



**REQUIREMENTS FOR THE EVALUATION OF
STANDARD ELECTRONIC COMPONENTS FOR
SPACE APPLICATION**

ESCC Basic Specification No. 22600

Issue 9	September 2023
---------	----------------



Document Custodian: European Space Agency – see <https://escies.org>

LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2023. All rights reserved.

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

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

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

DOCUMENTATION CHANGE NOTICE

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

DCR No.	CHANGE DESCRIPTION
1568	Specification upissued to incorporate changes per DCR.

TABLE OF CONTENTS

1	PURPOSE	5
2	APPLICATION	5
3	RELATED DOCUMENTS	5
3.1	APPLICABLE DOCUMENTS	5
3.2	REFERENCE DOCUMENTS	6
4	TERMS AND DEFINITIONS	6
4.1	DEFINITIONS	6
4.2	ABBREVIATIONS	6
5	INTRODUCTION	6
6	GENERAL	7
7	THE COMPONENT SELECTION PHASE	7
7.1	RESTRICTIONS ON MATERIALS USED IN ESCC COMPONENTS	8
8	THE DETAILED EVALUATION PHASE	8
8.1	EA / MANUFACTURER LIAISON	8
8.2	EVALUATION OF A MANUFACTURER	8
8.3	EVALUATION TEST PROGRAMME (ETP)	9
8.4	BASIC SPECIFICATIONS	10
9	EVALUATION REPORT	10
10	FINAL DOCUMENTATION REVIEW	10
11	CERTIFICATION OF EVALUATION	10
12	ANCILLARY SPECIFICATIONS	11
13	CHART 1 - EVALUATION ACTIVITIES	12

1 **PURPOSE**

This specification describes the basic aspects of, and defines the minimum requirements for, a component evaluation procedure. This procedure normally forms one part of the Detailed Evaluation Phase of each of the three ESCC qualification approaches, namely:

- a qualification for a standard electronic component, performed in accordance with ESCC Basic Specification No. [20100](#).
- a capability approval for an electronic component technology, performed in accordance with ESCC Basic Specification No. [24300](#).
- a technology flow qualification for electronic components, performed in accordance with ESCC Basic Specification No. [25400](#).

(The other part of the Detailed Evaluation Phase, the Manufacturer Evaluation, is the subject of ESCC Basic Specification No. [20200](#))

2 **APPLICATION**

For any electronic component which is not the subject of an ESCC evaluation or qualification activity, this specification is available to, and recommended for use, either in whole or in part, by any user organisation procuring for space applications.

Application of this specification in such circumstances will be in the interest of standardisation of the approach to qualification and procurement of components for space application, contribute to a cost-effective and timely project qualification and provide, in an economical manner, data which can be assimilated for use in any subsequent ESCC qualification.

3 **RELATED DOCUMENTS**

3.1 **APPLICABLE DOCUMENTS**

The following ESCC specifications form part of, and shall be read in conjunction with, this specification. The relevant issues shall be those in effect on the date of commencement of the evaluation of the component.

ESCC 20200	Component Manufacturer Evaluation
ESCC 20800	New ESCC Specifications and Specification Change Requests
ESCC 21700	General Requirements for the Marking of ESCC Components
ESCC 22700	Requirements and Guidelines for the Process Identification Document (PID)
ESCC XXXX, ESCC XXXX/XXX	ESCC Generic and Detail Specification(s) relevant to the component(s) to be evaluated.

Based on the qualification methodology selected, one of the following ESCC specifications forms part of, and shall be read in conjunction with, this specification.

ESCC 20100	Requirements for Qualification of Standard Electronic Components for Space Application
ESCC 24300	Requirements for the Capability Approval of Electronic Component Technologies for Space Application
ESCC 25400	Requirements for the Technology Flow Qualification of Electronic Components for Space Application

3.2 REFERENCE DOCUMENTS

ECSS-Q-ST-60	Space Product Assurance – Electrical, Electronic and Electromechanical (EEE) Components
ECSS-Q-ST-70-02	Space Product Assurance – Thermal vacuum outgassing test for the screening of space materials
ECSS-Q-ST-70-08	Space Product Assurance – The manual soldering of high-reliability electrical connections
ECSS-Q-ST-70-38	Space Product Assurance – High-reliability soldering for surface-mount and mixed technology

4 TERMS AND DEFINITIONS

4.1 DEFINITIONS

Standard Electronic Component	A standard electronic component is one which: <ul style="list-style-type: none">• is fabricated from well understood and stable technologies according to an effective quality assurance system.• has a history of continuous or frequent production runs.• has well established and available data for its performance, reliability and application.
-------------------------------	---

4.2 ABBREVIATIONS

CA	Constructional Analysis
EA	Evaluating Authority
ESCC	European Space Components Coordination
ESCIES	European Space Components Information Exchange System
ETP	Evaluation Test Programme
PID	Process Identification Document

5 INTRODUCTION

The purpose of the evaluation detailed herein is to arrive, in the most cost-effective manner, at a decision to proceed with the qualification of a component for use in space applications, with a high level of confidence in the result.

