ECSS-Q-ST-60-13C
21 October 2013

Space product assurance

Commercial electrical, electronic and electromechanical (EEE) components

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 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-Q-ST-60-13C Working Group, under the auspice of the ESCC Space Components Steering Board, reviewed by the ECSS Executive Secretariat and jointly approved by the ESCC SCSB and the ECSS Technical Authority.

Disclaimer

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

Change log

ECSS-Q-ST-60-13C 21 October 2013	First issue.

Table of contents

Figures

Tables

Introduction

This standard is based on and complementary to ECSS-Q-ST-60C (with upward revisions). This standard can only be used in conjunction with ECSS-Q-ST-60C in its current revision. This standard applies only to commercial components - as defined in its scope - which meet defined technical parameters that are on the system application level demonstrated to be unachievable with existing space components or only achievable with qualitative and quantitative penalties. The standard requires that qualitative and quantitative penalties are specified, as applicable, as a minimum in terms of quantifiable parameters such as: functional capability, parts count, power dissipation, frequency of operation, data/signal processing efficiency, interconnect complexity, mass, volume, …

For traceability to ECSS-Q-ST-60, the modifications or additions are marked in blue. Text in black colour is unmodified text.

The objective of the EEE component selection, control, procurement and use requirements is to ensure that EEE components used in a space project enables the project to meet its mission requirements.

Important elements of EEE component requirements include:

a. component programme management,
b. component selection, evaluation and approval,
c. procurement,
d. handling and storage,
e. component quality assurance,
f. specific components, and
g. documentation.

The main tools which can be used to reach the objective are:

a. concurrent engineering,
b. standardization of component types,
c. characterization of components,
d. assessment of component manufacturers including declared competencies and processes,
e. testing, screening, lot acceptance and periodic testing,
f. procurement specifications,
g. control and inspection,
h. control of nonconforming materials,
i. assessment and use of existing component data,
j. application of specific control to mitigate risk for components with limited data or confidence, and
k. information management.

The basic approach is as follows:

- The customer of a given space project defines the EEE component requirements within the boundaries of this standard. They appear in the appropriate clauses of the project requirements as defined in ECSS-M-ST-10.
- The supplier defines a component control plan to implement those requirements into a system which enables, for instance, to control the selection, approval, procurement, handling in a schedule compatible with his requirements, and in a cost-efficient way.
- The supplier ensures that the applicable parts requirements are passed down to lower level suppliers and ensure that they are compliant to these parts requirements.

1 Scope

This standard defines the requirements for selection, control, procurement and usage of EEE commercial components for space projects.

This standard is applicable to commercial encapsulated active monolithic parts (integrated circuits and discrete):

- diodes
- microwave diodes
- integrated circuits
- microwave integrated circuits (MMIC)
- transistors
- microwave transistors

This standard is not applicable to the commercial parts from the following families:

- capacitors
- connectors
- crystals
- filters
- fuses
- heaters
- inductors
- microwave passive parts
- oscillators
- relays
- resistors
- switches
- thermistors
- transformers
- cables & wires
- hybrids
- surface acoustic waves (SAW)
- charge coupled devices (CCD)
- active pixel sensors (APS)

In addition, the following families of EEE components are not addressed by the present ECSS standard but it can be used as guideline and revisited on case/case basis:

- photodiodes
- light emitting diodes (LED)
- phototransistors
- opto-couplers
- laser diodes

In line with ECSS-Q-ST-60, this standard differentiates between three classes of components through three different sets of standardization requirements (clauses) to be met.

The three classes provide for three levels of trade-off between assurance and risk. The highest assurance and lowest risk is provided by class 1 and the lowest assurance and highest risk by class 3. Procurement costs are typically highest for class 1 and lowest for class 3. Mitigation and other engineering measures can decrease the total cost of ownership differences between the three classes. The project objectives, definition and constraints determine which class or classes of components are appropriate to be utilised within the system and subsystems.

a. Class 1 components are described in Clause 4

b. Class 2 components are described in Clause 5

c. Class 3 components are described in Clause 6

Annex G includes a diagram that summarizes the difference between these three classes for evaluation, screening and lot acceptance.

The requirements of this document are applicable to all parties involved at all levels in the integration of EEE commercial components into space segment hardware and launchers.

For easy tailoring and implementation of the requirements into a Requirement Management Tool, and for direct traceability to ECSS-Q-ST-60, requirements in this standards have been written in the way of a ECSS Applicability Requirement Matrix (EARM), as defined in Annex A of ECSS-S-ST-00 “ECSS system – Description, implementation and general requirements”.

This standard may be tailored for the specific characteristics 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-60	Space product assurance - Electrical, electronic and electromechanical (EEE) components
ECSS-Q-ST-60-14	Space product assurance - Relifing procedure - EEE components
ECSS-Q-ST-60-15	Space product assurance – Radiation hardness assurance – EEE components
ESCC 21300	Terms, definitions, abbreviations, symbols and units
ESCC 24900	Minimum requirements for controlling environmental contamination of components
ESCC 25500	Methodology for the detection of pure tin in the external surface finish of case and leads of EEE components
MIL-STD-750	Test methods for semiconductor devices
MIL-STD-883	Test method standard microcircuits
JESD22-A101	Steady state temperature humidity bias life test
JESD22-A110	Highly accelerated temperature and humidity stress test
JESD22-A113	Preconditioning of plastic surface mount devices prior to reliability testing
JESD22-A121	Test Method for Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes
JESD22-B106	Resistance to soldering temperature for through hole mounted devices
JESD-201	Environmental Acceptance Requirements for Tin

	Whisker Susceptibility of Tin and Tin Alloy Surface Finishes
J-STD-020	Moisture/Reflow sensitivity classification for nonhermetic solid state surface mount devices
J-STD-033	Handling, packing, shipping and use of moisture/ reflow sensitive surface mount devices

3
Terms, definitions and abbreviated terms

3.1 Terms from other standards

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

For the purpose of this standard, the following terms and definitions from ECSS-Q-ST-60 apply:

agent

characterization

commercial component

concurrent engineering

franchised distributor

parts engineer

parts procurer

qualified parts

screening

space qualified parts

3.2 Terms specific to the present standard

3.2.1 traceability information (trace code)

unique identifier used by manufacturers to label and trace a quantity of components with a common manufacturing history and thereby common characteristics.

NOTE 1 The notion of "lot of EEE parts" used for the radiation and lot acceptance tests is defined by the trace code.

NOTE 2 Several trace codes can be part of a same delivery from the manufacturer or the distributor.

NOTE 3 It is possible to have several diffusion lots (as per ESCC 21300) in the same trace code.

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
AOQ	average outgoing quality
ASIC	application specific integrated circuit
BGA	ball grid array
CA	construction analysis
CCD	charge coupled device
CCP	component control plan
CN	change notice
CoC	certificate of conformance
CDR	critical design review
CR	change request
DCL	declared components list
DPA	destructive physical analysis
DRD	document requirement definition
DSM	deep Sub-Micron
Ea	activation energy
ECSS	European Coordination for Space Standardization
EEE	electrical, electronic, electromechanical
EFR	early failure rate
ESCC	European space components coordination
GSE	ground support equipment
HAST	highly accelerated stress test
HTRB	high temperature reverse bias
JD	justification document
LAT	lot acceptance test
LED	light emitting diode
LVT	lot validation testing
MMIC	microwave monolithic integrated circuit
PAD	parts approval document
PCB	parts control board
PCN	process change notice
PDA	percent defective allowable
PED	plastic encapsulated device
PIND	particle impact noise detection
QBSD	full quadrant back scatter electron detector
QCI	quality conformance inspection
RFD	request for deviation

Abbreviation	Meaning
RH	relative humidity
RoHs	restriction of the use of certain hazardous substances
RVT	radiation verification testing
SCSB	Space Components Steering Board
SAM	scanning accoustic microscopy
SEM	scanning electron microscope
SMD	surface mount device
TCI	technology conformance inspection
Tg	glassivation temperature
THB	temperature humidity bias
Tj	junction temperature
T/C	thermal cycling

3.4 Conventions

a. The term “EEE component“ is synonymous with the terms "EEE Part", "Component" or just "Part".

b. The term “for approval” means that a decision of the approval authority is necessary for continuing the process.

c. The term “for review” means that raised reviewers comments are considered and dispositioned.

d. The term “for information” means that no comments are expected about the delivered item.

e. For the purpose of clear understanding of this document, hereunder is a listing of component categories which are covered by the term EEE component, encapsulated or non-encapsulated, irrespective of the quality level:

1. Capacitors
2. Connectors
3. Crystals
4. Discrete semiconductors (including diodes, transistors)
5. Filters
6. Fuses
7. Magnetic components (e.g. inductors, transformers, including in-house products)
8. Monolithic Microcircuits (including MMICs)
9. Hybrid circuits

10. Relays
11. Resistors, heaters
12. Surface acoustic wave devices
13. Switches (including mechanical, thermal)
14. Thermistors
15. Wires and Cables
16. Optoelectronic Devices (including opto-couplers, LED, CCDs, displays, sensors)
17. Passive Microwave Devices (including, for instance, mixers, couplers, isolators and switches)

NOTE Microwave switches consisting of multiple EEE components are considered as equipment. The requirements of this standard are applicable to the EEE parts they incorporate and to microwave switches having a simple design (single EEE part).

3.5 Nomenclature

The following nomenclature applies throughout this document:

a. The word "shall" is used in this Standard to express requirements. All the requirements are expressed with the word "shall".

b. The word "should" is used in this Standard to express recommendations. All the recommendations are expressed with the word "should".

NOTE It is expected that, during tailoring, recommendations in this document are either converted into requirements or tailored out.

c. 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".

d. 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.

