



Space product assurance

Control of limited shelf-life materials

Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards. Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

This Standard has been prepared by the ECSS Executive Secretariat, endorsed by the Document and Discipline Focal points, and approved by the ECSS Technical Authority.

Disclaimer

ECSS does not provide any warranty whatsoever, whether expressed, implied, or statutory, including, but not limited to, any warranty of merchantability or fitness for a particular purpose or any warranty that the contents of the item are error-free. In no respect shall ECSS incur any liability for any damages, including, but not limited to, direct, indirect, special, or consequential damages arising out of, resulting from, or in any way connected to the use of this Standard, whether or not based upon warranty, business agreement, tort, or otherwise; whether or not injury was sustained by persons or property or otherwise; and whether or not loss was sustained from, or arose out of, the results of, the item, or any services that may be provided by ECSS.

Published by: ESA Requirements and Standards Division
ESTEC, P.O. Box 299,
2200 AG Noordwijk
The Netherlands
Copyright: 2008 © by the European Space Agency for the members of ECSS

Change log

ECSS-Q-70-22A 21 January 2000	First issue Transforming ESA-PSS-01-722 into an ECSS Standard
ECSS-Q-70-22B	Never issued
ECSS-Q-ST-70-22C 31 July 2008	Second issue Redrafting of ECSS-Q-70-22A according to new ECSS drafting rules and template. In particular: <ul style="list-style-type: none">• The content of the original clause 4 was moved to the clause 4.1.• The first sentence of the original requirement 4.3a was deleted because it is covered by the requirement 4.1.2.1a. The second sentence was moved to a note after the requirement 4.1.2.2a.• The original requirement 4.3d was moved to a note after the requirement 4.1.3d.• The content of the original clause 4.6.2 was moved to the informative Annex B and referenced in the clause 4.1.6.• The content of the original clause 5 was moved to the clause 4.2 and consolidated during the on-site meeting.• A DRD for evaluation reports was created in the normative Annex A.

Table of contents

Change log	3
1 Scope	5
2 Normative references	6
3 Terms, definitions and abbreviated terms	7
3.1 Terms defined in other standards.....	7
3.2 Terms specific to the present standard	7
3.3 Abbreviated terms	7
4 Requirements	8
4.1 Control of material life	8
4.1.1 Hazards, health and safety precautions	8
4.1.2 Material control	8
4.1.3 Assessment of shelf-life.....	9
4.1.4 Extension of shelf-life (re-certification)	10
4.1.5 Disposal of materials	10
4.1.6 Acceptance criteria, re-certification testing.....	10
4.2 Quality assurance.....	10
4.2.1 Data	10
4.2.2 Calibration	11
Annex A (normative) Shelf-life material evaluation report - DRD	12
Annex B (informative) Examples of properties to be measured	13
Bibliography	14

1 Scope

Several classes of materials depend on a chemical reaction for their application and their final properties are sensitive to the exact composition of the reactants. The final properties vary with the reactants' age and storage condition.

This Standard defines the requirements for the identification, handling, storage and control of limited shelf-life materials employed in the fabrication of spacecraft and associated equipment.

This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00.

2

Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

ECSS-S-ST-00-01	ECSS system – Glossary of terms
ECSS-Q-ST-10-09	Space product assurance – Nonconformance control system
ECSS-Q-ST-40	Space product assurance - Safety
ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes

3**Terms, definitions and abbreviated terms**

3.1 Terms defined in other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 and ECSS-Q-ST-70 apply.

3.2 Terms specific to the present standard**3.2.1 batch**

quantity produced at one operation

NOTE One batch can be subdivided into several lots.

3.2.2 shelf-life

period of time during which a material can be processed to produce final properties with consistently stable parameters

3.3 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
RH	relative humidity

4 Requirements

4.1 Control of material life

4.1.1 Hazards, health and safety precautions

- a. Materials and parts with hazardous characteristics shall be identified and manage in conformance with the "Safety programme plan" specified in ECSS-Q-ST-40.
- b. Procedures to control hazards, health and safety to personnel, equipment or materials shall be defined and implemented.

4.1.2 Material control

4.1.2.1 Procurement document

- a. For procurement specifications and purchase orders, the date of manufacture, storage conditions and shelf-life of the products shall be declared.

4.1.2.2 Identification

- a. Materials shall be labelled with the shelf-life and the date of the beginning of life or the date of manufacture (see clause 4.1.3).

NOTE In some critical applications, the project can reduce the shelf-life as originally stated by the manufacturer or supplier in order to meet particularly stringent product assurance requirements.

- b. For quantities which are split from a batch, it shall be ensured that materials are fully traceable to it and bear the same date and life indications.

4.1.2.3 Storage

- a. Materials shall be stored in a nominally clean area at $(22 \pm 3) ^\circ\text{C}$ with a relative humidity of $(55 \pm 10) \%$ unless specified otherwise by the manufacturer or supplier.

NOTE A wide range of pre-impregnated composites, adhesives and related materials which are used in the fabrication of spacecraft structures at lower temperatures to preserve their shelf-lives. Refer to clause 4.1.3.

- b. Storage areas shall be organized and controlled in such a way that limited shelf-life items are identified.

NOTE The reason is to avoid the possibility of over-aged material being used.

4.1.2.4 Handling

- a. Materials shall be handled with clean lint-free or nylon gloves unless their use is precluded for reasons of safety.

