ECSS Secretariat

ESA-ESTEC

Requirements & Standards Division

Noordwijk, The Netherlands

**Foreword**

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering, product assurance and sustainability 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 reviewed 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: 2019 © by the European Space Agency for the members of ECSS

Change log

|  |  |
| --- | --- |
| ECSS-Q-ST-70-31A | Never issued |
| ECSS-Q-ST-70-31B | Never issued |
| ECSS-ST-Q-70-31C15 November 2008 | First issueThis document replaces the ECSS-Q-70 paint standards: ECSS-Q-70-25A, ECSS-Q-70-33A, ECSS-Q-70-34A and ECSS-Q-70-35A. It also covers the acceptance criteria for paints. |
| ECSS-ST-Q-70-31C Rev.115 October 2019 | First issue Revision 1Major changes between ECSS-Q-ST-70-31C (15 November 2008) and this version are:* Update of the Standard to include the European Regulation "Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)" leading to deletion requirements
* Implementation of ECSS Change Requests
* Update of clause 3.1 “Terms defined in other standards”
* Update of clause 3.3 “Abbreviated terms”
* Clause 3.4 “Nomenclature” added

Detailed Change Record:Added requirements:* none

Modified requirements: * 4.2.4.3a; 4.2.5a; 4.3.6.3a, 4.5.2a.

Deleted requirements: * 4.1.1d.

Editorial changes: * Interleaved Notes moved to the end of requirement for: 4.2.4.3a; 4.2.5a; 4.3.6.3a.
 |

Table of contents

[Change log 3](#_Toc23346407)

[Introduction 6](#_Toc23346408)

[1 Scope 7](#_Toc23346409)

[2 Normative references 8](#_Toc23346410)

[3 Terms, definitions and abbreviated terms 9](#_Toc23346411)

[3.1 Terms from other standards 9](#_Toc23346412)

[3.2 Terms specific to the present standard 9](#_Toc23346413)

[3.3 Abbreviated terms 10](#_Toc23346414)

[3.4 Nomenclature 10](#_Toc23346418)

[4 Requirements 11](#_Toc23346419)

[4.1 General 11](#_Toc23346420)

[4.1.1 Establishment of verification programme 11](#_Toc23346421)

[4.1.2 Surface to be coated 11](#_Toc23346422)

[4.1.3 Potential limitations on parts geometry and structure 12](#_Toc23346423)

[4.1.4 Aspect and dimensions of parts prior to painting 12](#_Toc23346424)

[4.2 Preparatory conditions 12](#_Toc23346425)

[4.2.1 Hazards, health and safety precautions 12](#_Toc23346426)

[4.2.2 Preparation of materials and workpieces 13](#_Toc23346427)

[4.2.3 Procurement 14](#_Toc23346428)

[4.2.4 Facilities 15](#_Toc23346429)

[4.2.5 Equipment 16](#_Toc23346430)

[4.3 Procedures 17](#_Toc23346431)

[4.3.1 Pre-treatment 17](#_Toc23346432)

[4.3.2 Masking 19](#_Toc23346433)

[4.3.3 Primer 20](#_Toc23346434)

[4.3.4 Paint 20](#_Toc23346435)

[4.3.5 Handling and packaging of finished parts 22](#_Toc23346436)

[4.3.6 Paint repairing process 23](#_Toc23346437)

[4.4 Acceptance criteria 24](#_Toc23346438)

[4.5 Quality assurance 25](#_Toc23346439)

[4.5.1 General 25](#_Toc23346440)

[4.5.2 Data 25](#_Toc23346441)

[4.5.3 Nonconformance 26](#_Toc23346443)

[4.5.4 Calibration 26](#_Toc23346444)

[4.5.5 Traceability 26](#_Toc23346445)

[Bibliography 27](#_Toc23346446)

Introduction

This Standard describes in a generic way the methods and techniques that can be used for application of paints on space hardware. This document is prepared to replace all existing ECSS-Q-70 paint standards, i.e. ECSS-Q-70-25A, ECSS-Q-70-33A, ECSS-Q-70-34A and ECSS-Q-70-35A. It also covers the acceptance criteria for paints.

