

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

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Noordwijk
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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
7. 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 mixed technology



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



1. TEC-Q (W. Veith)

a. TEC-QT (M. Nikulainen)

- TEC-QTM (T. Ghidini)
- C. Villette



- J. Hokka

- G. Corocher

- N. Beadle (100%)

- R. Dohmen (50%)

- D. Adams (on demand)



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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



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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

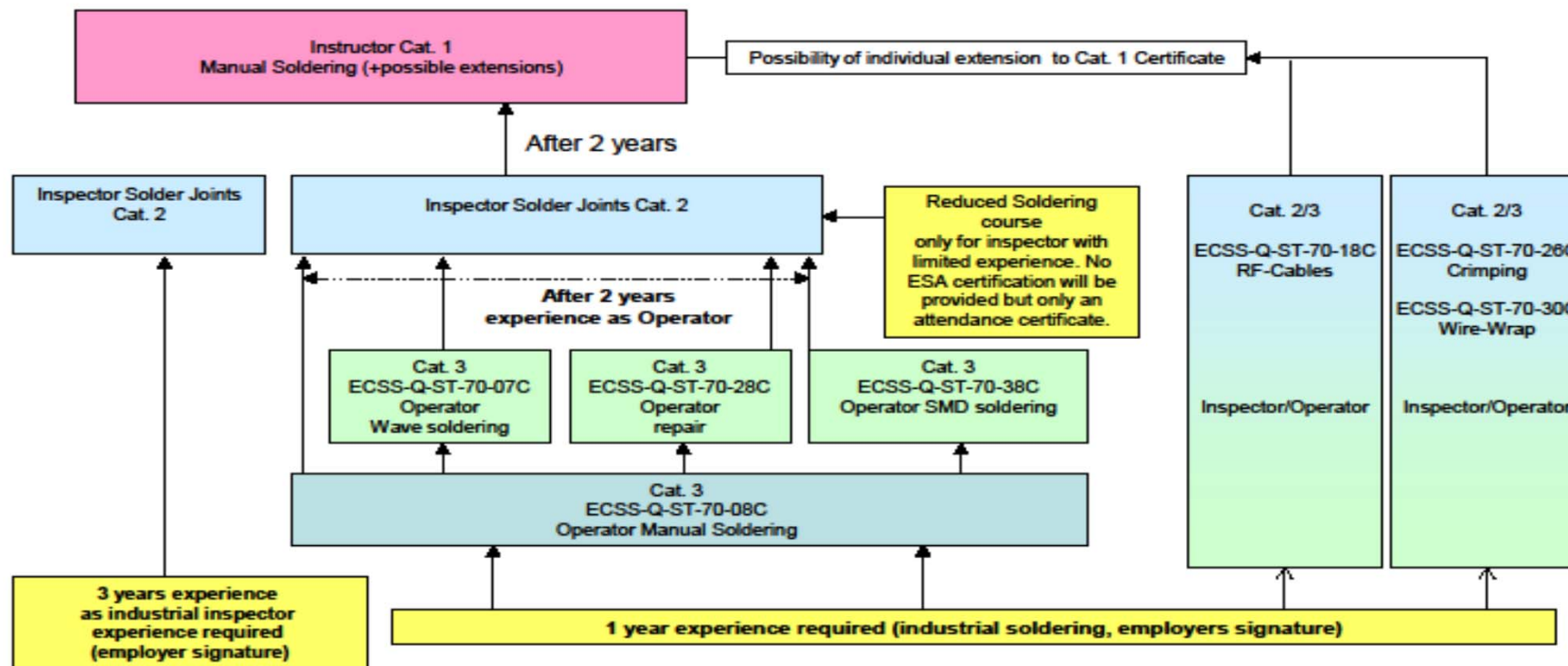


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Certification status of the operators and inspectors



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



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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



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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.