The procedures are based on the maximum use of substantiated current data which exist for the component and the minimising or elimination of the need to introduce new and/or additional testing or test procedures.

Reference is made herein to an Evaluating Authority (EA). For an ESCC activity, this authority will be the ESCC Executive. When this specification is used in other circumstances, the EA shall be as nominated by the appropriate user organisation.

6 **GENERAL**

The flow of activities is set out in Chart 1 of this specification and comprises essentially 2 phases:

- (a) The Component Selection phase.
- (b) The Detailed Evaluation phase.

The evaluation will be carried out by the EA and the precise responsibilities of all parties shall be specified before the commencement of each phase.

Phase (a) (Chart 1, Activities 1 to 5) should normally be completed within 3 months.

Phase (b) (Chart 1, Activities 6 to 13) will depend on the particular Evaluation Test Programme defined, but should not normally exceed 6 months.

7 **THE COMPONENT SELECTION PHASE**

Prior to embarking on the Detailed Evaluation Phase, the EA will review and verify that the proposed component is appropriate for evaluation. In consultation with end users, where possible, the EA shall consider the published data on the candidate component and examine the production record of the Manufacturer against the envisaged space requirements. This will establish the scale of the task ahead by considering the amount and type of additional work required to satisfy the space application.

If the results are promising, random samples, taken from current production shall be subjected to a CA by the EA. This CA shall comprise both destructive and non-destructive testing for the purpose of identifying:

- (a) Construction technology.
- (b) Materials used (see Para. 7.1).
- (c) Inherent reliability problems.
- (d) Suitable screening procedures for the particular construction and technology.

The EA shall review the CA results, together with all other data to hand, against the foreseen requirements and decide whether to proceed to the Detailed Evaluation Phase. If the decision is to proceed, a Detail Specification will be required at this point. Where one does not already exist it shall be drafted in the ESCC format in cooperation with the ESCC Executive Secretariat in accordance with ESCC Basic Specification No. [20800](#).

7.1 RESTRICTIONS ON MATERIALS USED IN ESCC COMPONENTS

An ESCC component shall not contain any hazardous material. Inter alia, the following restrictions shall apply to materials employed in the manufacture of ESCC components. Any component not meeting these restrictions shall fail the selection phase.

- (a) Components shall not contain materials or residues that are unstable or fail to meet the ESCC outgassing requirements per ECSS-Q-ST-70-02.
- (b) Components shall not contain the following materials or residues:
 - Cadmium
 - Lithium
 - Magnesium
 - Mercury
 - Any radioactive substance
- (c) Components shall not use as a finish on the leads, terminations or external surfaces:
 - Zinc
 - Pure tin (> 97% purity)
- (d) Pure tin (> 97% purity) may be permitted in the internal construction of hermetically sealed components, on a case by case basis, only when there is no viable alternative and it can be demonstrated that there is no risk. Such use shall subsequently be clearly noted in the PID.
- (e) Beryllium oxide may only be used if an appropriate safety clause is contained in the relevant ESCC Detail Specification and a warning sign, in accordance with ESCC Basic Specification No. [21700](#), is marked on the component primary package and, where size permits, the component itself.

8 THE DETAILED EVALUATION PHASE

8.1 EA / MANUFACTURER LIAISON

At the commencement of the Detailed Evaluation Phase, the EA shall acquaint the Manufacturer of its findings following the review of his data and the outcome of the CA.

The EA shall discuss criticisms and proposed corrective actions with the Manufacturer and establish agreements to their mutual satisfaction. The Detail Specification for the component shall be discussed and agreement reached with the Manufacturer. Any other relevant matters shall be discussed and/or resolved such that between them, the Manufacturer and EA establish a firm basis from which the Detailed Evaluation will proceed.

8.2 EVALUATION OF A MANUFACTURER

A survey of the Manufacturer's production, inspection and testing facilities shall be carried out by the EA, particular attention being given to the existence and adequacy of formal updated documentation and control procedures relating to the component to be evaluated.

For an ESCC activity, this survey shall be performed as a formal audit in accordance with the requirements of ESCC Basic Specification No. [20200](#).

8.3 EVALUATION TEST PROGRAMME (ETP)

To establish the suitability of all aspects of the technology and function of the component for the envisaged application, the EA, in conjunction with the Manufacturer, shall draw up an ETP.

The ETP shall be performed on a sample representative of the variations of size, technology, material and, if appropriate, the constructional techniques employed in the manufacture of the envisaged component variants or component series or family.

The ETP shall include step-stress and steady state stress testing designed to determine failure modes and to establish the margins between strength and the specified conditions for use.

For ETP, accelerated tests may be performed with an acceleration factor either known in advance or determined on the basis of the test results. The tests applied shall apply electrical, temperature and, if appropriate, mechanical, chemical and climatic stresses. Tests to confirm physical integrity (e.g. robustness of terminations, package leakage, with corresponding electrical parameter measurements, etc.) shall also be included. In the case of test failures, a failure analysis shall be performed to confirm the failure mode.

The ETP shall include a constructional analysis of components representative of all the materials and constructional techniques employed.

