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Change in optical transmittance during the test
(e) Result of external visual inspection

8.11.5 Subgroup 3B - Strength of Coupling Mechanism Data

All data shall be recorded against serial numbers. This shall include:

(a) Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Result of external visual inspection

8.12 GROUP 4 - ENVIRONMENTAL DATA

8.12.1 Subgroup 4A - Shock Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Details of the cable/connector support mechanism
(c) Initial optical measurements

(d) Intermediate optical measurements
(e) Final optical measurements
(f) Change in optical transmittance during the test
(g) Plots of shock profile
(h) Result of external visual inspection

8.12.2 Subgroup 4B - Vibration Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Details of the cable/connector support mechanism
(c) Initial optical measurements
(d) Intermediate optical measurements
(e) Final optical measurements
(f) Change in optical transmittance during the test
(g) Plots of vibration spectrum
(h) Result of external visual inspection

8.12.3 Subgroup 4C - Temperature Cycling Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Plot of temperature cycle profile
(g) Result of external visual inspection

8.12.4 Subgroup 4C - Rapid Change in Temperature Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Rate of Temperature Change and maximum/minimum temperatures
(g) Result of external visual inspection

8.12.5 Subgroup 4C - Salt Mist Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Pre conditioning Procedure
(c) Duration and mist density
(d) Initial optical measurements
(e) Final optical measurements
(f) Change in optical transmittance during the test

(g) Result of external visual inspection
(h) Recovery procedure

8.12.6 Subgroup 4C - Rapid Depressurisation Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Initial optical measurements and dimensional measurements
(c) Intermediate optical measurements
(d) Final optical measurements and dimensional measurements
(e) Rate of pressure fall and minimum pressure
(f) Change in optical transmittance during the test
(g) Change in dimensions during the test
(h) Result of external visual inspection

8.13 GROUP 5 - ENDURANCE TESTS

8.13.1 Subgroup 5A - Mating Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Result of external visual inspection

8.13.2 Subgroup 5B - Temperature Life Data

All data shall be recorded against serial numbers. This shall include:

(a) Connector set type and Patchcord length
(b) Initial optical measurements
(c) Intermediate optical measurements
(d) Final optical measurements
(e) Change in optical transmittance during the test
(f) Result of external visual inspection

8.14 FAILURE ANALYSIS RESULTS

A failure analysis report for all failures during evaluation testing shall be part of the data delivery.

8.15 SUMMARY OF RESULTS AND CONCLUSION

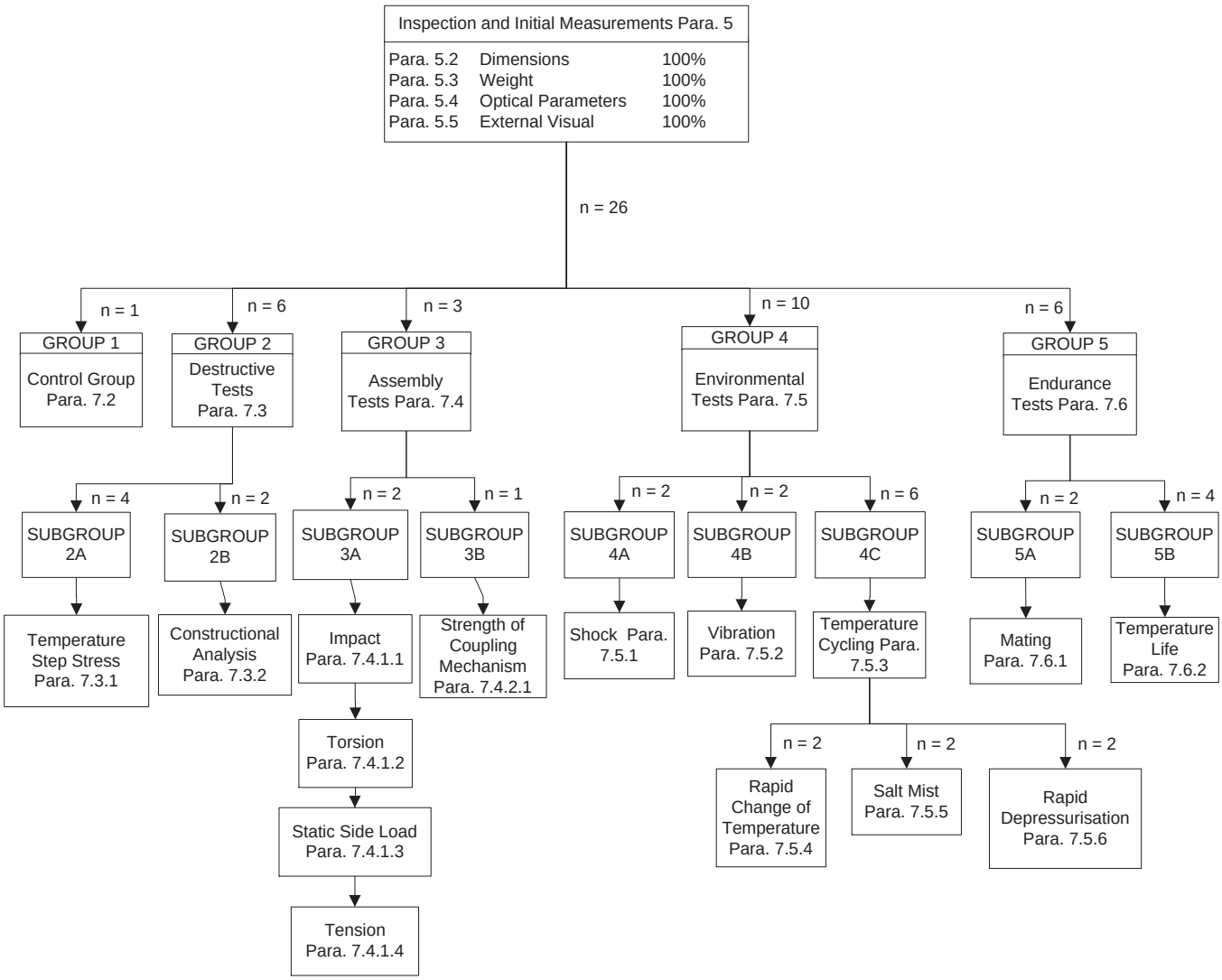
The above shall be briefly reviewed, indicating the success or otherwise of the evaluation test programme. Any production changes that need to be introduced into the PID shall be outlined.

