

Verification of the assembly per ECSS-Q-ST-70-38C

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ESA standards for assembly of space hardware



- 1. ECSS-Q-ST-70-08: The manual soldering of high reliability electrical connections
- 2. ECSS-Q-ST-70-07: Verification and approval of automatic machine wave soldering
- 3. ECSS-Q-ST-70-18: Preparation, assembly and mounting of RF cables
- 4. ECSS-Q-ST-70-20: Determination of the susceptibility of silver plated copper wire and cables to 'red plague' corrosion.
- 5. ECSS-Q-ST-70-26: Crimping of high reliability electrical connections
- 6. ECSS-Q-ST-70-28: repair and modification of printed circuit board assembly for space applications
- ECSS-Q-ST-70-30: Wire wrapping of high reliability electrical connections
- 8. ECSS-Q-ST-70-38: High reliability soldering for surface mount and



ESA-ESTEC team in charge of verification in compliance with the ECSS-Q-ST-70-XX





Mechanical stress: Vibrations and shocks



Mechanical Vibration stresses

- Unit acceptance tests
- System acceptance tests
- Satellite acceptance tests
- Launch
- Re-entry

Mechanical shocks stresses

- Stages separation
- Solar Array deployment
- Landing



Thermal stresses



- Curing of adhesive
- In step PCB bake out
- Acceptance thermal cycles at unit level
- Acceptance thermal cycles at system level
- Acceptance thermal cycles at satellite level
- On-Off cycle during ground testing
- Temperature variation during the mission



Certification status of the operators and inspectors



ESA Training Structure – ESA STR-258 (Skill Training Schools) Progression route for certification



Minimum time from cat3 to cat2 and from cat 2 to cat 1 is 2 years

Detailed informations concerning every courses are reported in Annex



ESA skills training school



- ASTA (UK)
- Hytek (Denmark)
- IFE (Germany)
- IS (France)
- IIS (I)
- ZVE (Germany)
- New interest from 2 schools
 - SWI in Switzerland
 - Renex in Poland





ECSS-Q-ST-70-08C: Manual soldering of high reliability electrical connections



ECSS-ST-Q-70-08C: Manual soldering of high reliability soldering connections:

Dedicated to plated through hole assemblies and wires connections

Requires:

- Certification of personnel (operators and inspectors) by an ESA Skills soldering training school.
- Verification by testing only for assembly configurations which are not defined in the standard.



ECSS-Q-ST-70-08C: Manual soldering of high reliability electrical connections



Assembly of component assembled through hole by hand





 Verification (Vibration + 200 thermal cycles + microsectioning)



ECSS-Q-ST-70-38C: High reliability soldering for surface mount and mixed technology



14.1 General

The supplier shall establish a verification programme to be approved by the Approval authority.

A.1 General

The final customer makes the final decision to grant verification status to the supplier of surface mount technology on the basis of examination and acceptance of the fully documented verification test report.

A.2.4 Verification programme

A verification programme is submitted to the approval authority for acceptance prior to the start of assembly of the test SMT.



ECSS-Q-ST-70-38C: High reliability soldering for surface mount and mixed technology



Assembly by **hand** or by **machine** of SMDs in compliance with the ECSS-Q-ST-70-38C and TEC-QT/2013/398/CV

- Technology sample to be provided for inspection at TEC-QTM
- Audit of the manufacturing line
- Review of PID and associated procedures
- Assembly of a populated verification board with representative devices in compliance with the TEC-QT/2013/398/CV
 - a. Assembled by hand (repair to be demonstrated)
 - b. Assembled by machine (if applicable)
- Final verification review
- ESA Approval of the Summary Table and PID



TEC-QT/2013/398/CV



- ESA Assembly verification procedure:
- What are the conditions to start a ESA assembly verification
- How to notify the Agency the start of a verification
- How to prepare a soldering verification plan.



In order to facilitate the review of the verification programme the content of the different documents is Annexed to this letter.

In order to assure the quality of the input to ESA and avoid unnecessary iterations, it is recommended that the universections are performed in the laboratorics listed in Annex 4 or by "industry proposed laboratory that has been accepted by RSATEX-QTM -.

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C. Villette Materials Technology Section

T. Ghidini Head of Materials Technology Section

Enclosed: Annes 1: Content of the worling iron programme to be submitted to ESA Annes 2: Additional information needed related to the verification programme Annes; 1: Jato FSA ?PA Managers with its associated programme Anness: 1: Jato FSA ?PA Managers with its associated programme Anness: 1: TeC-07/2001/2006/CV Anness 6: TEC-07/2001/2006/CV

Figst 2/13 Dute Ref European Space Agency Agence spatiale europeanne

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TEC-QT/2013/398/CV



ESA Assembly verification procedure

- Verification programme content (list of materials, PCB built up...)
- Additional requirement compared to the ECSS-Q-ST-70-38C

-Number of devices to be assembled (3 machine reflow + 3 HS) except for critical devices

-Critical devices (from R1206, LCCs, SMDs packages, Chip capacitors, CWR06)- 5 machine reflow and 5 HS

-Requirements for microsectioning at completion of tests.