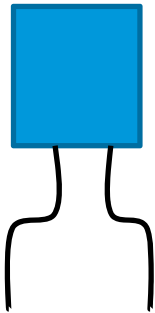


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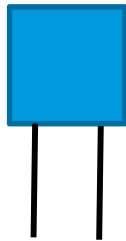
ECSS-Q-ST-70-08C: Manual soldering of high reliability electrical connections



Assembly of component assembled through hole by hand



– No verification



– Verification (Vibration + 200 thermal cycles + microsectioning)



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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



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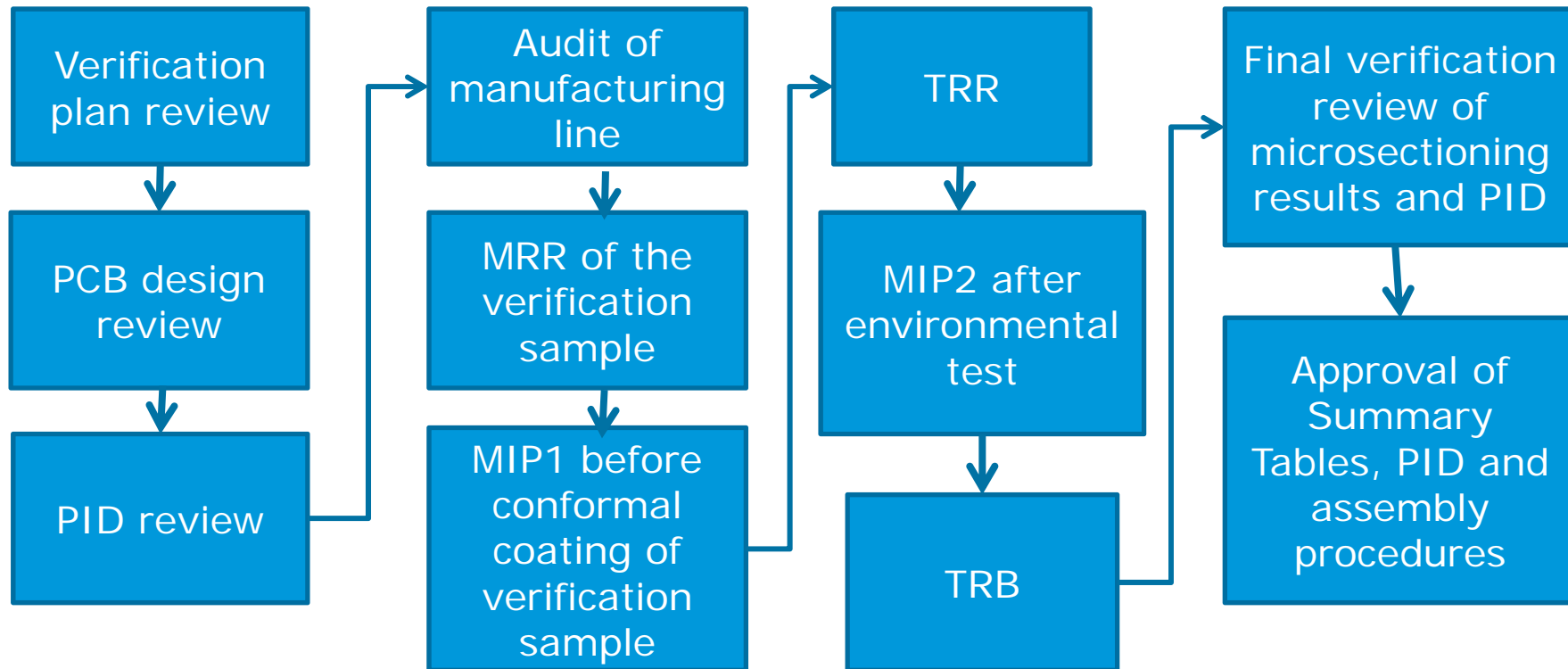
- **ESA Assembly verification procedure:**
- What are the conditions to start a ESA assembly verification
- How to notify the Agency the start of a verification
- How to prepare a soldering verification plan.



