ESCC
European Space Components Coordination

ESCC COMPONENT QUALIFICATION

esa
European Space Agency

ESCC Specifications: To maintain and improve the efficiency, effectiveness and validity of test methods and relevant standards for the selection, procurement and qualification of EEE components.

ESCC QPL/QML: To support ESA and space projects with qualified EEE components ensuring their overall adequacy and suitability to meet the performance requirements on schedule, without additional analysis, and with cost and lead time efficiency.

ESCC PCAL: to establish certified manufacturing lines where the materials and processes have been evaluated and certified for their suitability for producing, assembling and/or testing of high quality space grade products.

ESCC EPPL I/II: To support the introduction of innovative technologies and products (R&D) while maintaining quality assurance requirements for space programmes.

Definitions

EPPL = European Preferred Parts List

QPL = Qualified Parts List

QML = Qualified Manufacturer List

PCAL = Process Capability Approval List

Introduction

This brochure has been prepared by the Requirements and Standardisation section in ESA (Product Assurance and Quality department) to provide an overview of the ESCC component qualification approaches and the benefits offered to manufacturers and users when qualifying or procuring ESCC qualified EEE (Electrical, Electronic, Electromechanical)components.

ESCC CERTIFICATION SYSTEM

The ESCC qualification system provides a set of technical and quality requirements, and the means to verify compliance in an objective and impartial manner.

It is a well established, product oriented system that has secured the access of the European space industry to a stable supply of reliable space qualified EEE components from European manufacturers for more than 45 years. Since the adoption of the ESCC Charter in 2002, ESCC is the European forum for space component harmonisation and standardisation within which ESCC Executive and ESA acts as the Qualification and Certification Authority.

System Benefits

ESCC qualified manufacturers and component users benefit from the system's international recognition, and ESCC qualified parts follow a simplified part approval process for space projects, as defined by the requirements of ECSS-Q-ST-60C.
ESCC QPL/QML and EPPL plus other parts from QML manufacturers are preferred in ESA programmes, as defined by the ECSS-Q-ST-60C standard for EEE components.
The ESCC QPL (Qualified Parts List: REP005) is the list of components and technologies which have been qualified and capability approved to the rules of the ESCC Specification System and the results certified by ESA. These components and technologies are intended for use in ESA and other European spacecraft and Space segment hardware.
For more information and to download the latest ESCC QPL visit ESCIES.org
The ESCC QML (Qualified Manufacturers List: REP006) is the list of manufacturers who have been qualified for technology flow to the rules of the ESCC Specification System and the results certified by ESA. Components from these Manufacturers' technology flows are intended for use in ESA and other European spacecraft and Space segment hardware. For more information visit ESCIES.org
The ESCC PCAL (Process Capability Approval List: REP008) is the list of active and valid Process Capability Approval Certificates. Such approvals are certified by ESA in accordance with the requirements of ESCC Basic Specification No. 25600 and relevant ancillary ESCC Basic specifications. For more information visit ESCIES.org

The EPPL (European Preferred Parts List) is the list of preferred and suitable components to be used by European manufacturers of spacecraft hardware and associated equipment.
For more information see ESCC 12300 and the EPPL itself on ESCIES.org. Components and processes chosen from the ESCC QPL, QML, PCAL, EPPL are preferred because:

- the components included in these lists have been evaluated to demonstrate their reliability and operational margins for use in space applications
- their technologies, design, manufacturing processed materials are defined and kept under configuration control
- their manufacturer supply chains have been audited by the ESCC Executive, and any deviations are managed and corrected with the involvement of the ESCC executive through an ESCC nonconformance control process.

The opportunity to rely on the ready availability of ESCC qualified components from manufacturers with a quality management and product assurance system in place reduces mission risks, engineering and test efforts providing cost savings for the users.

As an insert in this brochure, the summary of all the active ESCC QPL, QML, PCAL certificates, is reported.
It should be noted that some qualification activities are still ongoing and therefore have not yet reached qualified status.
New qualifications are continuously initiated to exploit new component technologies and to satisfy user needs.