The parameters to be defined are:

* For substrate:
* Cleanliness
* Roughness or other preparation
* For primer:
* Quality
* Thickness
* Adhesion
* Time between application of primer and application of paint
* For paint:
* Aspect
* Thickness
* Adhesion
* Thermo-optical properties
* Electrical properties
1. This list is not exhaustive.

# Scope

This Standard defines the approach for producing a defined surface finish to spacecraft or associated equipment, by means of the controlled application of a paint. This also includes measurements and verifications to be performed.

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

# 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-20 | Space product assurance - Quality assurance |
| ECSS-Q-ST-70 | Space product assurance - Materials, mechanical parts and processes |
| ECSS-Q-ST-70-02 | Space product assurance - Thermal vacuum outgassing test for the screening of space materials  |
| ECSS-Q-ST-70-09 | Space product assurance - Measurement of thermo-optical properties of thermal control materials  |
| ECSS-Q-ST-70-13 | Space product assurance - Measurement of the peel and pull-off strength of coatings and finishes using pressure-sensitive tapes |
| ECSS-Q-ST-70-22 | Space product assurance - Control of limited shelf-life materials |
| ASTM D1005-95 | Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers |
| ASTM D1400-94 | Standard Test Method for Non-destructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base |
| ISO 2409:2007 | Paints and Varnishes – Cross-cut test |
| ISO 2360:2003 | Non-conductive coatings on non-magnetic electrically conductive basis materials – Measurement of coating thickness – Amplitude-sensitive eddy current method |
| EC 1907/2006  | European regulation for the registration, evaluation, authorisation and restriction of chemicals |

# Terms, definitions and abbreviated terms

## Terms from other standards

1. For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01 apply, in particular for:
	1. acceptance
	2. analysis
	3. batch
	4. component
	5. conformance
	6. contaminant
	7. toxic

## Terms specific to the present standard

1. hemispherical emittance (εh)

ratio of the radiant intensity of the specimen to that emitted by a black body radiator at the same temperature and under the same geometric and wavelength conditions

1. Examples are:
* Hemispherical emittance (ε**h**) -- conditions for incident or viewing of flux over a hemispherical region.
* Normal emittance (ε**n**) -- conditions for incidence or viewing through a solid angle normal to the specimen.
1. solar absorptance (αs)

ratio of the solar radiant flux absorbed by a material (or body) to that incident upon it

1. Differentiation is made between two methods:
* Spectroscopic method using a photospectrometer covering the range from 0,25 μm to 2,5 μm for the determination of αs.
* Portable equipment using a xenon flash for relative measurements (αp).
1. viscosity

measure of the fluidity of a liquid, in comparison with that of standard oil based on the time of outflow through a certain orifice under specified conditions

## Abbreviated terms

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

|  |  |
| --- | --- |
| Abbreviation | Meaning |
| RML | recovered mass loss |
|  |  |

## Nomenclature

The following nomenclature applies throughout this document:

1. The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.
2. The word “should” is used in this Standard to express recommendations. All the recommendations are expressed with the word “should”.
3. It is expected that, during tailoring, recommendations in this document are either converted into requirements or tailored out.
4. The words “may” and “need not” are used in this Standard to express positive and negative permissions, respectively. All the positive permissions are expressed with the word “may”. All the negative permissions are expressed with the words “need not”.
5. The word “can” is used in this Standard to express capabilities or possibilities, and therefore, if not accompanied by one of the previous words, it implies descriptive text.
6. In ECSS “may” and “can” have completely different meanings: “may” is normative (permission), and “can” is descriptive.
7. The present and past tenses are used in this Standard to express statements of fact, and therefore they imply descriptive text.

# Requirements

## General

### Establishment of verification programme

ECSS-Q-ST-70-31\_0660001

The adequacy of a paint process shall be demonstrated through a verification programme.

ECSS-Q-ST-70-31\_0660002

Depending on the specific project requirements, the paint applied shall fulfil part or all the acceptance criteria given in 4.4 of this Standard.

ECSS-Q-ST-70-31\_0660003

ECSS-Q-ST-70 shall apply.