Recommendations/deviations pertaining to the Detail Specification or the qualification programme shall

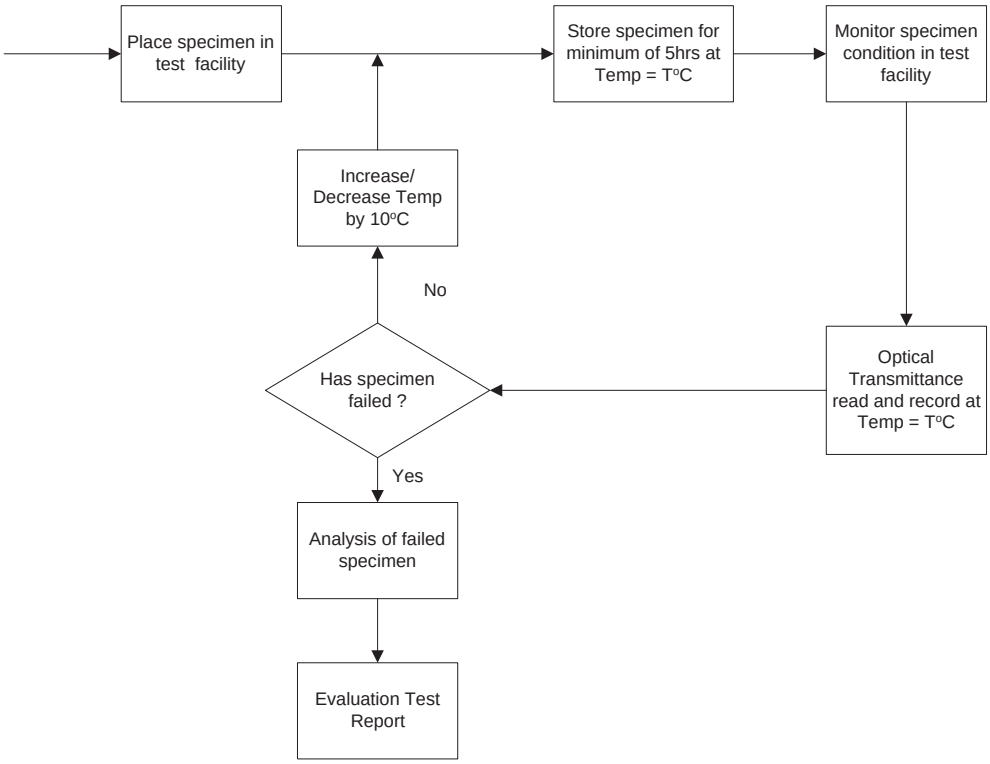
also be outlined.

9. CHARTS

9.1 CHART I - EVALUATION TEST PROGRAMME



9.2 CHART II - TEMPERATURE STEP-STRESS SEQUENCE



NOTES:

1.

First step T_0 (˚C)

T_1

T_2

Last step T_n

Where for High Temperature Step Stress T_n>.....T_2>T_1>T_0

For Low Temperature Step Stress T_n<.....T_2<T_1<T_0

For High Temperature Step Stress T_0 = +80˚C

For Low Temperature Step Stress T_0 = -40˚C