NOTE In ECSS "may" and "can" have completely different meanings: "may" is normative (permission), and "can" is descriptive.

e. The present and past tenses are used in this Standard to express statements of fact, and therefore they imply descriptive text.

4
Requirements for class 1 components

Identifier	Requirement	Applicability
4.1 Component programme management		
	4.1.1 General	
4.1.1a		Applicable
	4.1.2 Components control programme	
	4.1.2.1 Organization	
4.1.2.1a		Applicable
4.1.2.1b		Applicable
	4.1.2.2 Component control plan	
4.1.2.2a		Applicable
4.1.2.2b		Applicable
4.1.2.2c		Applicable
	4.1.3 Parts control board	
4.1.3a		Applicable
4.1.3b		Applicable
4.1.3c		Applicable
4.1.3d		Applicable
	4.1.4 Declared component list	
4.1.4a		Applicable
4.1.4b		Applicable
4.1.4c		Applicable
4.1.4d	After equipment CDR, all modifications affecting the JD information shall be implemented, in the "as design" DCL, through the CN / CR process and submitted to the customer for approval. NOTE For JD generation, see 4.2.4.d.	Modified
4.1.4e		Applicable
4.1.4f		Applicable
4.1.4g		Applicable
4.1.4h		Applicable

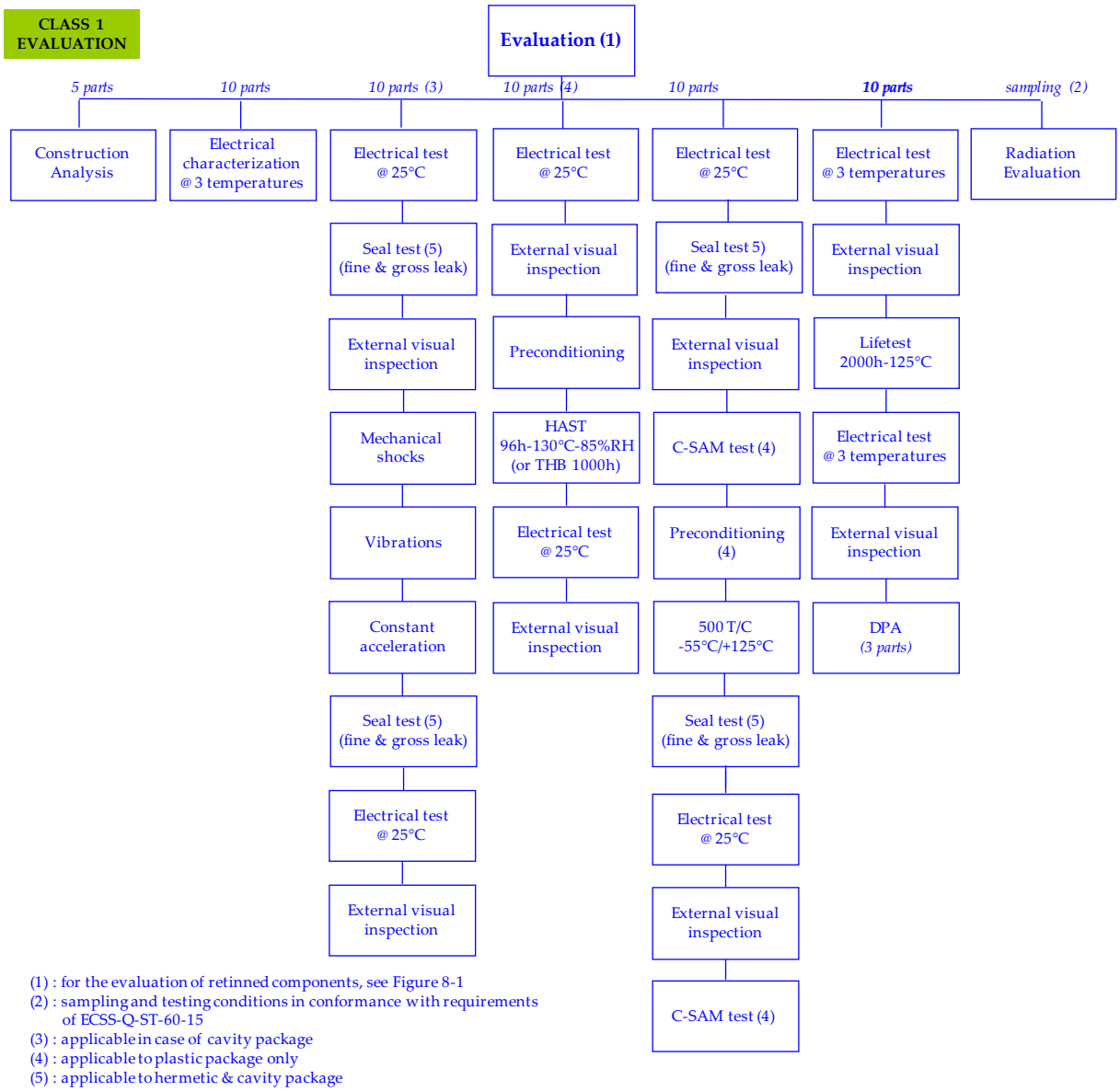
4.1.5 Electrical and mechanical GSE		
4.1.5a		Applicable
4.1.5b		Applicable
4.2 Component selection, evaluation and approval		
4.2.1 General		
4.2.1a		Applicable
4.2.1b		Applicable
4.2.2 Manufacturer and component selection		
4.2.2.1 General rules		
4.2.2.1a		Applicable
4.2.2.1b		Applicable
4.2.2.1c		Applicable
4.2.2.1d		Applicable
4.2.2.1e		Applicable
4.2.2.1f		Applicable
4.2.2.1g	For the assessment of commercial components, the supplier shall collect the available data on the manufacturer and the component in the JD specified in the requirement 4.2.4d. NOTE It is important to check the exhaustiveness of the manufacturer documentation & data sheet with respect to e.g. the following items: • component marking, • mechanical description, • electrical and thermal description.	New
4.2.2.1h	For Deep Sub-Micron Technologies (<90nm), the detailed test definition shall identify the technology through the construction analysis and the application. NOTE 1 It is important to ensure that the test conditions remain as close as possible to application. NOTE 2 This requirement is important due to the specificities of Deep Sub-Micron Technologies (<90nm).	New
4.2.2.2 Parts and material restriction		
4.2.2.2a		Applicable
4.2.2.2b		Applicable
4.2.2.2c		Applicable
4.2.2.2d	For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used:	Modified

	1. EEE components with pure tin (less than 3% Pb in case of SnPb alloy) used as a finish on the leads, terminations and external surfaces of components and packages. NOTE For EEE components with pure tin, see also requirements 4.2.2.2h and 4.2.2.2i. 2. Hollow core resistors 3. Potentiometers (except for mechanism position monitoring) 4. Non-metallurgically bonded diodes 5. Semiconductor dice with unglassivated active area 6. Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case 7. Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions 8. Wire link fuses < 5A 9. TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside	
4.2.2.2e		Applicable
4.2.2.2f		Applicable
4.2.2.2g		Applicable
4.2.2.2h	The use of pure tin (inside or outside the part) shall be declared in the JD.	Modified
4.2.2.2i	To assess Pb free with tin finish whisker risk, the following actions shall be performed by the supplier: 1. In order to verify information from manufacturer (included in the JD), as part of the incoming inspection, check the lead finish of all procured lots as per ESCC 25500 basic specification. 2. When confirmed during incoming, assess individually each use of pure tin termination through a RFD. 3. Submit each lot confirmed with pure tin terminations to solder dip with an SnPb solder. NOTE Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation it is required that the termination is coated over its entire length, right up to the package surface (no stand off). 4. Perform the retinning operation before screening and before the lot acceptance test. 5. Before retinning of flight parts, document the hot solder	New

	dip process by a procedure to be submitted to customer for approval. 6. Perform the evaluation of retinned components in conformance with Figure 8-1 from the requirement 8.1a. 7. Perform the lot acceptance of retinned components in conformance with Figure 8-2 from the requirement 8.1a.	
	4.2.2.3 Preferred sources	
4.2.2.3a		Not applicable
4.2.2.3b		Not applicable
4.2.2.3c		Applicable
	4.2.2.4 Radiation hardness	
4.2.2.4a		Applicable
4.2.2.4b		Applicable
4.2.2.4c		Applicable
4.2.2.4d		Applicable
4.2.2.4e		Applicable
4.2.2.4f		Applicable
4.2.2.4g		Applicable
4.2.2.4h		Applicable
4.2.2.4i		Applicable
	4.2.2.5 Derating	
4.2.2.5a		Applicable
4.2.2.5b		Applicable
	4.2.2.6 Temperature range	
4.2.2.6a	Commercial parts shall be selected in the highest available temperature range.	New
4.2.2.6b	A minimum 10 °C margin shall be used between the maximum manufacturer temperature range and the application temperature range (including worst cases).	New
4.2.2.6c	In case |(manufacturer max temperature range – used max temp)| < 10 °C, an electrical characterisation shall be performed at used temperature with an additional margin of 10 °C during the evaluation step. NOTE 1 Example: for a manufacturer -40°C/+85°C temperature range with an application up to +80°C, then an electrical characterisation is performed at +90°C. NOTE 2 Example for a manufacturer -40°C/+85°C temperature range with an application down to -35°C, then an electrical characterisation is performed at -45°C.	New