The ESCC Executive

The ESCC Executive management team and ESCC Secretariat are part of the ESA Product Assurance & Safety Department within the Directorate of Technical and Quality Management, located at ESA/ESTEC, Noordwijk, The Netherlands. Among other ESCC tasks, this team oversees and supports all ESCC qualification activities in close contact with space component manufacturers. Through the mechanism of Executive Implementation Agreements (EIA), resources are provided by:

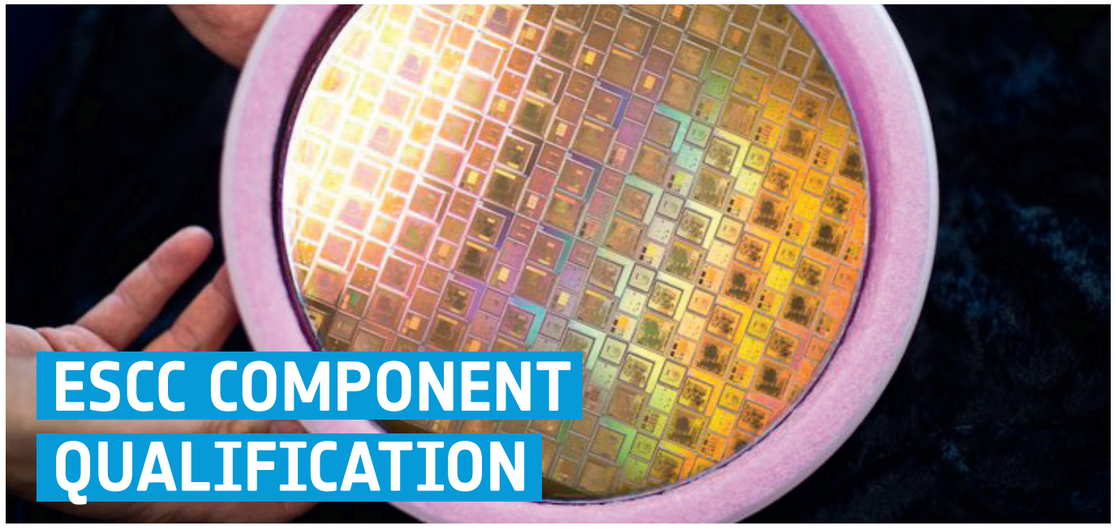
- ESA, for European manufacturers not supported by a National Space Agency with an EIA
- CNES, for manufacturers based in France
- DLR, for manufacturers based in Germany
- Enterprise Ireland, for manufacturers based in Ireland
- The UK Space Agency, for manufacturers based in the United Kingdom

The ESA team has the responsibility for all ESCC Executive activities in all other European countries and in cases where it is requested to assist.

ESA acts as a certifying agency for the ESCC QPL/QML and ESCC PCAL Certificates

Facts & figures

- 38 ESCC Qualified Manufacturers from 10 different European countries
- 135 Active ESCC Certificates
- 340 Qualified Part Type families
- 693 active ESCC Specifications



ESCC COMPONENT QUALIFICATION

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Across the globe, institutional and commercial space programmes have benefitted from the use of ESCC qualified components for many years.

ESCC qualified components come with added value. Specific user advantages of ESCC qualified EEE components are:

- Simplified procurement – maintenance of qualification is widely based on periodic testing which is used to reduce the lot-specific verification tests.
- Robust components – ESCC qualified components hold an impressive record of faultless operation in thousands of space systems. Issues affecting workmanship and performance are almost unknown with ESCC qualified parts. If any faults do appear, national space agencies and ESA commit their resources to address and fix the problems together with the manufacturer and any affected customers using the ESCC non-conformance process.
- High product maturity and low rate of obsolescence - many ESCC qualified products have been listed on the Qualified Parts List for a long time and have reliably flown on numerous missions.
- High TRL (Technology Readiness Level) - new ESCC qualified components are introduced every year following user needs in terms of functionality and performance and demonstrated long term reliability.
- Simplified parts approval process – for projects complying with ECSS-Q-ST-60C ESCC qualified products are, in the majority of cases, pre-approved.
- Solid performance - very high repeatability between manufacturing lots and across manufacturers (multiple sources may be qualified to a common standard).
- Proven supply chains - periodic testing and audit are inherent to the system. In addition, qualified manufacturers operate an open-books policy with the qualifying agencies and ESA, so their cooperation in any problems' resolution is guaranteed.
- Quality Assurance - third-party independent monitoring of the manufacturer's operations, performed by impartial space agencies and ESA. The ESCC Executive approves the full industrial configuration of qualified components
- In summary, a valid ESA certificate is perceived by most space system customers as a strong endorsement of performance and quality.

The ESCC system of specifications that serves to support component qualification is built on decades of work and experience of component manufacturers and specialist component engineers working for space agencies and user industries. The system makes space components available and fit for purpose for most sorts of space missions and applications.

The ESCC QPL is updated every month and is published on ESCIES.org

ESCC Qualified Components provide added value for Manufacturers & their Users

THE ESCC QUALIFICATION PROGRAMME: EVALUATION AND QUALIFICATION

The ESCC Evaluation Phase: to understand the part and its limits. The successful completion of the ESCC evaluation phase is a mandatory prerequisite to initiate the qualification phase.

