REQUIREMENTS FOR
ESCC ENHANCED GRADE COMPONENTS

ESCC Basic Specification No. 25700

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1 PURPOSE AND SCOPE

This specification describes all aspects and requirements applicable to ESCC Enhanced Grade (EG) components. It outlines the ESCC Enhanced Grade certification procedure applicable to electrical, electronic, and electromechanical (EEE) components to be listed as ESCC Enhanced Grade components within the European Preferred Parts List 2 (EPPL 2), that are potentially suitable for space applications, subject to Customer approval.

EG certification is available to cover any EEE component(s) or family of components from any Manufacturer holding either ESCC Technology Flow Qualification (TFQ) or ESCC Process Capability Approval (PCA), as listed on the ESCC QML (ref. REP006) or ESCC PCAL (ref. REP008) respectively, subject to the requirements outlined herein.

Note: ESCC Enhanced Grade components shall not be considered as ESCC qualified.

Whilst EG certification of a Manufacturer's designated range of components does not indicate the likelihood of a future ESCC Qualification of those components, data and information accrued during the EG certification process may, if so desired by the Manufacturer, subsequently be used to assist an application for ESCC Qualification through methodologies specified in ESCC No. 20100, 24300 or 25400.

1.1 APPLICABLE DOCUMENTS

The following ESCC Specifications form part of, and shall be read in conjunction with, this specification:

REP006	ESCC Qualified Manufacturer List (QML)
REP007	ESCC European Preferred Parts List (EPPL)
REP008	ESCC Process Capability Approved List (PCAL)
ESCC No. 12300	ESCC Document: Requirements for the European Preferred Parts List (EPPL)
ESCC No. 20100	ESCC Basic Specification: Requirements for the Qualification of Standard Electronic Components for Space Application
ESCC No. 21300	ESCC Basic Specification: Terms, Definitions, Abbreviations, Symbols and Units
ESCC No. 22600	ESCC Basic Specification: Requirements for the Evaluation of Standard Electronic Components for Space Application
ESCC No. 22700	ESCC Basic Specification: Requirements and Guidelines for the Process Identification Document (PID)
ESCC No. 24300	ESCC Basic Specification: Requirements for the Capability Approval of Electronic Component Technologies for Space Application
ESCC No. 25400	ESCC Basic Specification: Requirements for Technology Flow Qualification (TFQ)
ESCC No. 25600	ESCC Basic Specification: Requirements for Process Capability Approval (PCA)
ECSS-Q-ST-70-02	Space product assurance – Thermal vacuum outgassing test for the screening of space materials
JESD-201A	Environmental and Electrical Compliance for Surface Mount Solder Process
GEIA-STD-0005-2	Standard for the Implementation of Tin Whisker Mitigation

2 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

2.1 DEFINITIONS

For the purposes of this specification, the terms and definitions defined in ESCC No. 21300 shall apply.

2.2 ABBREVIATIONS

EG	Enhanced Grade
EG-CD	Enhanced Grade Component Document
EG-TRB	Enhanced Grade Technical Review Board
EPPL	European Preferred Parts List
EPPL 2	The separate list within the EPPL that contains only Enhanced Grade (EG) components
NSA	National Space Agency
PCA	Process Capability Approval
PCAL	Process Capability Approved List
PID	Process Identification Document
QML	Qualified Manufacturer List
TA	EPPL Technical Authority (see ESCC No. 12300)
TFQ	Technology Flow Qualification

3 INTRODUCTION

An ESCC Enhanced Grade component is a component that meets the requirements specified herein and that demonstrates suitability for space applications, originating exclusively from Manufacturers holding:

(a) an ESCC Technology Flow Qualification according to ESCC No. 25400,

or

(b) an ESCC Process Capability Approval according to ESCC No. 25600,

but is not actually ESCC qualified.

EG components take advantage of a TFQ/PCA Manufacturer's existing quality systems and any relevant manufacturing processes.

The management and control of EG components shall be maintained within and by the Manufacturer's existing quality system, operating under the authority of a Manufacturer established Enhanced Grade Technical Review Board (EG-TRB) (see Para. 5.2). The requirements placed on the EG-TRB for EG components are as described herein.

