ECSS-Q-70-22A
21 January 2000

Space product assurance

The control of limited shelf-life materials

ECSS Secretariat
ESA-ESTEC
Requirements & Standards Division
Noordwijk, The Netherlands

Published by: ESA Publications Division
ESTEC, P.O. Box 299,
2200 AG Noordwijk,
The Netherlands

ISSN: 1028-396X

Price: € 10

Printed in The Netherlands

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.

The formulation of this Standard takes into account the existing ISO 9000 family of documents.

This Standard has been prepared by editing the ESA PSS-01-722, reviewed by the ECSS Technical Panel and approved by the ECSS Steering Board.

(This page is intentionally left blank)

Contents

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 procedure to be used for the control of limited shelf-life materials employed in the fabrication of spacecraft and associated equipment.

(This page is intentionally left blank)

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 revisions 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 most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

ECSS-P-001	Glossary of terms
ECSS-Q-20	Space product assurance - Quality assurance
ECSS-Q-20-09	Space product assurance - Nonconformance control system
ECSS-Q-40	Space product assurance - Safety
ECSS-Q-70	Space product assurance - Materials, mechanical parts and processes
ECSS-Q-70-13	Space product assurance - Measurement of the peel and pull-off strength of coatings and finishes using pressure-sensitive tapes

(This page is intentionally left blank)

3

Terms, definitions and abbreviated terms

3.1 Terms and definitions

The following terms and definitions are specific to this Standard in the sense that they are complementary or additional with respect to those contained in ECSS-P-001 and ECSS-Q-70.

3.1.1
batch
quantity produced at one operation

NOTE One batch may be subdivided into several lots.

3.1.2
shelf-life
period of time during which a material can be processed to produce final properties with consistently stable parameters

3.2 Abbreviated terms

The following abbreviated term is defined and used within this Standard.

Abbreviation	Meaning
RH	relative humidity

(This page is intentionally left blank)

4

Control of material life

4.1 Hazards, health and safety precautions

Materials and parts with hazardous characteristics shall be identified, managed and processed according to ECSS-Q-40. Particular attention shall be given to health and safety precautions. In addition, hazards to personnel, equipment and materials shall be controlled and reduced to a minimum.

4.2 Material control

4.2.1 Procurement document

Procurement specifications or purchase orders shall require the manufacturer or supplier to declare the date of manufacture, required storage conditions and shelf-life of the products.

4.2.2 Identification

Materials shall be clearly identified with the shelf-life and the date of the beginning of life or the date of manufacture (see subclause 4.3). In addition, quantities which are split from a batch shall be fully traceable to it and bear the same date and life indications.

4.2.3 Storage

Materials shall be stored in a nominally clean area at (22 ± 3) °C with a relative humidity of (55 ± 10) % RH unless specified otherwise by the manufacturer or supplier. A wide range of pre-impregnated composites, adhesives and related materials which are used in the fabrication of spacecraft structures require controlled storage at lower temperatures to preserve their shelf-lives. Refer to subclause 4.3.

Storage areas shall be organized and controlled in such a way that limited shelf-life items are clearly identified and handled to avoid the possibility of over-aged material being used.

4.2.4 Handling

Materials shall only be handled with clean lint-free or nylon gloves unless their use is precluded for reasons of safety, i.e. when handling corrosive, toxic and oxidizing substances.

4.3 Assessment of shelf-life

a. The shelf-life of a material is generally stated by the manufacturer or supplier who accepts no liability on this point due to there being no way to determine control or storage and handling conditions after sale. In some critical applications, the project may reduce the shelf-life in order to meet particularly stringent product assurance requirements.

b. If the shelf-life cannot be obtained the material shall be certified at incoming inspection. Tests shall be performed 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). Where satisfactory results are obtained the material shall be deemed to have spent half its shelf-life at the time of delivery; if the results are not satisfactory the material shall be rejected. The date of manufacture and shelf-life shall appear on the label attached to limited shelf-life material (see subclause 4.2.2).

c. The number of container openings shall always be kept to the minimum possible by ensuring that the quantity in each container is compatible with the planned short term usage. Decanting materials from larger into smaller containers shall be used where appropriate to avoid storage with large air space above the material.