The ESCC Evaluation consists mainly of the following:
Manufacturer Evaluation - The ESCC Executive performs an audit of the manufacturer's design, production and test facilities. This combines a Quality Management System audit and a manufacturing line survey.
Component Evaluation - Components/technologies are extensively characterised and tested (to destruction when determining reliability margins) in accordance with the applicable Evaluation Test Programme (Basic Specification No. 226xxxx).

Tests are failure mechanisms oriented and designed to:

- Gauge reliability and lifetime
- Provide stresses that:
  - Simulate the application environment
  - Address intrinsic and extrinsic failure modes
  - Determine parametric specification margins.

Note: ESCC evaluation tests may be waived when the manufacturer has already obtained the necessary test data on fully representative test samples which are compliant with the required test conditions, and if the data has been obtained within a period not exceeding two years prior to the start of ESCC evaluation.

Establishment of a Product Baseline including:

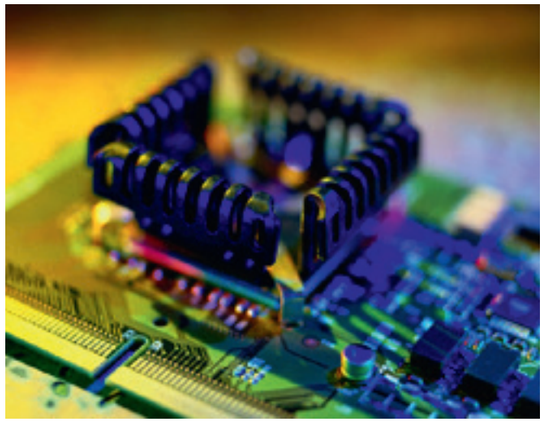
- PID (Process Identification Document) which establishes a precise reference for the EEE component(s) to be qualified in accordance with the ESCC System
- ESCC Detail Specification(s)
- Quality Assurance System

The ESCC Qualification Phase: emulates the procurement process and exercises the approved flow of manufacturing and test operations.
The ESCC Qualification Phase consists mainly of:

- Verification of the first production lot
- Parts are screened and lot tested according to the relevant ESCC Generic Spec. (e.g. ESCC 9000 for ICs; ESCC 4001 for film resistors; etc.) and the requirements (accept and reject criteria) of the applicable ESCC Detail specification.

Prerequisites for the start of the ESCC Qualification phase are:

- An ESCC Executive Approved Evaluation Test Report
- The PID, ESCC Generic and Component Detail Specification(s) are approved by the ESCC Executive
- Production and test schedules are available
- A Production Flow chart, Process Schedules, and inspection Procedures are available



The ESCC Executive regularly audits ESCC Qualified manufacturers

Adequate configuration control and full traceability are integral parts of the ESCC System

PID = Process Identification Document

ESCC COMPONENT QUALIFICATION APPROACHES

ESCC Qualification is a status given to standard EEE components which are manufactured in Europe under controlled conditions, and which have been shown to meet all the requirements of the relevant ESCC specifications.

Qualified parts and manufacturers are listed in the ESCC QPL and QML respectively.

The following equivalent and similarly structured approaches to ESCC Qualification exist:

- **ESCC Component Qualification** for standard parts (ESCC 20100)
- **ESCC Technology Flow Qualification** for stable and reliable manufacturing technology flows (ESCC 25400): qualified parts manufactured on a QML line.
- **ESCC Capability Approval** for technology domains supporting customised or application specific components qualification (ESCC 24300)

ESCC qualifications and certifications are awarded under the Authority of the European Space Agency.

ESCC qualified components are marked with the ESA logo whilst produced under a valid qualification.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Certificate of Qualification No. XXX

This is to certify that XXXXXXXXXXXXXXXXX has been qualified by ESA for the supply of XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX for use in ESA space programmes, according to ESCC Generic Specification XXXX and associated Detail Specification XXXXXXX as recommended by the Space Components Steering Board.

This certificate is valid until 30 September 2018.

Head of the Product Assurance and Safety Department

Date
30 September 2016

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ESCC COMPONENT QUALIFICATION QUALIFIED PARTS LIST (QPL)

Application for ESCC Qualification
- Preparation of PID, Domain description, Design of TV, draft ESCC Detail Spec
- Evaluation Test Plan

ESCC Evaluation
- Evaluation test programme (procurement of parts, testing)
- Manufacturer (and subcontractor as applicable) Audit

ESCC Qualification
- Qualification test programme
- Final ESCC detail spec

Preparation of Application for Qualification form
ESCC Executive review application

ESA award certificate

ESCC Component Qualification is the ESCC quality assessment and maintenance process designed to certify that individual components, ranges of components or structurally similar EEE components have the appropriate performance characteristics and reliability for use in space applications. Components qualified in this manner are listed in the ESCC QPL.

This approach is applicable to components of standard design (standard parts) which are in continuous or repetitive lot by lot production.