For TFQ Manufacturers, the existing Technology Review Board structures (ref. ESCC No. 25400) can also be employed for EG components (under the designation: EG-TRB). For PCAL Manufacturers, an EG-TRB shall be established by the Manufacturer based around their existing quality systems, to handle and be responsible for all aspects of their EG components.

The Manufacturer's specific philosophy and approach for all aspects of EG components, as well as the range of components/technologies available as EG components, will be detailed within an Enhanced Grade Definition (see Para. 5.1).

For EG components from a TFQ Manufacturer, the EG Definition will be included in and made publicly available via the ESCC QML. For EG components from a PCAL Manufacturer, the EG Definition will be included in and made publicly available via the ESCC PCAL.

All essential information covering a particular component including all applicable processing and testing details, and the requirements applied for EG Validation Testing (see Para. 5.7) and Maintenance of EG Certification (see Para. 5.8) shall be contained within the Manufacturer's own document(s)/specification(s). Specific information and requirements applicable solely to procurement of a particular EG component shall be detailed in the Manufacturer's own dedicated EG Procurement Specification (see Para. 5.10).

Note: ESCC Generic and Detail Specifications are not required for procurement of EG components.

Once the EG Definition has been approved by the ESCC Executive, the Manufacturer's EG components will be listed in EPPL 2 in accordance with the requirements of ESCC No. 12300, as supported by their existing ESCC certified quality system and the Manufacturer's self-defined and self-controlled manufacturing processes. This EPPL 2 listing for a particular EG component(s) will include the following:

(a) All the individual part numbers of the components covered.

(b) the Manufacturer's EG Procurement Specification number (see Para. 5.10),

(c) reference to a summary of the tests included in the applicable EG Validation Testing plan (see Para. 5.7) and Maintenance of EG Certification plan (see Para. 5.8).

(d) any pertinent information on the EG component(s) including, when applicable, any radiation assessment information and specific application warnings/recommendations.

4 REQUEST FOR CERTIFICATION OF ENHANCED GRADE COMPONENTS

To obtain certification for one or more ESCC EG components and to have them listed in EPPL 2 , the Manufacturer shall submit a formal request to the ESCC Executive.

As a minimum, the Manufacturer shall provide the following data package with the request:

(a) the Enhanced Grade Definition (see Para. 5.1)

(b) the Enhanced Grade Component Document (EG-CD; see para. 5.3)

NOTE: When considered appropriate by the Manufacturer, the test results/data applicable to the EG Validation Testing Plan (see Para. 5.7) may be provided after the ESCC Executive has approved the plan. However, the request for EG certification will not be granted until after these results/data have been reviewed and accepted.

This request shall be processed as follows:

- For TFQ Manufacturers: via the same channels as for their Request for Qualification in accordance with ESCC No. 25400.
- For PCAL Manufacturers: via the same channels as for their Request for Process Capability Approval in accordance with ESCC No. 25600.

When the ESCC Executive has reviewed all the documentation included in the data package provided as part of the Manufacturer's request (i.e. (a) & (b) above) and found everything to be satisfactory, as an indication of the EG certification being granted, the ESCC Executive will include the EG Definition within the Manufacturer's ESCC QML or PCAL entry, as applicable, and the details of the EG components (i.e. the EPPL Content Component Information (see ESCC No. 12300) will subsequently be added to EPPL 2 (all of which are available on the ESCC website: https://escies.org).

5 REQUIREMENTS

5.1 ENHANCED GRADE DEFINITION

The Manufacturer shall produce a document designated as the Enhanced Grade Definition to comprehensively detail all aspects of the range or ranges of the Manufacturer's EG components.

The contents of the EG Definition shall be commercially insensitive and suitable for public access via the ESCC QML or PCAL.

The EG Definition shall detail the Manufacturer's particular approach and philosophy for the selection of the component families and/or particular component types which are intended for recognition, certification and listing as EG components in EPPL 2 .

When relevant, the EG Definition shall detail all similarities and differences of EG components to the Manufacturer's ESCC qualified or certified components covered by their TFQ/PCA certified process. These similarities/differences shall include, but not be limited to:

- Design and/or design processes
- fabrication, manufacturing and assembly processes
- materials, finishes and component packages
- in-process testing and controls
- final Screening
- EG Validation Testing
- Manufacturing and testing facilities

The EG Definition will indicate the range(s) of component types selected by the Manufacturer for release as EG components as well as references of the applicable EG Procurement Specification(s) (see Para. 5.10), the EG Validation Testing plan (see Para. 5.7) and the Maintenance of EG Certification plan (see Para. 5.8).