The ETP shall also include an assessment of the component capability to withstand typical mounting in accordance with ECSS-Q-ST-70-08 and/or ECSS-Q-ST-70-38. Where specific mounting conditions resulting in a critical mounting behaviour are identified, the Manufacturer and the EA are entitled to set-up an adequate procedure to closely simulate the behaviour of components mounted on printed circuit boards. This may include the participation of users but these tests do not replace the mandatory users' validation of their mounting processes as per project requirements and ECSS-Q-ST-70-08 and/or ECSS-Q-ST-70-38 recommendations.

In certain cases, the requirements for an ETP can be minimised by the substitution of relevant current test data from the Manufacturer.

During the definition of the ETP, the EA shall carefully review any such data submitted, equating it where possible to the requirements originally formulated.

Examples of data which might be considered in this context are:

- (a) Qualification and approval to National or International specification systems.
- (b) Satisfactory production and yield data for military hi-rel or other stringent requirements.
- (c) Evaluations carried out to ECSS-Q-ST-60.
- (d) Manufacturer's in-house production and testing data for the component.

The list is not necessarily exhaustive.

The components submitted to the ETP shall be unscreened components produced in accordance with the same techniques, processes and materials and drawn from the same line that will be employed for the production of components for which qualification is intended. The quantity of components to be used for the ETP shall be agreed by the EA and the Manufacturer.

8.4 **BASIC SPECIFICATIONS**

For the purpose of the evaluation, the EA will consider the use of Manufacturer's versions of the Basic Specifications normally called up by the ESCC Generic Specifications (e.g. Internal Visual Inspection, X-ray and SEM Inspection, etc.). Such substitutes may be authorised where the substitute material can be shown to be equal to, or more stringent than, the ESCC version. In the case of a dispute, the appropriate ESCC Basic Specification shall be the reference document.

9 **EVALUATION REPORT**

On completion of the evaluation, the EA shall prepare an evaluation report. This report shall include:

- (a) Component description and data.
- (b) References to all documentation employed for the evaluation.
- (c) A summary of the original CA and subsequent DPA on the component.
- (d) An assessment of the Manufacturer's facilities with reference to the ESCC Audit if applicable.
- (e) A report on the ETP together with a summary of results.
- (f) Reference to the Manufacturer's alternative test data accepted as satisfying part or all of the ETP.

10 **FINAL DOCUMENTATION REVIEW**

The EA shall review the Detail Specification and all other relevant documents resulting from the evaluation. If these are satisfactory, they shall be approved and frozen at the issues then current.

11 **CERTIFICATION OF EVALUATION**

Following a satisfactory component evaluation phase, the EA shall formally certify its approval of the evaluation. For an ESCC activity this certification shall be in accordance with the requirements of ESCC Basic Specification No. [20100](#), [24300](#) or [25400](#) as applicable.

12 **ANCILLARY SPECIFICATIONS**

The following supplementary specifications have been issued:

ESCC 2263000	Evaluation Test Programme for Capacitors Fixed.
ESCC 2263010	Evaluation Test Programme for Optical Fibre Connector Sets.
ESCC 2263202	Evaluation Test Programme for Ferrite Microwave Components (Isolators and Circulators).
ESCC 2263400	Evaluation Test Programme for Connectors.
ESCC 2263408	Evaluation Test Programme for Radio Frequency, High Data Rate and High Voltage Cable Assemblies.
ESCC 2263420	Evaluation Test Programme for Optical Fibre Cable Assemblies.
ESCC 2263501	Evaluation Test Programme for Quartz Crystal Units.
ESCC 2263502	Evaluation Test Programme for Surface Acoustic Wave (SAW) Devices.
ESCC 2263503	Evaluation Test Programme for Crystal Controlled Oscillators in Hybrid Technology.
ESCC 2263600	Evaluation Test Programme for Electromagnetic Relays.
ESCC 2264000	Evaluation Test Programme for Resistors.
ESCC 2265000	Evaluation Test Programme for Discrete Non-Microwave Semiconductors.
ESCC 2265010	Evaluation Test Programme for Discrete Microwave Semiconductors.
ESCC 2269000	Evaluation Test Programme for Integrated Circuits: Monolithic and Multichip Microcircuits, Wire-Bonded, Hermetically Sealed, and Flip-Chip Monolithic Microcircuits, with Non-Organic Substrate, Hermetically and Non-Hermetically Sealed.
ESCC 2269010	Evaluation Test Programme for Monolithic Microwave Integrated Circuits (MMICs).
ESCC 2269030	Evaluation Test Programme for Integrated Circuits: Monolithic Microcircuits, Wire-Bonded, Plastic Encapsulated, and Flip-Chip Monolithic Microcircuits, with Organic Substrate.

NOTES:

1. For Photosensitive Charge Coupled Devices and Active Pixel Sensors with Hermetic and Non-Hermetic Packages (ESCC Generic Specification No. 9020), no individual ancillary specification for Evaluation Test Programme exists. ESCC 2269000 should be used to the extent applicable.

13 **CHART 1 - EVALUATION ACTIVITIES**