ECSS-Q-ST-70-31\_0660004

<<deleted>>

### Surface to be coated

ECSS-Q-ST-70-31\_0660005

All couples paint - substrate shall be qualified for the given application, taking into account the use conditions.

1. 1 Examples of use conditions are temperature, thermal cycling, optical, mechanical and electrical properties.
2. 2 There exist no universal paint systems that can be applied to all substrates.

ECSS-Q-ST-70-31\_0660006

The suitability of the substrate with respect to the paint process shall be demonstrated on representative test pieces having the same specific characteristics as the workpiece.

1. Representative sample does not only concern the composition, but also the state of the surface and the geometry of the work piece.

### Potential limitations on parts geometry and structure

ECSS-Q-ST-70-31\_0660007

The paint application process shall be adapted to the geometry of the surface to be coated.

1. The geometry of the surface to be coated has an impact on the characteristics of the paints

### Aspect and dimensions of parts prior to painting

ECSS-Q-ST-70-31\_0660008

In case of scratching, shock or any other event disturbing the surface aspect, the customer shall be informed and a non conformance report issued.

1. While handling the parts to be coated, it is important to note that the paint layer mimics the underlying substrate.

## Preparatory conditions

### Hazards, health and safety precautions

ECSS-Q-ST-70-31\_0660009

The details of hazards for each material used in the process shall be available to all personnel involved into the application.

ECSS-Q-ST-70-31\_0660010

All Material Safety Data Sheets shall be available and known to the operators and supervising staff.

ECSS-Q-ST-70-31\_0660011

In addition, hazards to personnel, equipment, environment and materials shall be controlled and reduced to an acceptable risk.

1. Hazard can be reduced by using protective clothing.

### Preparation of materials and workpieces

#### Handling and storage

ECSS-Q-ST-70-31\_0660012

The conditions for handling and storage of materials used in this process shall be clearly indicated to all operators and supervising staff.

ECSS-Q-ST-70-31\_0660013

The workpiece or sample shall only be handled with clean, powder-free and lint-free gloves and shall be stored in a clean area.

ECSS-Q-ST-70-31\_0660014

Gloves shall be compatible with all compounds used.

1. For example: compatibility between paint, solvents, and cleaning agents.

ECSS-Q-ST-70-31\_0660015

Coated surfaces shall be shielded from contact by using appropriate bags or sheets.

1. The suitable bags are for example plastic bags with desiccators, sheet of tissue-paper, sheet of polyethylene foam.

ECSS-Q-ST-70-31\_0660016

Mechanical damage shall be avoided in the standard way by wrapping the packed pieces in clean, dust- and lint-free material.

ECSS-Q-ST-70-31\_0660017

Limited-life materials shall be labelled with their relative shelf-lives and dates of manufacture or date of delivery if date of manufacture is not known.

1. See ECSS-Q-ST-70-22, clause 4.1.3.

#### Identification

ECSS-Q-ST-70-31\_0660018

Materials used in this process shall be labelled and identified by:

Trade name and lot number.

Name of manufacturer or agent through whom the purchase was made.

ECSS-Q-ST-70-31\_0660019

Workpiece submitted for treatment shall as a minimum be identified by:

Name and lot number of item.

Name of manufacturer or supplier through whom the item was obtained.

Configuration-control status of the item.

#### Quality control samples

ECSS-Q-ST-70-31\_0660020

For spraying operation, samples shall be produced at the same time as the paint operation in order to control the quality of the paint.

ECSS-Q-ST-70-31\_0660021

These samples shall be of the same material and be surface treated in the same manner as the workpiece.

ECSS-Q-ST-70-31\_0660022

Adhesion test sample shall be prepared and tested according to ECSS-Q-ST-70-13, clause 5.1.2, ISO-2409:2007, or equivalent national standards.

1. For silicone’s paint, a tape based on silicon adhesive is used. However the added power of such tape can be out of the ISO specified strength

ECSS-Q-ST-70-31\_0660023

For the thermo-optical properties measurement at least 4 control samples of minimal dimension 20 mm × 20 mm shall be prepared and tested according to ECSS-Q-ST-70-09 clause 4.2.