5.2 ENHANCED GRADE TECHNICAL REVIEW BOARD

The management of ESCC EG components for both TFQ Manufacturers and PCAL Manufacturers shall be conducted under the responsibility of a Manufacturer controlled, internal governing body designated as the Enhanced Grade Technical Review Board (EG-TRB).

For TFQ Manufacturers, the existing Technology Review Board structures (ref. ESCC No. 25400) can also be employed for EG components (under the designation: EG-TRB).

The EG-TRB's responsibilities are key to ensuring that the flexibility granted to the Manufacturer in support of their EG components is exercised under strict control, thereby maintaining the EG components' reliability and suitability for space applications.

The role and responsibilities of the EG-TRB include:

- Defining and controlling the EG process: The EG-TRB is responsible for the internal approval and ongoing oversight of the Manufacturer's specific EG Definition and its associated Enhanced Grade Component Document (EG-CD) (see Para. 5.1).
- Non-Conformance and Process Change Authority (see Paras. 5.4 and 5.5): The EG-TRB shall review all non-conformances and process changes related to EG components. It is responsible for defining and approving corrective actions, assessing the impact, and, when appropriate, informing the ESCC Executive.
- Managing all aspects of EG Validation Testing and all the activities associated with the Maintenance of EG Certification (see Paras. 5.7 and 5.8). The EG-TRB is responsible for reviewing and approving the Manufacturer's plans and test results/data for both EG Validation Testing and the ongoing Maintenance of EG Certification activities for all EG components/families in order to ensure continued process stability and to demonstrate reliability.
- All EG-TRB minutes shall be provided to the ESCC Executive on at least an annual basis. When deemed necessary, and at any time, the Manufacturer and/or the ESCC Executive may request discussions with each other on any preliminary EG-TRB matters (e.g. non-conformances, the contents of the EG Validation Testing plan, test vehicle similarities, etc.).
- EPPL 2 Eligibility: The EG-TRB is responsible for proposing specific EG component(s) from within the EG Definition for EPPL 2 certification. It shall manage, maintain and monitor all aspects related to the production of the selected EG component(s) in order to assure that EG component(s) consistently meet their defined specifications and thereby retain their eligibility for listing as EG components in the EPPL 2 .

5.3 ENHANCED GRADE COMPONENT DOCUMENT

For EG components, a Manufacturer controlled Enhanced Grade Component Document (EG-CD) that includes references to all the relevant documentation related to EG component manufacturing, and their certification as EG components, is required to ensure consistency and controlled manufacturing

Note: The EG-CD is not expected to be as exhaustive as the Process Identification Document (PID) for ESCC qualified components as outlined in the requirements of ESCC No. 22700.

The Manufacturer shall propose a minimum set of information for the EG-CD that is deemed necessary for the EG-TRB to define and control the EG components, and for the ESCC Executive to have a fundamental understanding of the EG components. In order to keep the EG documentation as minimal as possible, references to Manufacturer's internal documents should be used as a baseline.

The EG-CD may either be incorporated into an already existing PID for ESCC qualified components or be provided as a separate Manufacturer's dedicated document.

The content of the EG-CD should focus on aspects that are different from the similar ESCC qualified components. It is not necessary to repeat information from the PID of similar qualified components.

The following Manufacturer's documentation shall be included in the EG-CD and be available to the ESCC Executive:

- The EG Procurement Specification(s).
- Details of EG component design, construction and materials.
- Documentation covering traceability, manufacturing, and assembly processes, inspection and testing.
- Documentation covering EG procurement lot inspection and testing requirements including Screening, as applicable.
- Documentation covering Enhanced Grade Validation Testing (see Para. 5.7) requirements on the EG components including the EG Validation Testing plan and all applicable test results/data.
- Documentation applicable to how the Manufacturer intends to cover the requirements for Maintenance of EG Certification (see Para. 5.8) including the Maintenance of EG Certification plan.
  Once EG certification has been granted, all test results/data applicable to the ongoing maintenance activities.
- Documentation covering general quality control aspects of EG components i.e. non-conformance management and process change management.