4.2.3 Component evaluation		
4.2.3.1 General		
4.2.3.1a		Applicable
4.2.3.1b		Applicable
4.2.3.1c		Applicable
4.2.3.1d		Applicable
4.2.3.1e		Applicable
4.2.3.1f		Applicable
4.2.3.1g		Applicable
4.2.3.1h		Applicable
4.2.3.1i	The supplier shall review the evaluation results to determine their impact on the content of the screening and lot acceptance tests.	Modified
4.2.3.1j		Applicable
4.2.3.1k	The supplier shall prepare a preliminary internal supplier's specification for electrical testing during evaluation tests.	New
4.2.3.1l	The supplier specification specified in 4.2.3.1k shall as minimum include tested parameters, test conditions, acceptance criteria, drift limits.	New
4.2.3.1m	The supplier shall update the internal supplier's specification used for screening and lot acceptance in accordance with the results of evaluation testing.	New
4.2.3.1n	The preliminary and the final internal supplier's specification as specificed in Annex C shall be submitted to the customer for approval.	New
4.2.3.2 Component manufacturer assessment		
4.2.3.2.1		Not applicable See 4.2.2.1.g
4.2.3.2.2a		Not applicable See 4.2.2.1.g
4.2.3.2.2b		Not applicable See 4.2.2.1.g
4.2.3.3. Construction analysis		
4.2.3.3a		Applicable
4.2.3.3b	The Construction analysis shall be documented by a procedure to be sent to the customer for approval. NOTE Annex H provides guidelines for such procedure.	Modified
4.2.3.3c		Applicable

4.2.3.4 Evaluation testing		
4.2.3.4a		Applicable
4.2.3.4b		Applicable
4.2.3.4c	Evaluation tests shall be performed as specified in Figure 4-1 and Table 4-1.	New
4.2.3.4d	Omission of any of the elements of tests specified in Figure 4-1 and Table 4-1, or the introduction of alternative activities, shall be justified in the JD. NOTE For mounting process (including baking for PED), see ECSS-Q-ST-70-38 and ECSS-Q-ST-70-08.	New
4.2.3.4e	Evaluation of retinned components shall be performed as specified in Figure 8-1 from the requirement 8.1a.	New



(1) : for the evaluation of retinned components, see Figure 8-1
(2) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(3) : applicable in case of cavity package
(4) : applicable to plastic package only
(5) : applicable to hermetic & cavity package

Figure 4-1: Evaluation tests flow chart for Class 1 components

Table 4-1: Evaluation Tests for Class 1 components

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
1	Construction analysis	5 parts	As per clause 4.2.2.3 See Annex H	-
2	Electrical characterization	10 parts min	Electrical test under 3 T° (min, typ, max) or at using range +10 °C (whichever is higher as per 4.2.2.6).	Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
3	External visual inspection	10 parts min	ESCC 2055000 ESCC 2059000	
4	Mechanical shocks	10 parts min	MIL STD 883 TM 2002 condition B - 50 pulses (per orientation) instead of 5 pulses (per orientation). MIL-STD-750 TM 2016, 1500g, 0,5ms duration - 50 shocks instead of 5 shocks, planes X1, Y1 and Z1.	Applicable to cavity package. Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
	Vibrations		MIL-STD-883, TM 2007 condition A - 120 times (total) instead of 12 times (total) MIL-STD-750, TM 2056, 20g, 10-2000Hz, cross over at 50Hz - 120 times (total) instead of 12 times (total).	
	Constant acceleration		MIL-STD-883, TM 2001 condition E (resultant centrifugal acceleration to be in the Y1 axis only). For components which have a package weight of 5 grammes or more, or whose inner seal or cavity perimeter is more than 5 cm, Condition D shall be used MIL-STD-750, TM 2006, 20000g, planes X1, Y1 and Y2.	
5	Preconditioning + 96h HAST (or 1000h THB 85/85)	10 parts min	HAST 96h-130°C-85% RH (JESD22-A110 with continuous bias) or THB (JESD22-A101) Initial and final electrical test at 25°C (parameter & functional) Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Applicable to plastic package. Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
6	C-SAM	10 parts min	JEDEC J-STD-020	To be done on the 10 parts of step 7 after the electrical test at 25°C and before preconditioning. C-SAM test only applicable to plastic package.

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
7	Preconditioning + Thermal Cycling	10 parts min	500 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less) MIL-STD-750. method 1051 cond.B MIL-STD-883 method 1010 cond.B Initial, intermediate (100 T/C) and final electrical tests at 25°C (parameter & functional). Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Preconditioning applicable to plastic package only. Read & record for electrical tests as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
8	Seal test	10 parts min	MIL-STD-883 TM 1014 condition A or B (fine leak) and condition C (gross leak). MIL-STD-750 TM 1071 condition H1 or H2 (fine leak) and condition C or K (gross leak with cavity) or condition E (gross leak without cavity).	Applicable to hermetic & cavity package.
9	Lifetest 2000h-125°C minimum	10 parts min	MIL-STD-750 method 1026 & 1042 MIL-STD-883 method 1005 cond.D Initial, intermediate (1000h) and final electrical tests at 3 T° (min, typ, max) (parameter & functional).	The lifetest duration shall be 2000h at minimum 125°C. In case of a temperature lower than 125°C, the lifetest duration is extended i.a.w. MIL-STD-883 method 1005. Read & record for electrical tests. as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
10	DPA	3 parts	As per clause 4.3.9 see Annex H.	To be done on 3 parts after lifetest (as per above step 4).
11	Radiation evaluation	i.a.w. ECSS-Q-ST-60-15	See ECSS-Q-ST-60-15	-

	4.2.4 Parts approval	
4.2.4a		Applicable
4.2.4b		Applicable
4.2.4c		Applicable
4.2.4d	Prior to procurement of components (or before equipment CDR, at the latest), the approval process by the customer shall be organized as follows:	Modified
	1.	Not applicable
	2.	Not applicable
	3. A Justification Document is required in accordance with Annex F.	Modified
	4.	Applicable
4.2.4e	In case the evaluation results are changing the testing conditions documented in the JD, a new revision of JD shall be submitted to the customer for approval.	Modified
4.3 Component procurement		
	4.3.1 General	
4.3.1a		Applicable
4.3.1b		Not applicable
4.3.1c		Not applicable
4.3.1d		Applicable
4.3.1e		Applicable
4.3.1f		Applicable
4.3.1g		Applicable
4.3.1h		Applicable
4.3.1i	Each procured EEE part shall be traceable to a manufacturer assigned trace code. NOTE The procurement of a single trace code per delivery lot should be preferred and encouraged.	New
4.3.1j	Each trace code shall be maintained as is through the entire supply chain including distributor. NOTE As far as possible, commercial parts should be ordered in the manufacturer's standard packing quantities or multiples thereof to avoid distributor re-packing and handling and to preserve the traceability information usually included on the original manufacturer packaging.	New

4.3.1k	The supplier shall ensure that the elements of the JD in accordance with Annex F, including any action plan, are applicable to flight parts.	New
4.3.2. Procurement specification		
4.3.2a	The supplier shall procure EEE components according to controlled specifications. NOTE It can be procurer's in-house specification, a manufacturer's drawing or a datasheet as a minimum.	Modified
4.3.2b		Not applicable
4.3.2c		Not applicable
4.3.2d		Not applicable
4.3.2e		Applicable
4.3.2f		Applicable
4.3.2g		Applicable
4.3.2h	If additional requirements to the manufacturer are identified by the supplier, they shall be specified in the procurement specification, in conformance with DRD from Annex C.	New
4.3.3. Screening requirements		
4.3.3a		Applicable
4.3.3b		Applicable
4.3.3c		Applicable
4.3.3d	For commercial parts, screening tests shall be performed in accordance with Table 4-2.	Modified
4.3.3e		Applicable
4.3.3f		Applicable
4.3.3g		Applicable
4.3.3h		Applicable