-All critical devices to be microsectioned

- ESA recommended companies
 - Serma, Hytek, ZVE, IIS, Tecnalia, SPUR

Tailoring is possible. This can be discussed in the frame of review of the verification program which is approved by ESA.



Verification programme flow







Verification programme test flow







This validates the repair of each type of device removed and replaced.

Electrical testing is recommended. It is good practice to perform the vibration and thermal cycling testing under electrical monitoring

List of critical devices (TEC-QT/2013/206/CV)



- Memo issued by ESA and uploaded on Escies website
- https://escies.org/

The list will be updated when needed.

Cesa

MEMO

Date	14 January 2013	Ref	TEC-QT/2012/206/CV	
From	Carole Villette Melle	Visa	T. Ghidini	
То	Companies having ESA Approved Summary Tables or under verification	Сору	PA Managers	

Subject: Identified critical devices for the assembly as per ECSS-Q-ST-70-38 on PCB laminates

During the past years some failures on solder joints or in devices have been identified at the completion of the environmental testing performed in compliance with the ECSS-Q-ST-70-38C.

It is the intention of ESA to inform industry, when not already done in order to prevent the use of these devices or to identify possible corrective actions.

The list of devices is not exhaustive and some devices may be missing. In the future, this list will be updated every time new failures are documented. The criticality has been identified when the failures in the solder joints and/or in the

devices have been noticed in many occasions by different end users. In namy cases it has also be concluded that, failures could occur to a process not compliant to the component manufacturer assembly recommendations. In these cases the component was not considered as critical. In general, these failures have been identified thanks to the improvement of the quality of the nicrosections requested by ESA in the last years as well as increase of number of microsectional devices and terminals.

Some of the failures identified in the table may result to the large temperature range used during the thermal cycles and may not appear when the temperature range is reduced. Reduction of temperature range will result in an increase of number of cycles.

In addition to the failures listed in Table 1, a failure due to excessive conformal coating has also been identified.

It is recommended that conformal coating is used such that it does not negate the atress relief and does not fully encapsulate the devices. Indeed during thermal cycling the conformal coating is responsible to additional stress and may lead at some extend to cracks in the solder joints. Once writikution test in compliance with the RCSS-Q-SI-70-28C have been completed and

one considered successful, the ancurt of conformal coating shall not be modified since otherwise the ESA Approval status will no more be valid.

European Space Agency Agence spatiale scropeons



Companies ESA Approved for the assembly (TEC-QT/2013/335/CV)





The list is at the moment

under update.



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8

MEMO

Date	11 January 2013	Ref	TEC-QT/2012/335/CV
From	Carole Villette	Visa	T. Ghidini, M. Nikulainen
То	ESA PA Managers,	Сору	TEC-Q, TEC-QT, TEC-QTC, TEC- QTM, TEC-QQM, TEC-QE, ESA Skills Training Managers, CNES

Subject: Verification to ECSS-Q-ST-70-38C. Status of Surface Mount technology (SMT) as of January 2013

Please find hereafter the current update of the assembly approval status as per ECSS-Q-ST-70-38C of the Companies which have submitted their application to ESA. The verification of a Company is not a general approval, but relates uniquely to the materials (i.e. Type of PCB laminate, type of solder, type of conformal coating, etc.) to the precise types of components/packages and to the design of the foot print that were subjected to the verification programme performed in accordance to the ECSS-Q-ST-70-38C. Each Summary Table has a unique QM or TEC/QT reference number which should be identified in the relevant FSA Projects. Declared Process List.

It is under the responsibility of the Company to ensure that all devices and configurations being assembled on the Printed Circuit Boards are in the ESA Approved Summary Tables and that no changes have been made.

It is usual to have a running verification programme with a Company due to change in the processes, materials, vibration levels or presence of new devices.

The status of the Companies varies frequently and therefore an updated letter will be issued every 3 months and can be found on the esmat website (http://csmatu.ess.uht/Databases/SMTLetter.pdf).

Thirty five Companies have currently verified lines, forty are presently involved in verification or delta verification programme, and some have expressed an interest to become verified.

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Page 1/23

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Creation of a pool of companies available for assembly as subcontractor.

Some companies such as Matra electronique, Patria, RESA, RSA, RSE, SPUR, Syderal, Thales Espana, ... have already assembled flight hardware for other companies.

-Still to be done: Organization of a workshop to define the rules to be followed





Thank you for your time and attention

Any questions?