The ESCC Qualification test results are documented in the Qualification Test Report and the product compliance with ESCC requirements is certified by the manufacturer for each delivery lot.

ESCC QUALIFIED PARTS are procured with a simplified screening flow. LVT/LAT is not required

All Qualified Manufacturers are required to report any Non-conformances to the ESCC Executive

ESCIES = European Space Components Information Exchange System

The ESCC System is supported by ESA and European space agencies, space users represented by Eurospace and European component manufacturers.

Three ESCC Qualification Approaches and a Single Assurance system

ESCC TECHNOLOGY FLOW QUALIFICATION

Qualified Manufacturer List (QML)

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The ESCC Technology Flow Qualification (QML) is the ESCC quality assessment technique developed to ensure the reliability and performance of space components whilst maximizing the benefits of the manufacturers' best practices.

The ESCC Technology Flow Qualification system is designed for component manufacturing technology flows that combine effective quality management techniques with stable and reliable technologies capable of delivering numerous diff erent space component types. This approach places additional responsibilities on the manufacturer, and depends on the agile application of continuous quality improvement practices and the operation of a Technical Review Board (TRB).

ESCC Technology Flow Qualification is suitable for both standard continuous lot-by-lot production components and non-standard components that have design features customised to specific user requirements. It represents the widest range of qualified components defined in a technology domain. This approach has been successful in qualifying under each technology flow a list of components provided by qualified manufacturers (QML). Currently the following manufacturers and technology flows are qualified:

- Microchip Technology Atmel (ATC18RHA, ATMX150RHA)
- Vishay S.A. France (Thin Film Technology for Chip, Wraparound, Single and Network Resistors, Fixed, Based on Types P for Single Chip, PRA and CNW for Resistor Networks)
- Norspace (SAW Filters, Hermetically Sealed, Surface Mount, Frequency Range 10 MHz-4 GHz).
- Exxelia SAS (Custom Magnetics)
- Flux A/S (Custom Magnetics)

Products manufactured within a qualified domain listen in the QML are automatically listed into the ESCC QPL when an ESCC Detail Specification is available.

The 5 step process to obtain ESCC QML Certification

The sequence to obtain an ESCC QML certification for a manufacturer is summarized as follows:

- Establishment of a Quality Management (QM) Plan or Programme.
- Formal application for QML listing that shall include any existing in-house data for the technology to be qualified, for review by the Qualifying Authority.
- Establishment of an Evaluation and Qualification Test Programme (taking into account any relevant data for the technology).
- Review of a pre-validation data package and formal audit at the manufacturer's facility by the ESCC Lead Auditor.
- Granting of formal QML certification.

ESCC Executive / Manufacturer

Documentation

- Review and agreement of Evaluation Test Programme
- Technology Flow Definition
- Process Identification Document
- Evaluation Test Plan
- Quality Management Plan

→

Evaluation

- Run Evaluation Test
- Evaluation Test Report
- Qualification Test Plan

→

Certification

- Review and Agreement of Evaluation Test Results, Data Package and Qualification Test Plan

On Site AUDIT

→

Qualification

- Review and Agreement of Evaluation Test Results
- Run Qualification Test
- Qualification Test Report

→


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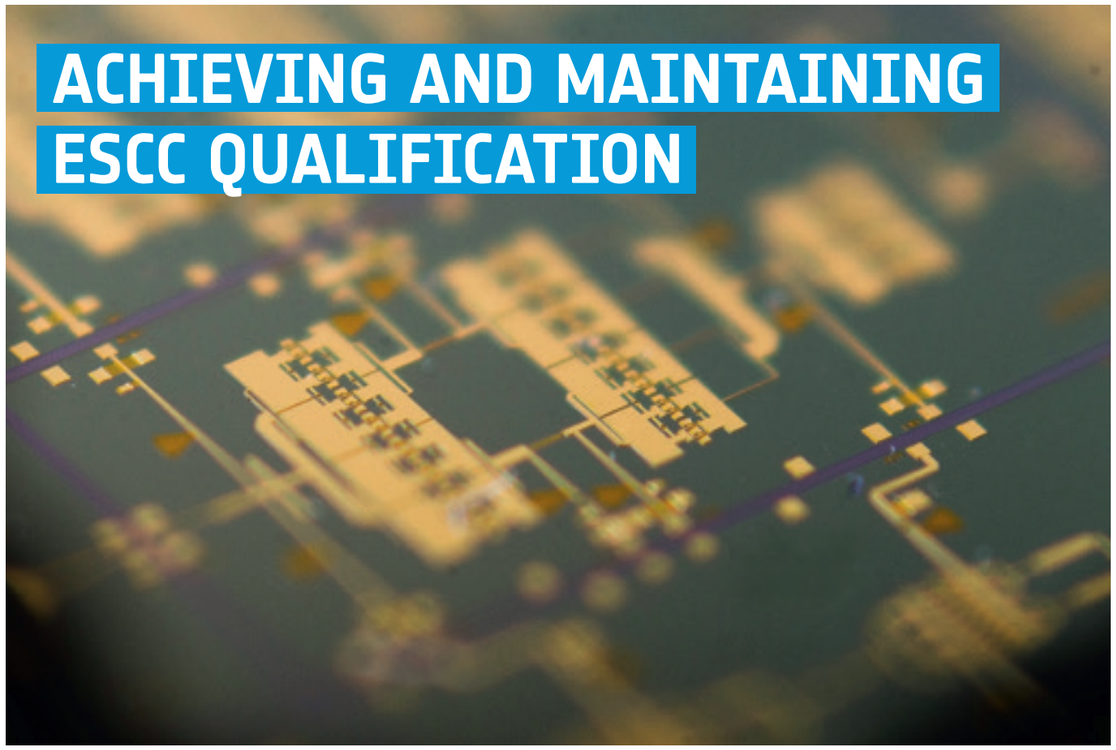
Certificate of Technology Flow Qualification No. XXX