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

e. Users of such material shall define and implement a system to record the time exposed to room temperature and the consequent reduction in shelf-life when returned to low temperature storage.

f. Care should be taken to ensure that all materials stored at temperatures below room temperature are allowed to attain room temperature prior to use.

4.4 Extension of shelf-life (re-certification)

a. Re-certification is permitted on condition that a material that has exceeded its shelf-life shall be submitted to the relevant tests described in subclause 4.6, and if successful, shall be given an extension of shelf-life equal to half the initial shelf-life.

b. Re-certification may be performed one further time on a case-by-case basis depending on product, application, storage and user experience. This second extension of shelf-life shall be equal to half of the first extension.

c. If a fully traceable, non-over-aged batch is suspect, for any reason, it shall be submitted for re-certification.

d. Batches awaiting results of a re-certification process shall be stored separately and bear a "suspended" label indicating the status.

4.5 Disposal of non-certifiable materials

a. When further re-certification is not permitted, the material shall be disposed of in accordance with the product assurance rules applicable to the project.

b. If traceability has been lost for a batch, or part of a batch, disposal shall take place in accordance with the product assurance rules applicable to the project.

4.6 Acceptance criteria, re-certification testing

4.6.1 General

Re-certification of material shelf-life shall be achieved by retesting the material to verify that its properties are still within limits taking into account tolerances.

The choice of property or properties to be measured is based on a combination of the final application of the material and its processing. As a minimum, retesting shall include those properties specified in the procurement specification or performed during incoming inspection. The choice of properties to be measured and test methods to be used are subject to the approval of product assurance.

4.6.2 Examples of properties to be tested

Examples of properties which may 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-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.

(This page is intentionally left blank)

5

Quality assurance

5.1 Quality assurance requirements

The quality assurance requirements are defined in ECSS-Q-20. Particular attention shall be given to the following points.

5.2 Data

The quality records (e.g. logbooks shall be retained for at least ten years or in accordance with project contract requirements, and contain as a minimum the following:

a. supplier's certification and definition of required storage conditions;

b. copy of incoming inspection documentation;

c. nonconformance reports and corrective action (if applicable);

d. record of storage conditions and re-certification testing.

5.3 Nonconformance

Any nonconformance which is observed in respect to the test process on materials, shall be dispositioned in accordance with quality assurance requirements, see ECSS-Q-20-09.

5.4 Calibration

The supplier shall calibrate each reference standard and piece of measuring equipment used to demonstrate the conformance of the product to the specified requirements. Any suspected or actual equipment failure shall be recorded as a project nonconformance report so that previous results are examined to ascertain whether or not re-inspection and retesting is required. The customer shall be notified of the nonconformance details.

5.5 Traceability

Traceability shall be maintained throughout the process from supplier's documentation via incoming inspection to final process, including details of procurement source, procurement data, storage conditions and acceptance or re-certification testing.

(This page is intentionally left blank)

ECSS Document Improvement Proposal

1. Document I.D.	2. Document date	3. Document title
ECSS-Q-70-22A	21 January 2000	The control of limited shelf-life materials

4. Recommended improvement (identify clauses, subclauses and include modified text or graphic, attach pages as necessary)

5. Reason for recommendation

6. Originator of recommendation

Name:	Organization:	
Address:	Phone: Fax: e-mail:	**7. Date of submission:**

8. Send to ECSS Secretariat

Name:	Address:	Phone: +31-71-565-3952
W. Kriedte ESA-TOS/QR	ESTEC, P.O. Box 299 2200 AG Noordwijk The Netherlands	Fax: +31-71-565-6839 e-mail: wkriedte@estec.esa.nl

Note: The originator of the submission should complete items 4, 5, 6 and 7.

This form is available as a Word and Wordperfect-Template on internet under
http://www.estec.esa.nl/ecss/improve/

(This page is intentionally left blank)