Table 4-2: Screening tests for Class 1 components

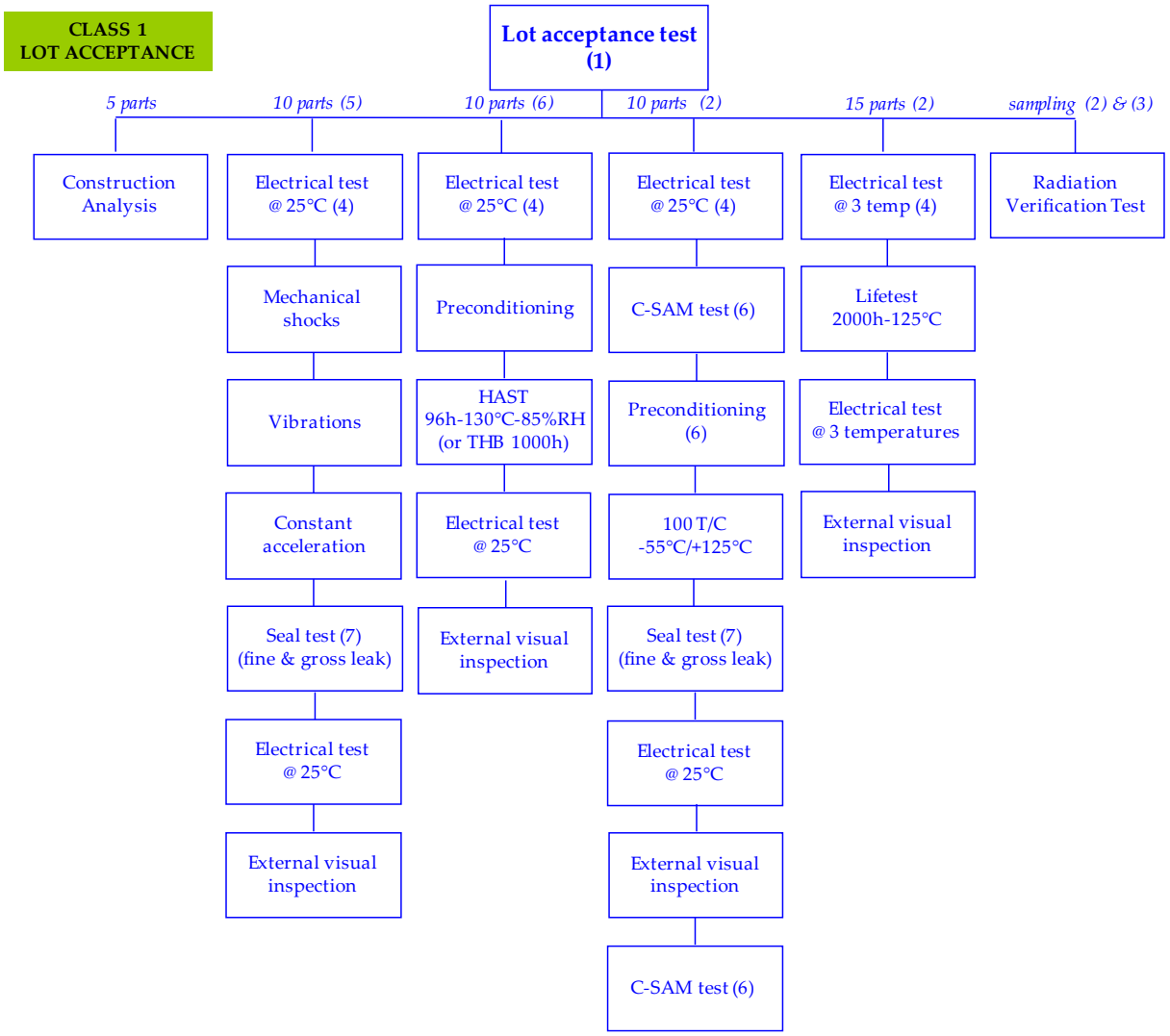
	TEST	SAMPLING	METHOD	COMMENTS
1	X-rays	100%	MIL-STD-750 method 2076 MIL-STD-883 method 2012.	Deposited total dose shall be< 1/10 of product acceptable dose.
2	Serialization	100%	Defined by the supplier.	-
3	Temperature cycling	100%	10 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less).	-

	TEST	SAMPLING	METHOD	COMMENTS
			MIL-STD-750 method 1051 MIL-STD-883 method 1010	
4	PIND test	100%	MIL-STD-750 method 2052 cond.A MIL-STD-883 method 2020 cond.A	Applicable to cavity package only.
5	Initial electrical test	100%	Electrical test (para-metrical and functional) at 25°C as per the internal supplier's specification.	Read & record on selected parameters as per the internal supplier's specification (see 4.2.3.1.k).
6	Burn-in	100%	MIL-STD-750 method 1038 & 1039 MIL-STd-883 method 1015 cond.B 240h – 125°C or 445h – 105°C or 885h – 85°C	Temperature shall be < Tjmax-10°C and Tg-10°C whichever is lower. In absence of Tj or Tg knowledge, 105°C max is required. Ea = 0,4eV for equivalence calculation unless a different value has been demonstrated for the product. Termination oxidation risk shall be controlled after burn-in. For discrete, HTRB and power burn-in depend on product family.
7	Final electrical test	100%	Electrical test (para-metrical and functional) at 3 temp. as per the internal supplier's specification.	Read & record on selected parameters as per the internal supplier's specification (see 4.2.3.1k).
8	PDA	-	On steps 5 and 7. Max acceptable PDA: 5%	PDA calculation applies to room temperature measurement only.
9	Seal test	100%	MIL-STD-750 method 1071 cond H1 or H2 and C or K.	Applicable to hermetic & cavity package only.

	TEST	SAMPLING	METHOD	COMMENTS
			MIL-STD-883 method 1014 cond A or B and C.	
10	External visual inspection	100%	MIL-STD-750 method 2071 MIL-STD-883 method 2009	The MIL specs are not adapted to visual inspection of plastic encapsulated components, but can be used as reference (mainly for connection corrosion and marking acceptance). In addition, for plastic packages, inspect for the following defects: Package deformation/ Foreign inclusions in the package, voids and cracks in the plastic/ deformed leads.

4.3.4 Initial customer source inspection (precap)		
4.3.4a		Not applicable
4.3.4b		Not applicable
4.3.4c		Not applicable
4.3.5 Lot acceptance		
4.3.5a	The supplier shall ensure that each trace code of EEE parts is submitted to a lot acceptance procedure specified in Figure 4-2 and Table 4-3 according to the following rules:	Modified
	1.	Not applicable
	2.	Not applicable
	3. Commercial components: (a) Each trace code is submitted to lot acceptance as specified in Table 4-3. (b) The proposed lot acceptance is approved through the approval process in accordance with the clause 4.2.4. (c) Omission of any of these elements, or the introduction of alternative tests, is justified in the JD.	Modified

	(d) If evaluation test is performed directly on flight lot (and if in conformance with lot acceptance and screening requirements), evaluation data can be used as lot acceptance. (e) The lot acceptance report is sent to the customer, on request, for information.	
4.3.5b		Not applicable
4.3.5c	Lot acceptance of retinned components shall be performed as specified in Figure 8-2, from the requirement 8.1a.	New



(1) : for the lot acceptance of retinned components, see Figure 8-2
(2) : screened parts
(3) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(4) : this test is optional to avoid possible duplication with screening (when done by the same entity)
(5) : applicable in case of cavity package
(6) : applicable to plastic package only
(7) : applicable to hermetic & cavity package

Figure 4-2: Lot acceptance tests flow chart for Class 1 components

Table 4-3: Lot acceptance tests for Class 1 components

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
1	Construction analysis	5 parts	As per clause 4.2.3.3 see Annex H.	-
2	Mechanical shocks	10 parts min	MIL STD 883 TM 2002 condition B - 50 pulses (per orientation) instead of 5 pulses (per orientation). MIL-STD-750 TM 2016, 1500g, 0,5ms duration - 50 shocks instead of 5 shocks, planes X1, Y1 and Z1.	Applicable to cavity package. Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
	Vibrations		MIL-STD-883, TM 2007 condition A - 120 times (total) instead of 12 times (total). MIL-STD-750, TM 2056, 20g, 10-2000Hz, cross over at 50Hz - 120 times (total) instead of 12 times (total).	
	Constant acceleration		MIL-STD-883, TM 2001 condition E (resultant centrifugal acceleration to be in the Y1 axis only). For components which have a package weight of 5 grammes or more, or whose inner seal or cavity perimeter is more than 5 cm, Condition D shall be used. MIL-STD-750, TM 2006, 20000g, planes X1, Y1 and Y2.	
3	Preconditioning + 96h HAST (or 1000h THB 85/85)	10 parts 0 defect accepted	HAST 96h-130°C-85%RH (JESD22-A110 with continuous bias) or THB (JESD22-A101). Electrical test (para-metrical and functional) at 25°C as per the internal supplier's specification. Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Applicable to plastic package. Internal supplier's specification (see 4.2.3.1k)

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
4	C-SAM	10 parts	JEDEC J-STD-020	To be done on the 10 parts of step 5 after the electrical test at 25°C and before preconditioning. C-SAM test only applicable to plastic package.
5	Preconditioning + Thermal Cycling [1]	10 parts 0 defect accepted	100 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less) MIL-STD-750 method 1051 cond.B MIL-STD-883 method 1010 cond.B Electrical test (para-metrical and functional) at 25°C as per the internal supplier's specification. Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Preconditioning applicable to plastic package only. Internal supplier's specification (see 4.2.3.1k)
6	Seal test	10 parts min	MIL-STD-883 TM 1014 condition A or B (fine leak) and condition C (gross leak). MIL-STD-750 TM 1071 condition H1 or H2 (fine leak) and condition C or K (gross leak with cavity) or condition E (gross leak without cavity).	Applicable to hermetic & cavity package.
7	C-SAM	10 parts	JEDEC J-STD-020	To be done on the 10 parts of step 5 after thermal cycling and the electrical test at 25°C. C-SAM test only applicable to plastic package.
8	Lifetest [1]	15 parts 0 defect accepted	2000h – 125°C minimum MIL-STD-750 method 1026 or 1042 MIL-STD-883 method 1005 cond.D	The lifetest duration shall be 2000h at minimum 125°C. In case of a temperature lower than 125°C, the

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
			Initial, intermediate (1000h) and final electrical test (parametrical and functional) at 3 temp as per the internal supplier's specification	lifetest duration is extended i.a.w. MIL-STD-883 method 1005. Can be reduced to 1000h if data 2000h are available (DC less than 2 years) and no technology change occurred. Read & record and drift calculation on selected parameters as per the internal supplier's specification (see 4.2.3.1k).
9	External visual inspection	10 parts min	ESCC 2055000 ESCC 2059000	
10	Radiation Verification Test [1]	i.a.w. ECSS-Q-ST-60-15	See ECSS-Q-ST-60-15	-
[1] : Lifetest, thermal cycling and radiation verification test are performed on screened parts (see 4.3.3).				