An ESCC Qualification, once established, is valid up to two years.

Verification information supporting qualifications are published on ESCIES.org

ACHIEVING AND MAINTAINING ESCC QUALIFICATION



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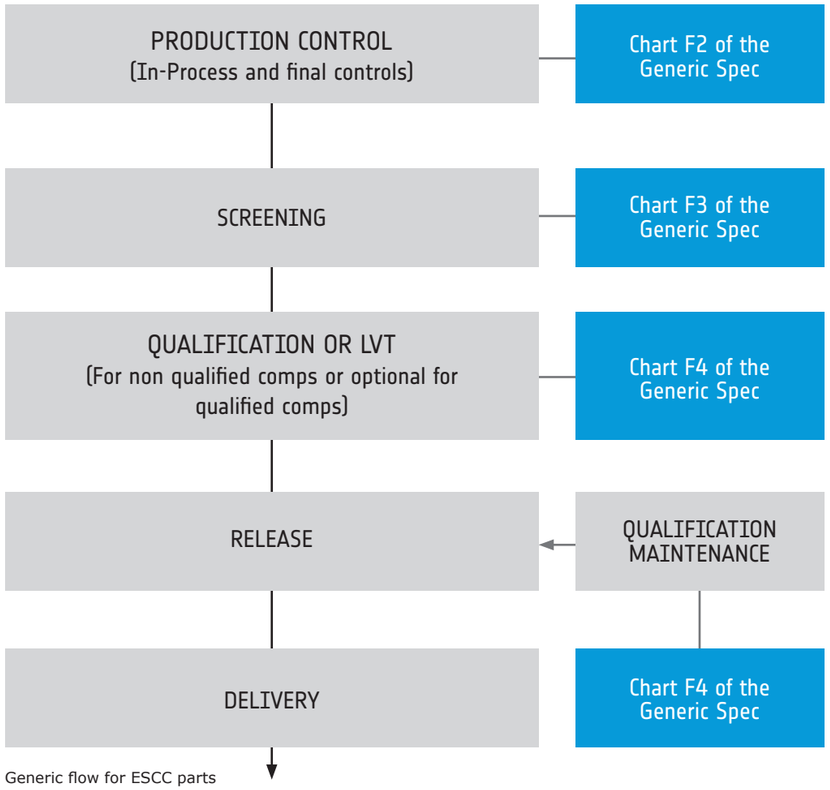
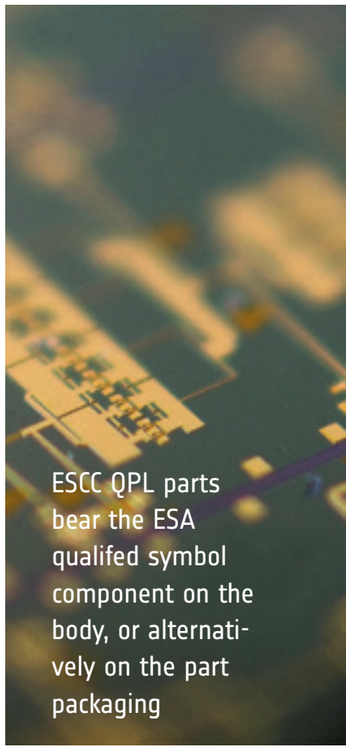


Generic flow for ESCC parts



Achieving ESCC qualification requires the following main elements:

- the definition of the intended scope of the final certification
- the verification by test of the performance of the selected components (or test vehicles) in accordance with the applicable Generic Specification and Component Detail Specification
- a satisfactory level of documentation of the production and test capabilities involved in the supply chain of the components (in the form of a Process Identification Document).