- **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, Tecnalía, SPUR

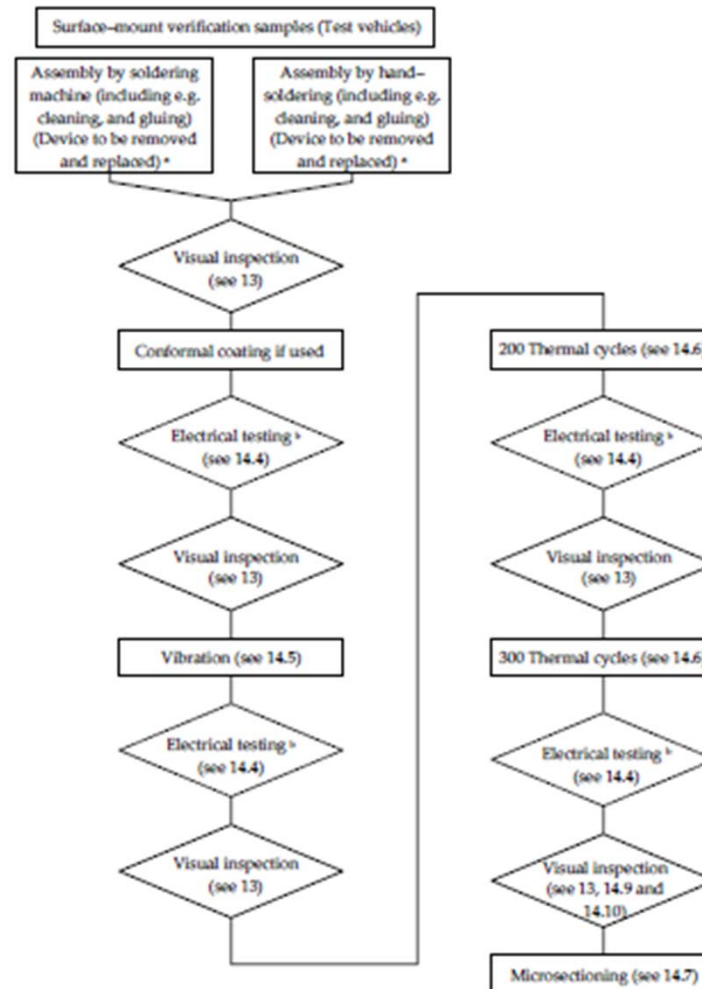
Tailoring is possible. This can be discussed in the frame of review of the verification program which is approved by ESA.

Verification programme flow



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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



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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.

MEMO

Date	14 January 2013	Ref	TEC-QT/2012/206/CV
From	Carole Villette 	Visa	T. Ghidini
To	Companies having ESA Approved Summary Tables or under verification programme	Copy	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 many cases it has also been 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 microsections requested by ESA in the last years as well as increase of number of microsectioned 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 stress 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 extent to cracks in the solder joints.

Once verification test in compliance with the ECSS-Q-ST-70-38C have been completed and are considered successful, the amount of conformal coating shall not be modified since otherwise the ESA Approval status will no more be valid.

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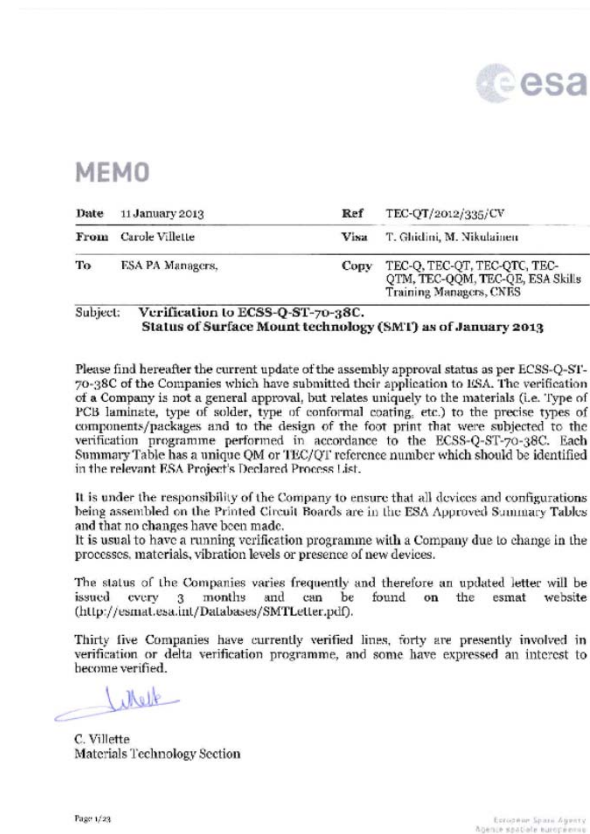
European Space Agency

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



Document available on the Escies website

➔ *The list is at the moment under update.*



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European Space Agency

New objective



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



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Thank you for your time and attention

Any questions?



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