4.3.6 Final customer source inspection (buy-off)		
4.3.6a		Not applicable
4.3.6b		Not applicable
4.3.6c	For commercial parts, the buy off shall be replaced by an incoming inspection at the procurement entity's facility reported in the JD in accordance with clause 4.3.7.	Modified
4.3.6d		Not applicable
4.3.7 Incoming inspection		
4.3.7a		Applicable
4.3.7b		Applicable
4.3.7c		Applicable
4.3.7d		Not applicable
4.3.7e		Applicable

4.3.8 Radiation verification testing		
4.3.8a		Applicable
4.3.8b		Applicable
4.3.8c		Not applicable
4.3.8d		Applicable
4.3.8e		Applicable
4.3.8f	Parts submitted to RVT shall be first screened as specified in the clause 4.3.3 to be fully representative of flight parts.	New
4.3.9 Destructive physical analysis		
4.3.9a	The DPA shall be performed on 3 samples per lot of commercial parts during evaluation after lifetest as specified in the clause 4.2.3.4 and after relifing as specified in the clause 4.3.10. NOTE Annex H provides guidelines for the construction analysis and descrtictive physical analysis.	Modified
4.3.9b		Not applicable
4.3.9c		Not applicable
4.3.9d		Not applicable
4.3.9e	The DPA process shall be documented by a procedure to be sent, on request, to the customer for review. NOTE Annex H provides guidelines for the construction analysis and destructive physical analysis.	Modified
4.3.9f		Applicable
4.3.9g		Applicable
4.3.9h		Not applicable
4.3.9i		Applicable
4.3.9j		Applicable
4.3.9k	A DPA shall be conducted during relifing in accordance with clause 4.3.10.	New
4.3.10 Relifing		
4.3.10a		Applicable
4.3.10b	For components meeting the criteria specified in the requirement 4.3.10a, and which have a lot / date code exceeding 7 years, the relifing procedure ECSS-Q-ST-60-14 shall apply to the lot.	Modified
4.3.10c	Humidity test and lifetest shall be performed in accordance with the clause 4.3.5 in case these tests have not been performed on the lot during the evaluation or the procurement phase. NOTE Humidity test includes HAST or THB.	New

4.3.10d	As part of the relifing process, a DPA on 3 pieces shall be performed on each lot in accordance with the clause 4.3.9.	New
	4.3.11 Manufacturer's data documentation deliveries	
4.3.11a	The manufacturer's or the franchised distributor's CoC shall be delivered to the parts procurer.	Modified
4.3.11b	Any other data, defined in the procurement documents, shall be delivered to the parts' procurer in line with the purchase order.	Modified
4.3.11c	The parts procurer shall store the documentation for a minimum of 10 years after receiption of the components.	Modified
	4.4 Handling and storage	
4.4a		Applicable
4.4b		Applicable
4.4c		Applicable
4.4d		Applicable
4.4e	Plastic encapsulated devices shall be stored in one of the following conditions: 1. Dry Nitrogen 2. Dry and ionised air, with RH in a range of 15% to 20% 3. Dry packs as specified in J-STD-033 for dry pack inspection and control	New
	4.5 Components quality assurance	
	4.5.1 General	
4.5.1a		Applicable
	4.5.2 Nonconformances or failures	
4.5.2a		Applicable
4.5.2b		Applicable
4.5.2c		Applicable
4.5.2d		Applicable
	4.5.3 Alerts	
4.5.3a		Applicable
4.5.3b		Applicable
4.5.3c		Applicable
	4.5.4 Traceability	
4.5.4a		Applicable
4.5.4b		Applicable
4.5.4c		Applicable

4.5.4d	The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer's trace code number of the EEE parts actually mounted.	Modified
4.5.4e	If the as built DCL has not yet been delivered, the supplier shall be able to provide this information (part type actually installed with its relevant trace code number) within one week.	Modified
	4.5.5 Lot homogeneity for sampling test	
4.5.5a	If tests are performed by sampling, the sampled parts shall be selected so that they are representative of the trace code distribution.	Modified
4.5.5b		Applicable
	4.6 Specific components	
	4.6.1 General	
4.6.1a	<<deleted>>	Deleted
	4.6.2 ASICs	
4.6.2a		Applicable
	4.6.3 Hybrids	
4.6.3a		Not applicable
4.6.3b		Not applicable
4.6.3c		Not applicable
	4.6.4 One time programmable devices	
4.6.4a		Applicable
4.6.4b	The JD shall allow traceability to the information related to the procurement of blank parts, the programming process and the acceptance of the programmed parts. NOTE The programming process and the acceptance of the programmed parts may be part of PCB, for customer approval, if not indicated in the JD.	Modified
4.6.4c	<<deleted>>	Deleted
4.6.4d		Applicable
4.6.4e		Applicable
4.6.4f		Applicable
4.6.4g		Applicable
4.6.4h		Applicable
	4.6.5 Microwave monolithic integrated circuits	
4.6.5a		Not applicable

4.7 Documentation

4.7a	Any result from inspection or control shall be documented (including lot acceptance, incoming, relifing and complementary tests).	Modified

Table 4-4: Documentation for Class 1 components

Document	Clause	Customer	Comments
New *:* RFD	4.2.2.2	Approval	For pure tin termination
New *:* Procedure for hot solder dip process	4.2.2.2	Approval	For retinning operation
New *:* Internal supplier's specification	4.2.3.1.i	Approval	Applicable to the preliminary and final internal supplier's specification
PAD : not applicable	4.2.4	-	-
New *:* Justification Document	4.2.4	Approval	-
Procedure for customer precap : not applicable	4.3.4	-	-
New *:* Procedure for construction analysis	4.2.3.3	Approval	-
New *:* Lot acceptance report	4.3.5	Information (on request)	-

5
Requirements for class 2 components

5.1 Components programme management		
	5.1.1. General	
5.1.1a		Applicable
	5.1.2 Components control programme	
	5.1.2.1 Organization	
5.1.2.1a		Applicable
	5.1.2.2 Component control plan	
5.1.2.2a		Applicable
5.1.2.2b		Applicable
	5.1.3 Parts control board	
5.1.3a		Applicable
5.1.3b		Applicable
5.1.3c		Applicable
5.1.3d		Applicable
	5.1.4. Declared component list	
5.1.4a		Applicable
5.1.4b		Applicable
5.1.4c		Applicable
5.1.4d	After equipment CDR, all modifications affecting the JD information shall be implemented, in the "as design" DCL, through the CN / CR process and submitted to the customer for approval. NOTE For JD generation, see 5.2.4.d.	Modified
5.1.4e		Applicable
5.1.4f		Applicable
5.1.4g		Applicable
5.1.4h		Applicable

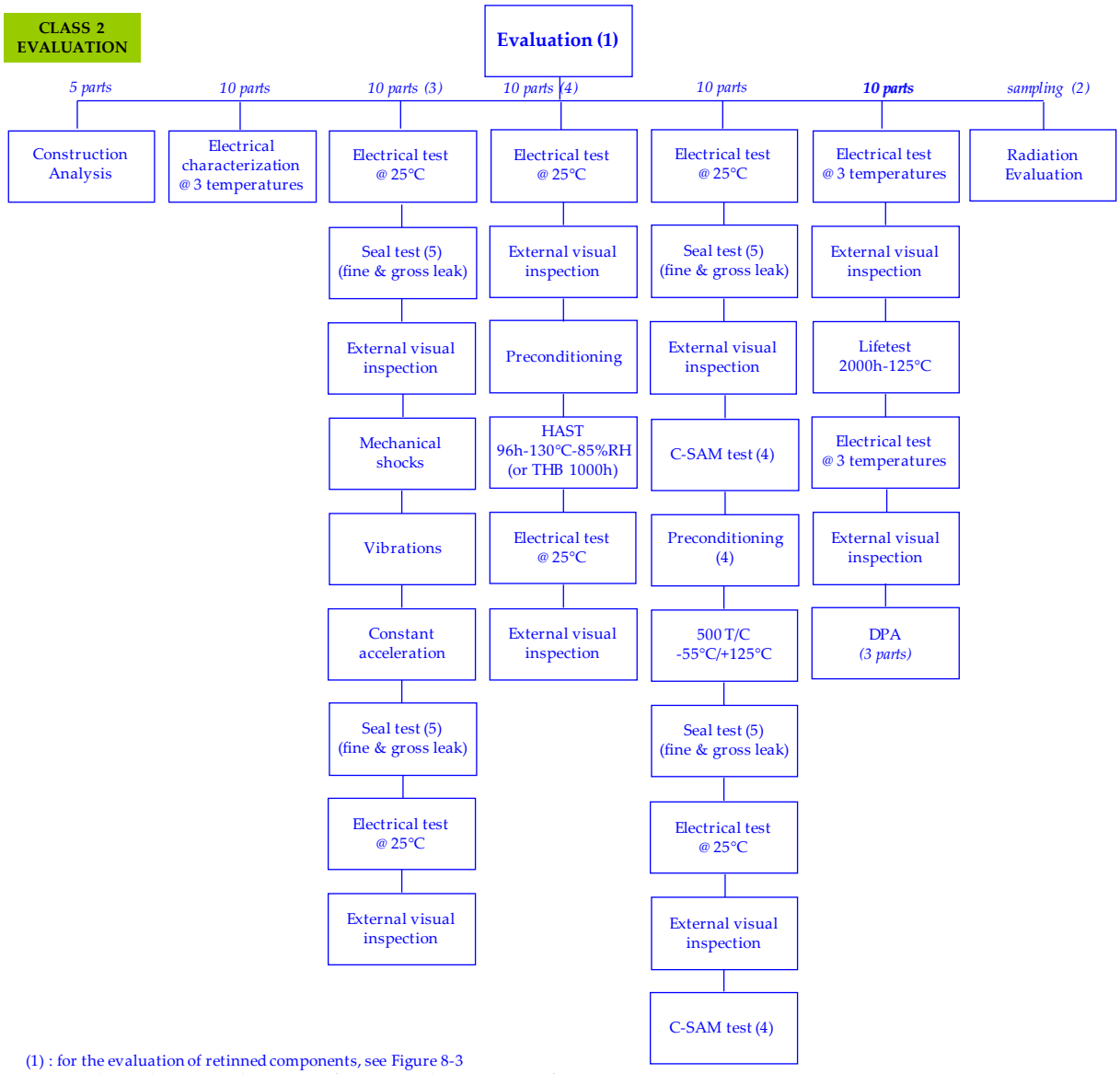
5.1.5. Electrical and mechanical GSE		
5.1.5a		Applicable
5.1.5b		Applicable
5.2 Component selection, evaluation and approval		
5.2.1 General		
5.2.1a		Applicable
5.2.1b		Applicable
5.2.2. Manufacturer and component selection		
5.2.2.1 General rules		
5.2.2.1a		Applicable
5.2.2.1b		Applicable
5.2.2.1c		Applicable
5.2.2.1d		Applicable
5.2.2.1e	For the assessment of commercial components, the supplier shall collect the available data on the manufacturer and the component in the JD. Specified in the requirement 5.2.4.d. NOTE It is important to check the exhaustiveness of the manufacturer documentation & data sheet with respect to the following items: • component marking, • mechanical description, • electrical and thermal description	New
5.2.2.1f	For Deep Sub-Micron Technologies (<90nm), the detailed test definition shall identify the technology through the construction analysis and the application. NOTE 1 It is important to ensure that the test conditions remain as close as possible to application. NOTE 2 This requirement is important due to the specificities of Deep Sub-Micron Technologies (<90nm).	New
5.2.2.2. Parts and material restriction		
5.2.2.2a		Applicable
5.2.2.2b		Applicable
5.2.2.2c		Applicable
5.2.2.2d	For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used:	Modified
	1. EEE components with pure tin (less than 3% Pb in case of	Modified