An Agency's audit of the manufacturing and test facilities is also part of the qualification process.
In practice, some of the tests to be performed aim to explore the basic construction, performance attributes, inherent failure modes and reliability risks of the component technology, while other tests and inspections try to establish the maturity of the supply chain and its capability to repeatedly deliver space components of the required quality. The whole process of qualification is described in the relevant ESCC specifications. All ESCC specifications are publicly available at https://escies.org.

Once achieved, the ESCC qualification is valid for two years. Periodic maintenance of qualification tests are done by manufacturers to keep their parts in the ESCC QPL list. Monitoring of Quality Assurance of ESCC qualified parts is paramount to guaranteeing constant and reliable performance over time.

After and during the two year ESCC Qualification period, the manufacturer is responsible for providing information to enable extension of the ESCC qualification (MoQ = maintenance of qualification). The manufacturer shall provide suitable information in order to demonstrate:

- The manufacture of components to ESCC requirements is strictly in accordance with the approved production and control documentation (with no concessions)
- Major changes to the PID have been notified and agreed (with the appropriate assessment)
- Detailed records of each ESCC production lot (including all test data) have been maintained
- Successful test data is available for the following:
  Periodic testing per ESCC Generic spec Chart F4 (with the specified sample size and test periodicity)
- No pending/open non-conformance.

Subject to ESA approval of the information provided by the manufacturer for MoQ, extension of ESCC Qualification will be granted for a further two years by means of a new ESCC qualification certificate being issued and listed in the ESCC QPL or QML.

A typical qualification and maintenance of qualification flow is reported above (see Generic Flow for ESCC Parts Table).

Maintenance is typically achieved using test results obtained from or in connection with customer procurements.
See https://escies.org

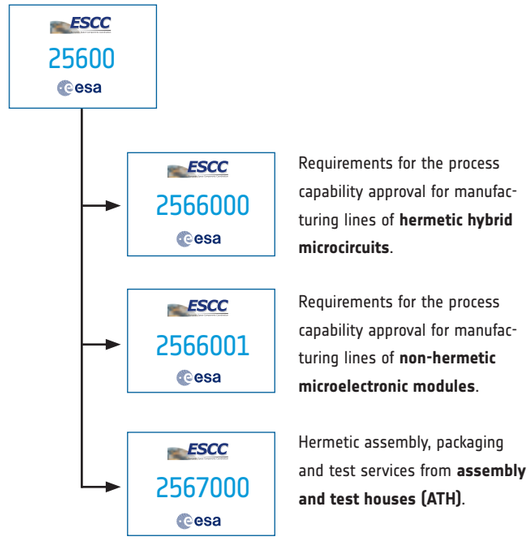
ESCC PROCESS CAPABILTY APPROVAL

ESCC Process Capability Approval List (PCAL)

Besides qualification, another ESCC certification scheme has been established: Process Capability Approval (PCA).

The certification scheme currently covers manufacturing lines producing high quality hermetic and non-hermetic hybrids and packaging assembly services. The approval is certified by ESA in accordance with the requirements of ESCC Basic Specification No. 25600 and relevant ancillary ESCC Basic specifications.

Each entry in the PCAL contains a Capability Abstract with a summary of the Process Capability approved domain. The materials and processes contained within the approved domains are described in the relevant manufacturer's Process Identification Document (PID).



The ESCC Executive publishes a list of active and valid Process Capability Approval Certificates (REP008). Currently the following manufacturers and processes are certified:

- 3D Plus (F) Non-Hermetic Modules
- Airbus Defence&Space (F) Hermetic Hybrid
- First Sensor Lewicki (G) Assembly Test House
- Safran Electronics (F) Hermetic Hybrid
- Tesat-Spacecom (G) Hermetic Hybrid
- Thales Alenia Space (B, F, I) Hermetic Hybrid

The listing of a manufacturing line in the PCAL does not imply any ESCC Qualification for any products manufactured in that line.

Current Ancillary specifications:

- 2566000 (First Issue June 2014)
- 2566001 (First Issue October 2017)
- 2567000 (First Issue December 2018)

The 5 step process to obtain ESCC PCA Certification

The sequence to obtain an ESCC PCA certification for a manufacturer is summarized as follows:

Definition of the process capability domain and its boundaries → **Evaluation of the supplier** → **Evaluation of the process capability domain.** → **PCA testing** →

An ESCC PCA, once established, is valid up to two years.