ECSS-Q-ST-70-31\_0660108

The samples prepared as specified in 4.2.2.3a. to d. may be used for paint thickness measurement.

### Procurement

ECSS-Q-ST-70-31\_0660025

The procurement details for each material used in the process shall be stated in the relevant procurement specifications and supporting documentation.

1. For example, in a traceability folder.

### Facilities

#### Cleanliness

ECSS-Q-ST-70-31\_0660026

The work area shall be a clean area.

ECSS-Q-ST-70-31\_0660027

Air used for ventilation shall be filtered to prevent contamination of the workpieces.

#### Environmental conditions

ECSS-Q-ST-70-31\_0660028

The ambient conditions for the process and work areas shall be (22 ± 3) °C with a relative humidity of (55 ± 10) % unless otherwise stated.

ECSS-Q-ST-70-31\_0660109

The ambient conditions specified in 4.2.4.2a may be different, providing that are qualified for the specific process.

ECSS-Q-ST-70-31\_0660030

During paint operations the temperature of the workpiece shall not fall below the dew point of the ambient air.

ECSS-Q-ST-70-31\_0660031

If condensation is observed on the workpiece, the paint operation shall be suspended immediately.

#### Special utilities

ECSS-Q-ST-70-31\_0660032

Dependant on the specific requirements, the following utilities shall be available:

An oven capable of maintaining the workpiece in a clean environment and within ±5 °C of the required control temperature.

An ultrasonic bath.

A fume cupboard used for handling toxic or irritating primers, paints, solvents or cleaning agents.

A spray booth.

1. to item 2: A combined system can be used, in which ultrasonic cleaning can be followed by vapour cleaning.

ECSS-Q-ST-70-31\_0660033

The air flow velocity at the spray table shall be sufficient to prevent dry overspray from settling on surfaces which have been coated and which are still tacky.

ECSS-Q-ST-70-31\_0660034

Vapour from solvents shall be controlled by means of a positive exhaust at the rear of the spray booth.

### Equipment

ECSS-Q-ST-70-31\_0660035

Dependant on the specific application, the following special items of equipment shall be used:

Spray-gun

Brushes

Containers

Test equipment.

1. 1 to item 1: Size and type of spray-gun depend on the size and shape of the workpiece. For most of the work, a standard spray-gun of a good make, preferably with a gravity cup, is adequate.
2. 2 to item 2: For repairing small damaged areas, brushes can be used.

ECSS-Q-ST-70-31\_0660110

For small areas or places difficult to reach, an airbrush may be used.

ECSS-Q-ST-70-31\_0660037

For each type of paint or primer, a spray-gun specifically for that paint/primer shall be reserved.

ECSS-Q-ST-70-31\_0660038

A spray gun shall be cleaned with an adequate solvent before and after spraying.

ECSS-Q-ST-70-31\_0660111

For repairing small damaged areas, brushes may be used.

ECSS-Q-ST-70-31\_0660040

Brushes shall be new or cleaned after use with a proper solvent.

ECSS-Q-ST-70-31\_0660041

All containers to be used for preparing paints shall be cleaned and dried so that the paint is not contaminated.

ECSS-Q-ST-70-31\_0660042

For acceptance tests, the test equipment as specified in the following documents, shall be used:

ECSS-Q-ST-70-13 or ISO 2409:2007 or equivalent national standards for the adhesion properties.

ECSS-Q-ST-70-09 or equivalent national standards for the thermo-optical properties.

ASTM D1005-95 or ISO 2360:2003 or equivalent national standards for the thickness measurements.

ECSS-Q-ST-70-02 or equivalent national standards for the outgassing properties.

Suitable measuring equipment to fulfil the monitoring requirements of the process i.e.:

Calibrated equipment for measuring the required temperature and humidity environment;

Weighing equipment for thinner and paint;

Viscosity cup (Ford, DIN, ISO or AFNOR);

Volume Graduated containers to measure primer;

Equipment for determining electrical surface / bulk resistance in the case of electrical conductive paints.