	SnPb alloy) used as a finish on the leads, terminations and external surfaces of components and packages. NOTE For EEE components with pure tin, see also requirements 5.2.2.2h and 5.2.2.2i. 2. Hollow core resistors 3. Potentiometers (except for mechanism position monitoring) 4. Non-metallurgically bonded diodes 5. Semiconductor dice with unglassivated active area 6. Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case 7. Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions 8. Wire link fuses < 5A 9. TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside	
5.2.2.2e		Applicable
5.2.2.2f		Applicable
5.2.2.2g		Applicable
5.2.2.2h	The use of pure tin (inside or outside the part) shall be declared in the JD.	Modified
5.2.2.2i	To assess Pb free with tin finish whisker risk, the following actions shall be performed by the supplier: 1. In order to verify information from manufacturer (included in the JD), as part of the incoming inspection, check the lead finish of all procured lots as per ESCC 25500 basic specification. 2. When confirmed during incoming, access individually each use of pure tin termination through a RFD. 3. Collect and synthesize all information participating to the risk analysis in conformance with the Clause 9. 4. Based on the risk analysis, elaborate a mitigation plan, submitted to the customer for approval. 5. Include into the mitigation plan one or a combination of the following solutions (not limited to): (a) Retinning of terminations with complementary evaluation in conformance with Figure 8-3 from the requirement 8.1a, and lot acceptance test in conformance with Figure 8-4 from the requirement 8.1a. NOTE Solder dip for tin whisker mitigation	New

	differs from solder dip for solderability in that for tin whisker mitigation, it is required that the termination is coated over its entire length, right up to the package surface (no stand off). (b) In case of both retinning and screening, perform the screening on retinned components. (c) Tin whisker sensitivity evaluation. (d) Conformal coating. (e) Design modification. 6. In case of retinning of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval. 7. Through RFD submit the mitigation plan and results for the customer approval.	
	5.2.2.3 Radiation hardness	
5.2.2.3a		Applicable
5.2.2.3b		Applicable
5.2.2.3c		Applicable
5.2.2.3d		Applicable
5.2.2.3e		Applicable
5.2.2.3f		Applicable
5.2.2.3g		Applicable
5.2.2.3h		Applicable
5.2.2.3i		Applicable
	5.2.2.4 Derating	
5.2.2.4a		Applicable
5.2.2.4b		Applicable
	5.2.2.5 Preferred sources	
5.2.2.5.a		Applicable
	5.2.2.6 Temperature range	
5.2.2.6a	Commercial parts shall be selected in the highest available temperature range.	New
5.2.2.6b	A minimum 10°C margin shall be used between the maximum manufacturer temperature range and the application temperature range (including worst cases).	New
5.2.2.6c	In case |(manufacturer max temperature range – used max temp)|< 10°C, an electrical characterisation shall be performed at used temperature with an additional margin of 10°C during the evaluation	New

	step. NOTE 1 Example: for a manufacturer -40°C/+85°C temperature range with an application up to +80°C, then an electrical characterisation is performed at +90°C. NOTE 2 Example for a manufacturer -40°C/+85°C temperature range with an application down to -35°C, then an electrical characterisation is performed at -45°C.	
	5.2.3 Component evaluation	
	5.2.3.1 General	
5.2.3.1a		Applicable
5.2.3.1b		Applicable
5.2.3.1c		Applicable
5.2.3.1d		Applicable
5.2.3.1e		Applicable
5.2.3.1f		Applicable
5.2.3.1g		Applicable
5.2.3.1h		Applicable
5.2.3.1i	The supplier shall review the evaluation results to determine their impact on the content of the screening and lot acceptance tests.	Modified
5.2.3.1j		Applicable
5.2.3.1k	The supplier shall prepare a preliminary internal supplier's specification for electrical testing during evaluation tests.	New
5.2.3.1l	The supplier specification specified in 5.2.3.1k shall as minimum include test parameters, test conditions, acceptance criteria, drift limits.	New
5.2.3.1m	The supplier shall update the internal supplier's specification used for screening and lot acceptance in accordance with the results of evaluation testing.	New
5.2.3.1n	The preliminary and the final internal supplier's specification as specified in Annex C shall be submitted to the customer for approval.	New
	5.2.3.2 Component manufacturer assessment	
5.2.3.2a		Not applicable See 5.2.2.1.e.
	5.2.3.3. Construction analysis	
5.2.3.3a		Applicable
5.2.3.3b	The Construction analysis shall be documented by a procedure to be sent to the customer for approval. NOTE Annex H provides guidelines for such procedure.	Modified

5.2.3.3c		Applicable
	5.2.3.4. Evaluation testing	
5.2.3.4a		Applicable
5.2.3.4b		Applicable
5.2.3.4c	Evaluation tests shall be performed as specified in Figure 5-1 and Table 5-1.	New
5.2.3.4d	Omission of any of the elements of tests specified in Figure 5-1 and Table 5-1, or the introduction of alternative activities, shall be justified in the JD. NOTE For mounting process (including baking for PED), see ECSS-Q-ST-70-38 and ECSS-Q-ST-70-08.	New
5.2.3.4e	Evaluation of retinned components shall be performed as specified in Figure 8-3 from the requirement 8.1a.	New



(1) : for the evaluation of retinned components, see Figure 8-3
(2) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(3) : applicable in case of cavity package
(4) : applicable to plastic package only
(5) : applicable to hermetic & cavity package

Figure 5-1: Evaluation Tests flow charts for Class 2 components

Table 5-1: Evaluation Tests for Class 2 components

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
1	Construction analysis	5 parts	As per clause 4.2.2.3 See Annex H	-
2	Electrical characterization	10 parts min	Electrical test under 3 T° (min, typ, max) or at using range +10 °C (whichever is higher as per 4.2.2.6).	Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
3	External visual inspection	10 parts min	ESCC 2055000 ESCC 2059000	
4	Mechanical shocks	10 parts min	MIL STD 883 TM 2002 condition B - 50 pulses (per orientation) instead of 5 pulses (per orientation). MIL-STD-750 TM 2016, 1500g, 0,5ms duration - 50 shocks instead of 5 shocks, planes X1, Y1 and Z1.	Applicable to cavity package. Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
	Vibrations		MIL-STD-883, TM 2007 condition A - 120 times (total) instead of 12 times (total). MIL-STD-750, TM 2056, 20g, 10-2000Hz, cross over at 50Hz - 120 times (total) instead of 12 times (total).	
	Constant acceleration		MIL-STD-883, TM 2001 condition E (resultant centrifugal acceleration to be in the Y1 axis only). For components which have a package weight of 5 grammes or more, or whose inner seal or cavity perimeter is more than 5 cm, Condition D shall be used. MIL-STD-750, TM 2006, 20000g, planes X1, Y1 and Y2.	

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
5	Preconditioning + 96h HAST (or 1000h THB 85/85)	10 parts min	HAST 96h-130°C-85%RH (JESD22-A110 with continuous bias) or THB (JESD22-A101) Initial and final electrical test at 25°C (parameter & functional) Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Applicable to plastic package. Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
6	C-SAM	10 parts min	JEDEC J-STD-020	To be done on the 10 parts of step 7 after the electrical test at 25°C and before preconditioning. C-SAM test only applicable to plastic package.
7	Preconditioning + Thermal Cycling	10 parts min	500 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less) MIL-STD-750. method 1051 cond.B MIL-STD-883 method 1010 cond.B Initial, intermediate (100 T/C) and final electrical tests at 25°C (parameter & functional). Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Preconditioning applicable to plastic package only. Read & record for electrical tests as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
8	Seal test	10 parts min	MIL-STD-883 TM 1014 condition A or B (fine leak) and condition C (gross leak). MIL-STD-750 TM 1071 condition H1 or H2 (fine leak) and condition C or K (gross leak with cavity) or condition E (gross leak without cavity).	Applicable to hermetic & cavity package.
9	Lifetest 2000h-125°C minimum	10 parts min	MIL-STD-750 method 1026 & 1042. MIL-STD-883 method 1005 cond.D Initial, intermediate (1000h) and final electrical tests at 3 T° (min, typ, max)	The lifetest duration shall be 2000h at minimum 125°C. In case of a temperature lower than 125°C, the