Note: The contents of the Manufacturer's Enhanced Grade Component Document, with the exception of the EG Procurement Specification(s), is considered as proprietary information and shall only be available to the ESCC Executive and the Technical Authority (TA) on a confidential basis.

5.4 NON-CONFORMANCE MANAGEMENT

The Manufacturer shall manage any non-conformances impacting on or related to EG components in line with the requirements of their established quality management system and their own internal non-conformance procedures for their other components/processes.

All decisions including any corrective actions and the final disposition applicable to any such non-conformances shall be defined, approved and controlled under the responsibility of the EG-TRB.

Note: The requirements of ESCC No. 22800 (Non-Conformance Control System) are not directly applicable to EG components.

In the event that the EG-TRB concludes that a non-conformance should result in the removal of EG certification from an EG component(s) or family of components, the Manufacturer shall immediately inform the ESCC Executive of the non-conformance details. The affected EG component(s) will subsequently be removed from EPPL 2 .

In the event that the EG-TRB concludes that the non-conformance could have an impact on any ESCC qualified component(s) or ESCC certified process(es), the Manufacturer shall take all necessary and appropriate measures in accordance with ESCC No. 25400 or 25600, as applicable.

5.5 PROCESS CHANGE MANAGEMENT

The Manufacturer shall manage any process changes impacting on EG components in line with the requirements of their established quality management system and their own internal process change procedures for their other components/processes.

All decisions including any corrective actions applicable to any such process changes shall be defined, approved and controlled under the responsibility of the EG-TRB.

In the event that the EG-TRB concludes that a process change should result in the removal of EG certification from the EG component(s) or family of components, the Manufacturer shall immediately inform the ESCC Executive of the process change details. The affected EG component(s) will subsequently be removed from EPPL 2

5.6 MANUFACTURER AUDIT

The ESCC Executive already performs routine audits at the Manufacturer's facility in accordance with TFQ/PCA requirements (ref. ESCC No. 25400 and 25600). During these audits, the Manufacturer will also be audited in respect of an assessment of their EG certification for their EG components.

This assessment will mainly be based on a review of relevant Manufacturer's documentation (since the previous audit), including:

- EG Procurement Specification(s)
- EG Definition
- EG-CD
- EG-TRB minutes (see Para. 5.2)
- Documentation pertaining to non-conformance and process change activity
- Documents pertaining to the results of EG component testing including Screening
- Documents pertaining to the results of EG Validation Testing
- Documents pertaining to the activities related to the Maintenance of EG Certification

When considered necessary by the ESCC Executive, an on-site audit of the Manufacturer's facilities (e.g. Manufacturing, Assembly, Testing, etc.) will also be performed.

5.7 ENHANCED GRADE VALIDATION TESTING

To validate the EG Definition, each EG component(s) or family of components shall have successfully completed a defined EG Validation Testing programme. The details, scope and contents of the EG Validation Testing programme shall be defined by the Manufacturer, based on their experience, within an EG Validation Testing plan. This plan plus all the test results/data shall be provided to the ESCC Executive as part of the EG-CD (see Para. 5.3)

For the purpose of providing EG validation testing results, the Manufacturer may use existing recent (less than one-year old) relevant test data or other relevant reliability information.

5.8 MAINTENANCE OF ENHANCED GRADE CERTIFICATION

The Manufacturer shall be able to demonstrate that the EG component(s) or component families defined in the EG Definition have long-term stable processes and have suitable reliability for space applications. To that end, once a component(s) or family of components is certified as Enhanced Grade, every two-years the Manufacturer shall provide the ESCC Executive with appropriate test results/data and/or other relevant, suitable information that demonstrates the component(s) stability and reliability over the previous two-year period and thereby justify their continued certification as EG components.

The details and scope of all the activities associated with the Maintenance of EG Certification to be performed by the Manufacturer during each two-year period shall be contained in the Maintenance of EG Certification plan. This plan plus all the test results/data shall be provided to the ESCC Executive as part of the EG-CD (see Para. 5.3)

5.9 LOSS OR SUSPENSION OF ENHANCED GRADE CERTIFICATION

In the event that:

(a) the EG-TRB confirms an appropriate issue/problem with a particular EG component(s) that would negatively affect EG certification,

or

(b) the Manufacturer wishes to remove the EG certification from an EG component(s),

the Manufacturer shall immediately inform the ESCC Executive of the details. The affected EG component(s) will subsequently be removed from EPPL 2 .