## Procedures

### Pre-treatment

#### Abrasion of surface

ECSS-Q-ST-70-31\_0660043

Surfaces shall be abraded in order to increase the adherence according to coating material manufacturer requirement and agreed with customer.

1. 1 Emery paper, sand paper, grit blasting can be used as abrasion medium.
2. 2 In certain cases, abrasion is not feasible or can damage the item.

ECSS-Q-ST-70-31\_0660044

The maximum duration between abrasion and application of primer or paint shall be in line with the manufacturers’ suggestions.

1. Typically for metals re-growth of the oxide layer means there is a limit of 2-4 hours.

#### Cleaning

ECSS-Q-ST-70-31\_0660045

Surfaces shall be cleaned according to an agreed procedure between the supplier and the customer.

ECSS-Q-ST-70-31\_0660046

Surfaces shall be free of dust and grease.

1. This can be achieved by standard cleaning procedures or by the manufacturer cleaning method.

ECSS-Q-ST-70-31\_0660047

Workpieces with complex shapes shall be ultrasonically cleaned.

ECSS-Q-ST-70-31\_0660048

For large pieces, or pieces that for other reasons cannot be ultrasonically cleaned, surfaces shall be carefully cleaned by hand with cleaning solvents and clean tissues.

1. The cleaning solvents are for example ketons, alcohols or ionic liquids.

ECSS-Q-ST-70-31\_0660049

When cleaning with tissues, the single wipe approach shall be used.

#### Handling and protection of surfaces

ECSS-Q-ST-70-31\_0660050

Unless specified otherwise, all operations following cleaning shall be performed by personnel wearing appropriate clean gloves.

ECSS-Q-ST-70-31\_0660051

The handling of parts shall be kept to a minimum.

ECSS-Q-ST-70-31\_0660052

Throughout all operations, contamination of surfaces shall be avoided.

1. Example of such contamination are fingerprints, hair or dust.

ECSS-Q-ST-70-31\_0660053

The hardware shall be protected from random temperature extremes, high humidity and physical damage.

ECSS-Q-ST-70-31\_0660054

The paint shall not be applied before any mechanical operations.

1. Examples of mechanical operations are machining, drilling, forming or welding.

ECSS-Q-ST-70-31\_0660055

Adhesive bonding on surfaces to be coated shall be completed before paint application.

### Masking

ECSS-Q-ST-70-31\_0660056

Surfaces to be masked shall be free of dust and grease.

ECSS-Q-ST-70-31\_0660057

Paint shall be masked with pressure-sensitive tape, leaving no residue after removal or with clean non-absorbent paper.

ECSS-Q-ST-70-31\_0660058

Parts that are subject to damage by tape removal shall be identified and protective measures shall be taken.

1. Examples of these parts are thin-gauge materials or thin plating.

ECSS-Q-ST-70-31\_0660059

Parts that are subject to possible contamination by tape adhesive shall be identified and protective measures shall be taken.

1. Examples of these parts are optical components, or other temperature control surfaces.

ECSS-Q-ST-70-31\_0660060

Parts shall be coated as soon as possible after cleaning.

1. When using solvents, it is important to take care of the dewpoint.

ECSS-Q-ST-70-31\_0660061

If the time before application is likely to exceed eight hours, the parts shall be protected through bagging.

### Primer

#### Preparation and application

ECSS-Q-ST-70-31\_0660062

The primer shall be prepared as defined in the manufacturer’s or other primer specific preparation procedure, taking into account all needed precautions regarding mixing.

ECSS-Q-ST-70-31\_0660063

The primer shall be applied within the specified pot-life and to the thickness as defined in the manufacture’s or other primer specific application procedure and using dry nitrogen or clean compressed air as spray gas.

1. 1 Generally the thickness of the primer is measured after the drying, and before application of the next layer.
2. 2 This is however not possible in case of silane primer.

#### Curing

ECSS-Q-ST-70-31\_0660064

Before application of the paint, the primer shall be cured in a clean and dust-free area for duration as defined in the manufacture’s or other paint specific application procedure.