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
			(parameter & functional).	lifetest duration is extended i.a.w. MIL-STD-883 method 1005. Read & record for electrical tests. as per the preliminary issue of the internal supplier's specification (see 4.2.3.1.k).
10	DPA	3 parts	As per clause 4.3.9 see Annex H.	To be done on 3 parts after lifetest (as per above step 4).
11	Radiation evaluation	i.a.w. ECSS-Q-ST-60-15	See ECSS-Q-ST-60-15	-

5.2.4 Parts approval		
5.2.4a		Applicable
5.2.4b		Applicable
5.2.4c		Applicable
5.2.4d	Prior to procurement of components (or before equipment CDR, at the latest), the approval process by the customer shall be organized as follows:	Modified
	1	Not applicable
	2	Not applicable
	3	Not applicable
	4. A Justification Document is required in accordance with annex F.	Modified
5.2.4e	In case the evaluation results are changing the testing conditions documented in the JD, a new revision of JD shall be submitted to the customer for approval.	Modified
5.3 Component procurement		
5.3.1 General		
5.3.1a		Applicable
5.3.1b		Not applicable
5.3.1c		Not applicable
5.3.1d		Applicable

5.3.1e		Applicable
5.3.1f		Applicable
5.3.1g		Applicable
5.3.1h		Applicable
5.3.1i	Each procured EEE part shall be traceable to a manufacturer assigned trace code. NOTE The procurement of a single trace code per delivery lot should be preferred and encouraged.	New
5.3.1j	Each trace code shall be maintained as is through the entire supply chain including distributor. NOTE As far as possible, commercial parts should be ordered in the manufacturer's standard packing quantities or multiples thereof to avoid distributor re-packing and handling and to preserve the traceability information usually included on the original manufacturer packaging.	New
5.3.1k	The supplier shall ensure that the elements of the JD in accordance with Annex F, including any action plan, are applicable to flight parts.	New
5.3.2 Procurement specification		
5.3.2a	The supplier shall procure EEE components according to controlled specifications. NOTE It can be procurer's in-house specification, a manufacturer's drawing or a datasheet as a minimum.	Modified
5.3.2b		Not applicable
5.3.2c		Not applicable
5.3.2d		Not applicable
5.3.2e		Applicable
5.3.2f		Applicable
5.3.2g		Applicable
5.3.2h	If aditional requirements to the manufacturer are identified, they shall be specified in the procurement specification.	New
5.3.3 Screening requirements		
5.3.3a		Applicable
5.3.3b		Applicable
5.3.3c		Applicable
5.3.3d	For commercial parts, screening tests shall be performed in	Modified

	accordance with Table 5-2.	
5.3.3e		Applicable
5.3.3f		Applicable
5.3.3g		Applicable
5.3.3h		Applicable
5.3.3.i	Based on data from the evaluation tests in conformance with the requirement 5.2.3.4 and data collected in the JD, the supplier may propose a modification of the screening flow of table 5-2, to be submitted to customer for approval. NOTE Data collected in the JD includes EFR, life test, thermal cycling.	New
5.3.3.j	If modification of 5.3.3f is proposed to the customer, it shall meet the following similarity criteria: 1. For EFR, either: (a) the data are as the same die revision, wafer fab, process and package. (b) the data are not provided, but in this case the data on the same part type is not older than two years w.r.t date code. 2. For lifetest, either: (a) the data are as the same die revision, wafer fab, process and pacakge. (b) the data are not provided, but in this case the data on the same part type is not older thant two years w.r.t date code. 3. For thermal cycles the data are on same package.	New
5.3.3.k	100% Pind test and 100% hermeticity test (when applicable) shall not be tailored out of the screening flow.	New
5.3.3.l	100% external visual inspection shall be performed in case of any test done during screening or in case of retinning.	New

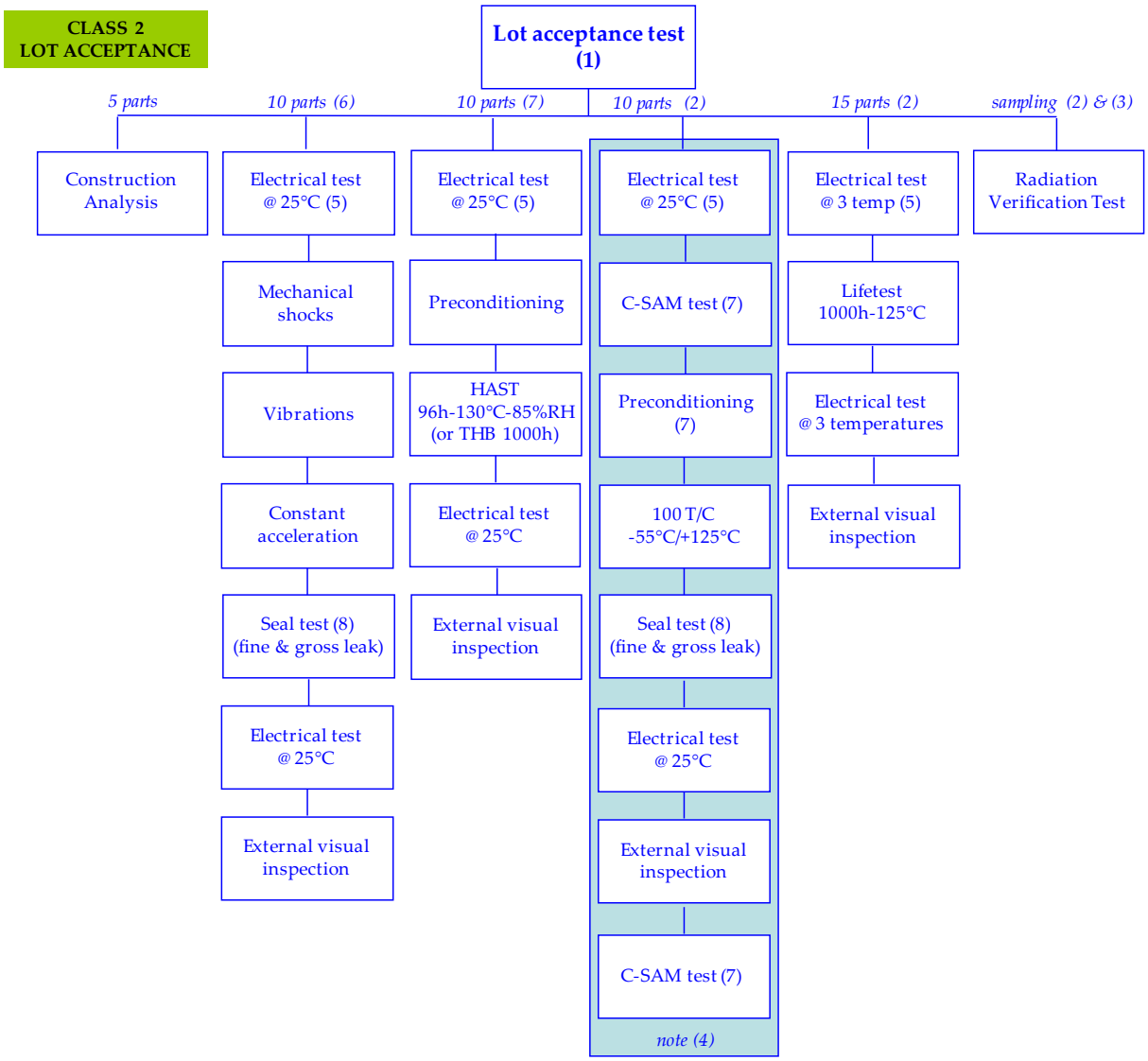
Table 5-2: Screening tests for the Class 2 components

	TEST	SAMPLING	METHOD	COMMENTS
1	Serialization	100%	Defined by the supplier.	-
2	Temperature cycling	100%	10 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less). MIL-STD-750 method 1051 MIL-STD-883 method 1010	-
3	PIND test	100%	MIL-STD-750 method 2052 cond.A MIL-STD-883 method 2020 cond.A	Applicable to cavity package only.
4	Initial electrical test	100%	Electrical test (parametrical and functional) at 25°C as per the internal supplier's specification.	Read & record on selected parameters as per the internal supplier's specification (see 5.2.3.1k).
5	Burn-in	100%	MIL-STD-750 method 1038 & 1039 MIL-STD-883 method 1015 cond.B 160h – 125°C or 300h – 105°C or 590h – 85°C	Temperature shall be < Tjmax-10°C and Tg-10°C whichever is lower. In absence of Tj or Tg knowledge, 105°C max is required. Ea = 0,4eV for equivalence calculation unless a different value has been demonstrated for the product. Termination oxidation risk shall be controlled after burn-in. For discrete, HTRB and power burn-in depend on product family.
6	Final electrical test	100%	Electrical test (para-metrical and functional) at 3 temp.as per the internal supplier's specification.	Read & record on selected parameters as per the internal supplier's specification (see 5.2.3.1k).

	TEST	SAMPLING	METHOD	COMMENTS
7	PDA	-	On steps 4 and 6. Max acceptable PDA: 5%	PDA calculation applies to room temperature measurement only.
8	Seal test	100%	MIL-STD-750 method 1071 cond H1 or H2 and C or K. MIL-STD-883 method 1014 cond A or B and C.	Applicable to hermetic & cavity package only.
9	External visual inspection	100%	MIL-STD-750 method 2071 MIL-STD-883 method 2009	The MIL specs are not adapted to visual inspection of plastic encapsulated components, but can be used as reference (mainly for connection corrosion and marking acceptance). In addition, for plastic packages, inspect for the following defects: Package deformation/ Foreign inclusions in the package, voids and cracks in the plastic/ deformed leads.