Verification information supporting certification are published on ESCIES.org

FREQUENTLY ASKED QUESTIONS

Where can I find the ESCC specifications, the QPL and QML and EPPL?
Find them all at https://escies.org

Our company has operations in many countries; can our components be ESCC qualified?
ESCC 21300 defines an ESCC component as: "A component which may have the benefit of ESCC qualified status by virtue of at least the quality operations (e.g. inspections and tests), as defined in the ESCC Specifications, being performed in one or more, and the delivered component originating from one, of the Member States of ESA or a state or country with a cooperation agreement with ESA. The component shall be freely available to the User Industry on a commercial basis without let or hindrance, inter alia being free from any form of selective export controls."

Can my product be qualified if no suitable specifications exist for it in the ESCC system?
Not yet. However, if its Qualification is supported by a national space agency and ESA, the necessary specifications will be developed, with your help and involvement.

We have components in development at the moment, can they be qualified in ESCC?
Yes; provided the development is successfully completed; the device has the potential for recurrent use in space applications and it passes the qualification test programme, or belongs to a qualified technology flow domain.

What is the validity period of an ESCC Qualification?
An ESCC qualification is valid for a period of two years. As long as a part type or manufacturer is listed on the QPL/QML, the qualification is valid.

Does ESCC cover the costs of Qualification or Maintenance of Qualification?
The ESCC Executive body covers its own activities and resources, however, there is no ESCC budget to support the relevant qualification activities. ESCC Executive partners (ESA and national space agencies) may choose to fund evaluation and qualification activities in part or full under their technology programmes. There are manufacturers that choose to fund ESCC qualifications themselves.

Can similarity be used to avoid duplication of tests on similar devices?
Yes. Similarity is a concept used in the ESCC system to manage test efforts. Explicit requirements are defined in Generic specifications with regard to the selection of test vehicles to cover a wider domain of parts. The Process Identification Document for a component family, capability or technology flow domain may define additional similarity criteria.

The published ESCC qualification records provide a limited amount of test data. How can a user obtain more visibility about the qualification results?
While the ESCC Executive is bound by confidentiality constraints, the manufacturer has full ownership of all qualification data. Upon customer request, the manufacturer may choose, possibly under a non-disclosure agreement, to share more information with a customer including Audit Reports and details contained in the Process Identification Document.

How is confidentiality managed within ESCC?
Confidentiality is a crucial factor for the ESCC System. Within the ESCC Executive, information is disclosed based on the need-to-know principle. Members of the ESCC Executive are not authorised to disclose confidential manufacturer information to any party including members of their employing organisation who are not supporting the ESCC Executive. Any potentially commercially sensitive information is only released with manufacturer agreement.

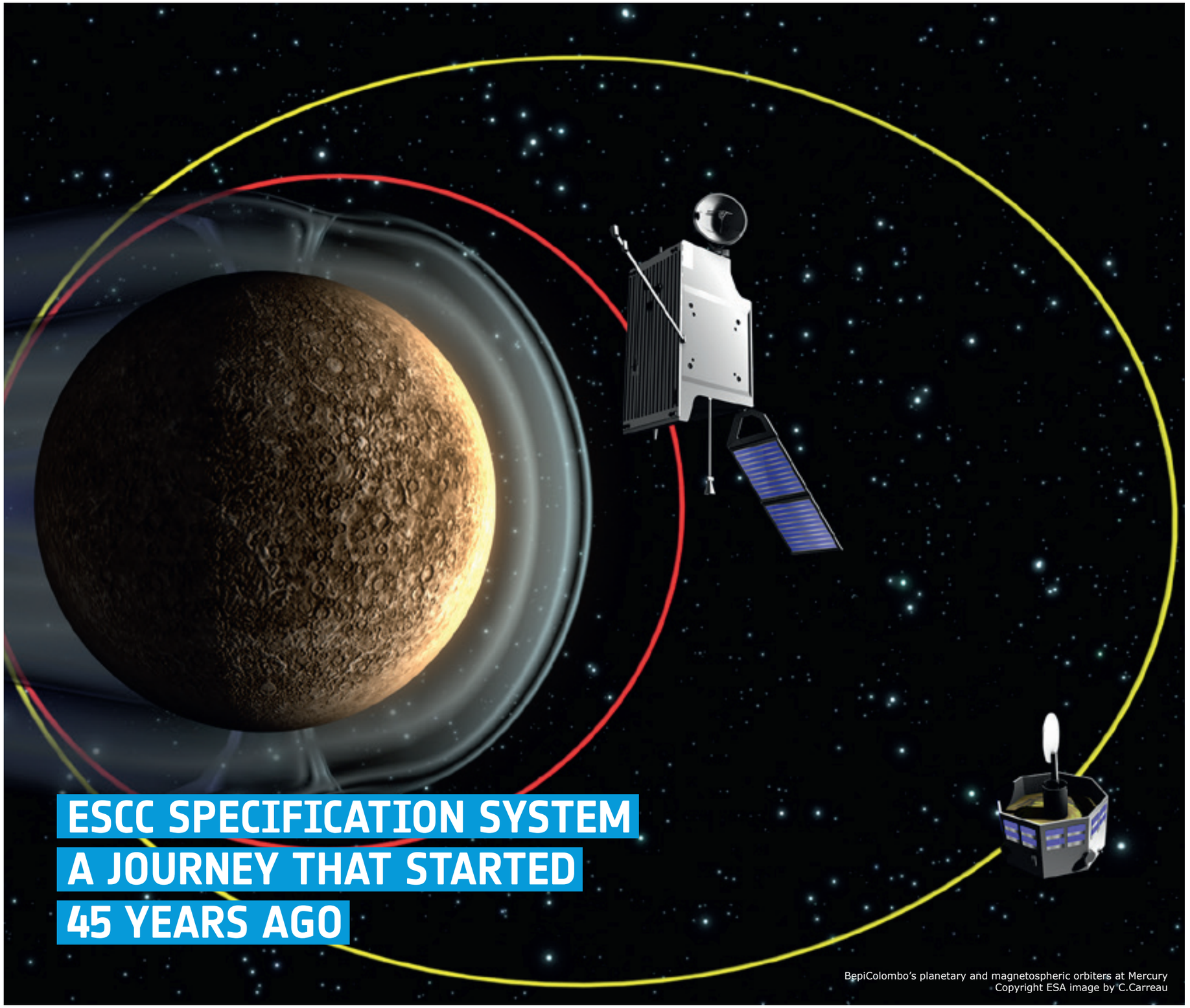
How are new ESCC QPL/QML entries selected?
Manufacturers interested to obtain an ESCC certification may make a proposal directly to the ESCC Executive.
More commonly, new qualifications are the result of agency R&D projects and programmes like ECI. ESCC has a leading role in the harmonisation of European EEE space components development activities.