ECSS-Q-ST-70-31\_0660112

Following priming and primer cure the workpieces may be stored before commencing painting in accordance with the manufacturers’ instructions.

### Paint

#### Preparation and application

ECSS-Q-ST-70-31\_0660066

The paint shall be thoroughly homogenised in its original container by stirring or shaking, as defined in the manufacturer’s or other paint specific application procedure.

ECSS-Q-ST-70-31\_0660067

After the desired amount has been poured into a dry, clean container, thinner or solvent shall be added to obtain the specified viscosity and the mixture homogenised.

ECSS-Q-ST-70-31\_0660068

The amount of thinner/solvent shall be established by making test pieces which bear a strongly adhering, homogeneous layer.

1. The amount of thinner/solvent needed depends on the type of spray gun that is used.

ECSS-Q-ST-70-31\_0660069

Once the amount of thinner/solvent is defined for a certain set-up, the viscosity shall be measured, and instructions for the workshop set down to obtain duplication of the process.

ECSS-Q-ST-70-31\_0660070

The paint shall be filtered according to supplier requirements.

ECSS-Q-ST-70-31\_0660071

Dry nitrogen or clean compressed air shall be used as spray gas.

ECSS-Q-ST-70-31\_0660072

For brush application, the amount of thinner/solvent shall be established.

ECSS-Q-ST-70-31\_0660073

Depending on the desired thickness, an adequate number of crossed layers shall be sprayed with a drying time between each layer as defined in manufacture’s or other paint specific application procedure.

ECSS-Q-ST-70-31\_0660074

The crossed layers shall be smooth and even with no localised concentrations of paint or agglomerations.

1. In order to avoid pooling of the liquid paint through dwelling the spray too long in one area.

ECSS-Q-ST-70-31\_0660075

After the last layer has been applied, the workpieces shall be dried for a time needed to obtain a touch-dry surface before they are transported to the curing area.

#### Unmasking

ECSS-Q-ST-70-31\_0660076

Unmasking shall be performed after the paint is sufficiently dried or cured to avoid damage.

ECSS-Q-ST-70-31\_0660077

Preliminary test pieces shall be made to evaluate this drying time.

ECSS-Q-ST-70-31\_0660078

Unmasking shall be performed carefully to avoid the starting of pulling stresses in the paint.

ECSS-Q-ST-70-31\_0660079

If masking tape adhesive remains on the surface, no attempt shall be made to clean it off until after the final cure.

#### Curing

ECSS-Q-ST-70-31\_0660080

The workpiece shall be placed in a clean, controlled environment for final cure.

ECSS-Q-ST-70-31\_0660081

The temperature, humidity and pressure conditions used for the final curing shall be as defined in manufacture or other paint specific application procedure.

1. For temperature sensitive equipment, it is possible to reduce the temperature, provided that the cure time is increased.

### Handling and packaging of finished parts

ECSS-Q-ST-70-31\_0660082

For handling and packaging of finished parts 4.2.2.1a and 4.2.2.1b shall apply.

### Paint repairing process

#### General

ECSS-Q-ST-70-31\_0660083

In agreement with the customer, surfaces shall be repaired according to the manufacturer’s specifications.

ECSS-Q-ST-70-31\_0660084

For small areas (less than 2 cm x 2 cm), the repairing shall be done with a paint brush in a clean room.

ECSS-Q-ST-70-31\_0660085

For areas between 2 cm x 2 cm and 10 cm x 10 cm, a low pressure spray shall be used.

ECSS-Q-ST-70-31\_0660086

For areas between 2 cm x 2 cm and 10 cm x 10 cm, the repairing shall be done in a painting room.

ECSS-Q-ST-70-31\_0660087

If the area to repair is larger than 10 % of the total surface, the paint shall be removed from the total surface by using paint stripper or mechanical stripping.

ECSS-Q-ST-70-31\_0660088

After stripping, the surface shall be cleaned according to 4.3.1.2a.

ECSS-Q-ST-70-31\_0660089

Paint stripper shall be washable with normal cleaning solvent.