NOTE For example, when handling corrosive, toxic and oxidizing substances.

4.1.3 Assessment of shelf-life

- a. If the shelf-life cannot be obtained, the following steps shall be performed:

1. Certify the material at incoming inspection.

NOTE Perform tests relevant to the application of the material to ensure that the properties are within those values either specified within the procurement specification or in the manufacturer's data sheet (where no procurement specification exists).

2. Where satisfactory results are obtained, state that the material has spent half its shelf-life at the time of delivery.
3. If the results are not satisfactory, reject the material.
4. Put the date of manufacture and shelf-life on the label attached to limited shelf-life material in conformance with clause 4.1.2.2.

- b. The quantity in each container shall be compatible with the planned short term usage.

NOTE The reason is that the number of container openings is kept to the minimum possible.

- c. Materials shall be decanted from larger into smaller containers if there is large air space above the material.
d. For materials which are stored at temperature below zero, a system shall be defined and implemented to record the time exposed to room temperature and the consequent reduction in shelf-life when returned to low temperature storage.

NOTE For materials normally stored at low temperature (below zero), exposure to room temperature can dramatically reduce the shelf-life.

- e. It shall be ensured that all materials stored at temperatures below room temperature are allowed to attain room temperature prior to use.

4.1.4 Extension of shelf-life (re-certification)

- a. To extend the shelf-life of a material that has exceeded its shelf-life, the following activities shall be performed:
 1. Re-certify the material for the first time by using the relevant tests in conformance with clause 4.1.6;
 2. If the first re-certification is successful, extend the shelf-life equal to half the initial shelf-life;
 3. Re-certify the material for the second time on a case-by-case basis depending on product, application, storage and user experience;
 4. If the second re-certification is successful, extend the shelf-life to half of the first extension.
- b. If a fully traceable, non-over-aged batch is suspect, for any reason, the user shall submit it for re-certification.
- c. Batches awaiting results of a re-certification process separately and shall be labelled as "suspended".

4.1.5 Disposal of materials

- a. In case further re-certification is not permitted or traceability has been lost for a batch, or part of a batch, the user shall dispose the material in conformance with the product assurance rules applicable to the project.

4.1.6 Acceptance criteria, re-certification testing

- a. Re-certification of material shelf-life shall be achieved by retesting the material to verify that its properties are still within their specified limits.
- b. Retesting shall include those properties specified in the procurement specification or performed during incoming inspection.

NOTE The choice of properties to be measured is based on a combination of the final application of the material and its processing.

- c. The choice of properties to be measured and test methods to be used shall be subject to the approval of product assurance.

NOTE For examples of properties to be measured see Annex B.

4.2 Quality assurance

4.2.1 Data

- a. Quality records shall be retained for ten years or in conformance with project business agreement requirements.

NOTE E.g. logbooks.

- b. The quality records shall be in conformance with Annex A.

4.2.2 Calibration

- a. Any measuring equipment shall be calibrated to traceable reference standards.
- b. Any suspected or actual equipment failure shall be recorded as a project nonconformance report according to the NCR DRD in ECSS-Q-ST-10-09.

NOTE This is to ensure that previous results are examined to ascertain whether or not re-inspection and retesting is necessary.

Annex A (normative)

Shelf-life material evaluation report - DRD

A.1 DRD identification

A.1.1 Requirement identification and source document

This DRD is called from ECSS-Q-ST-70-22, requirement 4.2.1b.

A.1.2 Purpose and objective

The purpose of the document is to describe the contents of the evaluation report for the control of limited shelf-life materials.

A.2 Expected response

A.2.1 Scope and content

- a. The evaluation report shall contain the supplier's certification and definition of storage conditions.
- b. The evaluation report shall contain the copy of incoming inspection documentation.
- c. The evaluation report shall contain the nonconformance reports and corrective action (if applicable).
- d. The evaluation report shall contain the record of storage conditions and re-certification testing.

A.2.2 Special remarks

None.

Annex B (informative)

Examples of properties to be measured

Properties which can be measured in order to gain re-certification are:

- a. Properties related to the individual components and the cure process that are particularly sensitive to the effects of ageing:
 1. molecular weight distribution as determined by gel permeation chromatography;
 2. molecular structure as determined by infrared spectroscopy;
 3. degree of cure, cure exotherm and glass transition temperature as determined by differential scanning calorimetry;
 4. measurement of pot life;
 5. measurement of resin flow characteristics, such as gel time (particularly important in the case of fibre reinforced materials);
 6. measurement of the degree of tackiness in the case of pre-impregnated materials.
- b. Properties related to the materials application are measured on cured samples:
 1. adhesives - adhesive strength as determined by lap shear testing;
 2. coatings (paints and varnishes) - adhesion to the relevant substrate using measurements of peel and pull-off strength (see ECSS-Q-ST-70-13);
 3. conformal coatings - hardness, adhesion properties;
 4. potting compounds - hardness, electrical or thermal characteristics;
 5. fibre-reinforced materials - resin/fibre/void content using chemical digestion techniques. Measurement of relevant mechanical properties such as tensile strength or flexural strength.

Bibliography

- | | |
|-----------------|---|
| ECSS-S-ST-00 | ECSS system – Description, implementation and general requirements |
| ECSS-Q-ST-70-13 | Space product assurance - Measurement of the peel and pull-off strength of coatings and finishes using pressure-sensitive tapes |