Does the ESCC system support 'Test Optimisation' known from the US-MIL system?
Yes, ESCC has a provision allowing for manufacturer specific deviations. Such deviations, if accepted by the ESCC Executive are described in an appendix to the applicable component Detail Specification(s).

How can I find out more about ESCC Qualification?
The process is described in detail in the following ESCC specifications which are available at https://escies.org:

- *ESCC No. 20100 (Component Qualification for standard parts)*
- *ESCC No. 23400 (Capability Approval for technology domains supporting customised or application specific components)*
- *ESCC No. 25400 (Technology Flow Qualification for stable and reliable manufacturing technology flows: qualified parts manufactured on a QML line)*

How can I find out more about ESCC Qualification?
ESA offers free ESCC training sessions at least once a year, held at ESTEC in Noordwijk. These training sessions cover all aspects of the ESCC system including qualification of components.
In addition, ESA can offer individual advice and guidance on the use of the ESCC specification system and the route to ESCC Qualification. Just drop us an email at:
secretariat@escies.org



ESCC SPECIFICATION SYSTEM
A JOURNEY THAT STARTED
45 YEARS AGO

BepiColombo's planetary and magnetospheric orbiters at Mercury
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ESCC is a unified and single European system for space component specifications and the corresponding qualification and certification activities. The ESCC system is on a charter ratified by ESA, national space agencies, space industry represented by Eurospace, and Component Manufacturers, who are committed to operate the system contributing resources on at their own expense.

To gain a broader understanding of the ESCC system and how it functions, please refer to ESCC 20000 which is available on ESCIES.org
There are three levels of ESCC specifi cations: Basic, Generic and Detail.

- **ESCC Basic Specifications** provide objectives, test methods, qualification methodology and general requirements applicable to ESCC EEE components.
- **ESCC Generic Specifications** provide the general requirements applicable to qualification, maintenance of qualification, procurement and delivery for individual families and subfamilies of EEE components.
- **ESCC Detail Specifications** define form, fit, function and performance requirements for individual or ranges of particular EEE components.

Note: There are additional ESCC documents that cover policy, organisation, support and implementation issues but they are not directly relevant to use of the ESCC system.

The ESCC specification system support the provision of space components which are fit for all types of space missions

https://escies.org website offers you our full list of Qualified Manufacturers, the Qualified Parts List, all ESCC Specifications, the ESA Radiation Database, the European Preferred Parts List, ESA Components Technology Activities, Component Conference announcements and proceedings and MUCH MORE.

Contact
ESCC Executive Secretariat - ESCC Components Standardisation Section (TEC-QES) ESA/ESTEC
Keplerlaan 1 - P.O. Box 299 - 2200 AG Noordwijk - The Netherlands
E-mail: escc-executive.secretariat@esa.int - https://escies.org

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