#### Paint brush repairing process

ECSS-Q-ST-70-31\_0660090

For paint brush repairing, cleaning shall consist in:

removing any non adhesive part on the area to repair with a small wooden stick;

cutting the edges with a scalpel, to obtain bevelled sides;

cleaning the area to repair with a thinner soaked cotton stick;

moistening the adjacent paint with the same thinner.

ECSS-Q-ST-70-31\_0660091

For paint brush repairing, painting shall consist in:

applying thin coats of paint when the thinner is evaporated, and letting dry a few minutes between each coat;

applying the two first coats and the last one with a diluted paint.

ECSS-Q-ST-70-31\_0660092

If the primer needs to be repaired, the same process as the paint shall apply (see technical data sheet).

#### Spray gun process

ECSS-Q-ST-70-31\_0660093

For spray gun, cleaning shall consist in:

removing any non adhesive part on the area to repair with a small wooden stick;

cutting the edges with a scalpel, to obtain bevelled sides;

cleaning the area to repair with a thinner soaked cotton stick;

masking the areas already painted to avoid a fog of paint on them;

moistening the adjacent paints with the same thinner.

1. to item 4: This ensures that the masking is not damaging the paint.

ECSS-Q-ST-70-31\_0660094

For spray gun, painting shall consist in:

applying the paint using the spray gun as soon as the thinner has evaporated;

applying the primer as described in technical data sheet, if the primer needs to be repaired;

applying the paint after complete drying.

## Acceptance criteria

ECSS-Q-ST-70-31\_0660095

The following properties of the control samples that were prepared at the same time as the workpieces shall be tested:

Thickness

Thermo-optical properties

Adhesion properties

Outgassing properties

ECSS-Q-ST-70-31\_0660096

Thicknessshall be measured in accordance with ASTM D1005-95 or ASTM D1400-94 or equivalent national standards

ECSS-Q-ST-70-31\_0660097

Thermo-optical propertiesshall be measured according to ECSS-Q-ST-70-09.

1. 1 Solar absorptance (s) or solar absorptance with portable equipment (p).
2. 2 Hemispherical emittance (h) or normal emittance with portable equipment (n).

ECSS-Q-ST-70-31\_0660098

Adhesion properties shall be measured according to ECSS-Q-ST-70-13, ISO 2409:2007 or equivalent national standards.

ECSS-Q-ST-70-31\_0660099

When measuring the adhesion properties, there shall be no sign of paint lifting from the surface.

ECSS-Q-ST-70-31\_0660100

Outgassing propertiesshall be measured according to ECSS-Q-ST-70-02.

ECSS-Q-ST-70-31\_0660101

Unqualified couple paint substrate with respect to outgassing requirement (as defined in ECSS-Q-ST-70-02), shall undergo a four weeks curing under atmospheric condition prior performing the outgassing qualification.

## Quality assurance

### General

ECSS-Q-ST-70-31\_0660102

The quality assurance requirements defined in ECSS-Q-ST-20 shall apply

### Data

ECSS-Q-ST-70-31\_0660103

The quality records shall be retained for at least ten years or in accordance with project business agreement requirements, and contain as a minimum the following:

copy of the final inspection documentation;

index of limited-life materials and their use times;

nonconformance reports and their corrective actions;

test pieces for ongoing verification;

copy of the inspection and test results with reference to relevant procedure;

event log which is a chronological history of process operations, inspections;

tests reports ;

details of failure mode (if applicable);

<<deleted>>

### Nonconformance

ECSS-Q-ST-70-31\_0660104

ECSS-Q-ST-10-09 shall apply.

### Calibration

ECSS-Q-ST-70-31\_0660105

Each reference standard and piece of measuring equipment shall be calibrated.

ECSS-Q-ST-70-31\_0660106

Any suspected or actual equipment failure shall be recorded as a project nonconformance report so that previous results can be examined to ascertain whether or not re-inspection and retesting is required.

### Traceability

ECSS-Q-ST-70-31\_0660107

Traceability shall be maintained throughout the process from incoming inspection to final test, including details of test equipment and personnel employed in performing the task.

Bibliography

|  |  |
| --- | --- |
| ECSS-S-ST-00 | ECSS system – Description, implementation and general requirements |