In addition, if the ESCC Executive or TA confirms with the EG-TRB a problem that would negatively affect EG certification:

(a) with a particular EG component(s),

(b) with test results/data from the EG Validation Testing programme (see Para. 5.7),

or

(c) related to test results/data accrued for the Maintenance of EG Certification (see Para. 5.8),

the affected EG component(s) will immediately be removed from EPPL 2 .

Details of the removal shall be incorporated into the EG Definition until such a time that it is agreed by the EG-TRB, the ESCC Executive and the TA that the EG component(s) may be reinstated.

5.10 ENHANCED GRADE PROCUREMENT SPECIFICATION

The Manufacturer shall release and control a suitable document/specification to be used for the procurement of EG components that is freely and publicly available. For components certified as Enhanced Grade, this Manufacturer's "EG Procurement Specification" will be listed against the component's part number within EPPL 2 .

The EG Procurement Specification shall contain the following information:

(a) General Identification and Scope details (as a minimum):
- The Manufacturer's name
- The Manufacturer's specific part number(s) of the EG component, including all available options/variants numbering
- A component description

(b) Technical and Performance Characteristics and Ratings (as a minimum):
- Component options/variants:
  - Description of all available option/variant (e.g. package type, terminal finish, parametric/functional differences, etc.)
  - details of physical dimensions with tolerances, and weight
  - component marking information including any traceability details
  - Terminal materials and finishes (see Para. 5.11(b))
- Absolute Maximum Ratings
  - Recommendations or warnings, as considered appropriate, for use / handing / mounting / soldering / ESD control / etc.
- Electrical Characteristics: Detailed tables presenting all relevant electrical parameters, specifying minimum and maximum limits
- Mechanical and Thermal Characteristics, as applicable
- Reference to any radiation test reports or radiation assessment data that characterise the component's performance under radiation environments (see Para. 5.12)

(c) Screening details:
A detailed description of all the Screening tests performed on the procured lot of EG components prior to delivery.

Note: This section might not be applicable if the Manufacturer has proposed an EG Definition, that has been accepted by the ESCC Executive, that does not require any Screening tests or inspections.

(d) Additional Application information (optional)
When considered relevant or useful, the Manufacturer may include specific application information for use of the EG component such as information applicable to mounting, handling, assembly, etc.

5.11 MATERIALS ASSESSMENT

(a) General Prohibitions and Restrictions:

EG components are generally prohibited from containing any hazardous materials as described within ESCC No. 22600. This prohibition includes, but is not limited to, the following substances:

- Cadmium, Lithium, Magnesium, Mercury, and any radioactive substances
- The use of toxic materials, such as Beryllium Oxide (BeO), is strictly controlled and is permitted only if an appropriate safety warning is included in the EG Procurement Specification
- Materials or residues, that are not within a hermetically sealed enclosure, that fail to meet ESCC outgassing requirements (as per ECSS-Q-ST-70-02) are forbidden

(b) Finish Restrictions:

EG components shall not use zinc on leads, terminations, or external surfaces.

EG components with a matte pure tin finish may be accepted, subject to the recommendation of the EG-TRB and acceptance by the ESCC Executive. In such cases, the pure tin finish (with > 97% tin content) shall either pass the JESD-201A Class 2 requirements or meet the GEIA-STD-0005-2/Level 2B requirements.

5.12 RADIATION ASSESSMENT

For EG components, the Manufacturer shall provide all available information pertaining to performance under radiation environments. This requirement applies specifically to component technologies known to be susceptible to degradation in space radiation environments, encompassing Total Ionizing Dose, Displacement Damage, and Single Event Effects, as applicable.

Radiation performance data provided by the Manufacturer will be displayed, or linked to test reports when available, within the EPPL 2 listing, as detailed in the radiation section of ESCC No. 12300.

It is crucial to understand that the provided radiation information does not constitute a guarantee of EG component performance. The User bears sole responsibility for interpreting this data and verifying its relevance and applicability to their specific mission requirements.