5.3.4 Initial customer source inspection (precap)		
5.3.4a		Not applicable
5.3.4b		Not applicable
5.3.5 Lot acceptance		
5.3.5a	The supplier shall ensure that each trace code of EEE parts is submitted to a lot acceptance procedure specified in Figure 5-2 and Table 5-3 according to the following rules:	Modified
	1.	Not applicable
	2.	Not applicable
	3. Commercial components: (a) Each trace code is submitted to lot acceptance as defined in Table 5-3. (b) The proposed lot acceptance is approved through	Modified

	the approval process in accordance with the clause 5.2.4. (c) Omission of any of these elements, or the introduction of alternative tests, is justified. (d) If evaluation test is performed directly on flight lot (and if in conformance with lot acceptance and screening requirements), evaluation data can be used as lot acceptance. (d) The lot acceptance report is sent to the customer, on request, for information.	
5.3.5b		Not applicable
5.3.5c	Lot acceptance of retinned components shall be performed as specified in Figure 8-4 from requirement 8.1a.	New



(1) : for the lot acceptance of retinned components, see Figure 8-4
(2) : screened parts
(3) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(4) : the performance of the "thermal cycling" branch will depend on application
(5) : this test is optional to avoid possible duplication with screening (when done by the same entity)
(6) : applicable in case of cavity package
(7) : applicable to plastic package only
(8) : applicable to hermetic & cavity package

Figure 5-2: Lot acceptance tests flow chart for Class 2 components

Table 5-3: Lot acceptance tests for Class 2 components

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
1	Construction analysis	5 parts	As per clause 5.2.3.3 see Annex H.	-
2	Mechanical shocks	10 parts min	MIL STD 883 TM 2002 condition B - 50 pulses (per orientation) instead of 5 pulses (per orientation). MIL-STD-750 TM 2016, 1500g, 0,5ms duration - 50 shocks instead of 5 shocks, planes X1, Y1 and Z1.	Applicable to cavity package. Read & record for electrical test as per the preliminary issue of the internal supplier's specification (see 5.2.3.1.k).
	Vibrations		MIL-STD-883, TM 2007 condition A - 120 times (total) instead of 12 times (total). MIL-STD-750, TM 2056, 20g, 10-2000Hz, cross over at 50Hz - 120 times (total) instead of 12 times (total).	
	Constant acceleration		MIL-STD-883, TM 2001 condition E (resultant centrifugal acceleration to be in the Y1 axis only). For components which have a package weight of 5 grammes or more, or whose inner seal or cavity perimeter is more than 5 cm, Condition D shall be used MIL-STD-750, TM 2006, 20000g, planes X1, Y1 and Y2.	
3	Preconditioning + 96h HAST (or 1000h THB 85/85)	10 parts 0 defect accepted	HAST 96h-130°C-85%RH (JESD22-A110 with continuous bias) or THB (JESD22-A101). Electrical test (para-metrical and functional) at 25°C as per the internal supplier's specification Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Only for plastic package. Internal supplier's specification (see 5.2.3.1k).
4	C-SAM	10 parts	JEDEC J-STD-020	To be done on the 10

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
				parts of step 5 after the electrical test at 25°C and before preconditioning. C-SAM test only applicable to plastic package.
5	Preconditioning + Thermal Cycling [1]	10 parts 0 defect accepted	100 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less) MIL-STD-750 method 1051 cond.B MIL-STD-883 method 1010 cond.B. Electrical test (para-metrical and functional) at 25°C as per the internal supplier's specification. Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Preconditioning applicable to plastic package only. The necessity to perform this step will depend on the application. Internal supplier's specification (see 5.2.3.1k).
6	Seal test	10 parts min	MIL-STD-883 TM 1014 condition A or B (fine leak) and condition C (gross leak). MIL-STD-750 TM 1071 condition H1 or H2 (fine leak) and condition C or K (gross leak with cavity) or condition E (gross leak without cavity).	Applicable to hermetic & cavity package.
7	C-SAM	10 parts	JEDEC J-STD-020	To be done on the 10 parts of step 5 after thermal cycling and the electrical test at 25°C. C-SAM test only applicable to plastic package.

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
8	Lifetest [1]	15 parts 0 defect accepted	1000h – 125°C minimum MIL-STD-750 method 1026 or 1042 MIL-STD-883 method 1005 cond.D Initial, intermediate and final electrical test (para-metrical and functional) at 3 temp as per the internal supplier's specification.	The lifetest duration shall be 1000h at minimum 125°C. In case a temperature lower than 125°C, the lifetest duration is extended i.a.w. MIL-STD-883 method 1005. Read & record and drift calculation on selected parameters as per the internal supplier's specification (see 5.2.3.1k)
9	External visual inspection	10 parts min	ESCC 2055000 ESCC 2059000	
10	Radiation Verification Test [1]	i.a.w. ECSS-Q-ST-60-15	See ECSS-Q-ST-60-15	-
[1] : Lifetest, thermal cycling and radiation verification test are performed on screened parts (see 5.3.3).				

5.3.6 Final customer source inspection (buy-off)		
5.3.6a		Not applicable
5.3.6b		Not applicable
5.3.6c	For commercial parts, the buy off shall be replaced by an incoming inspection at the procurement entity's facility reported in the JD in accordance with clause 5.3.7.	Modified
5.3.6d		Not applicable
5.3.7 Incoming inspection		
5.3.7a		Applicable
5.3.7b		Applicable
5.3.7c		Applicable
5.3.7d		Not Applicable
5.3.7e		Applicable
5.3.8 Radiation verification testing		
5.3.8a		Applicable

5.3.8b		Applicable
5.3.8c		Not applicable
5.3.8d		Applicable
5.3.8e		Applicable
5.3.8f	Parts submitted to RVT shall be screened as specified in clause 5.3.3 to be fully representative of flight parts.	New
5.3.9 Destructive physical analysis		
5.3.9a	The DPA shall be performed on 3 samples per lot of commercial parts (during evaluation after lifetest as specified in clause 5.2.3.4 and after relifing as specified by clause 5.3.10). NOTE Annex H provides guidelines for the construction analysis and destructive physical analysis.	Modified
5.3.9b		Not applicable
5.3.9c		Not applicable
5.3.9d	The DPA process shall be documented by a procedure to be sent, on request, to the customer for review. NOTE Annex H provides guidelines for the construction analysis and destructive physical analysis.	Modified
5.3.9e		Applicable
5.3.9f		Applicable
5.3.9g		Not applicable
5.3.9h		Applicable
5.3.9i		Applicable
5.3.9j	A DPA shall be conducted during relifing in accordance with clause 5.3.10.	New
5.3.10 Relifing		
5.3.10a		Applicable
5.3.10b	For components meeting the criteria specified in requirement 5.3.10a, and which have a lot / date code exceeding 7 years, the relifing procedure ECSS-Q-ST-60-14 shall apply to the lot.	Modified
5.3.10c	Humidity test and lifetest shall be performed in accordance with the clause 5.3.5 in case these tests have not been performed on the lot during the evaluation or the procurement phase. NOTE Humidity test include HAST or THB.	New
5.3.10d	As part of the relifing process, a DPA on 3 pieces shall be performed on each lot in accordance with the clause 5.3.9.	New

5.3.11 Manufacturer's data documentation deliveries		
5.3.11a	The manufacturer's or the franchised distributor's CoC shall be delivered to the parts procurer.	Modified
5.3.11b	Any other data, defined in the procurement documents, shall be delivered to the parts' procurer in line with the purchase order.	Modified
5.3.11c	The parts procurer shall store the documentation minimum 10 years after receiption of the components.	Modified
5.4 Handling and storage		
5.4a		Applicable
5.4b		Applicable
5.4c		Applicable
5.4d		Applicable
5.4e	Plastic encapsulated devices shall be stored in one of the following conditions: 1. Dry Nitrogen 2. Dry and ionised air with RH in a range of 15% to 20% 3. Dry packs as specified in J-STD-033 for dry pack inspection and control	New
5.5 Components quality assurance		
5.5.1 General		
5.5.1a		Applicable
5.5.2 Nonconformances or failures		
5.5.2a		Applicable
5.5.2b		Applicable
5.5.2c		Applicable
5.5.2d		Applicable
5.5.3 Alerts		
5.5.3a		Applicable
5.5.3b		Applicable
5.5.4 Traceability		
5.5.4a		Applicable
5.5.4b		Applicable
5.5.4c		Applicable
5.5.4d	The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer's trace code number of the EEE parts actually mounted.	Modified

5.5.4e	If the as built DCL has not yet been delivered, the supplier shall be able to provide this information (part type actually installed with its relevant trace code number) within one week.	Modified
	5.5.5 Lot homogeneity for sampling test	
5.5.5a		Applicable
5.6 Specific components		
	5.6.1 General	
5.6.1a	<<deleted>>	Deleted
	5.6.2 ASICs	
5.6.2a		Applicable
	5.6.3 Hybrids	
5.6.3a		Not applicable
5.6.3b		Not applicable
5.6.3c		Not applicable
	5.6.4 One time programmable devices	
5.6.4a		Applicable
5.6.4b	The JD shall allow traceability to the information related to the procurement of blank parts, the programming process and the acceptance of the programmed parts.	Modified
5.6.4c	The programming process and the acceptance of the programmed parts may be part of PCB, for customer approval, if not indicated in the JD.	Modified
5.6.4d		Applicable
5.6.4e		Applicable
5.6.4f		Applicable
5.6.4g		Applicable
5.6.4h		Applicable
	5.6.5 Microwave monolithic integrated circuits	
5.6.5a		Not applicable
5.7 Documentation		
5.7a	Any result from inspection or control shall be documented (including lot acceptance, incoming, relifing and complementary tests).	Modified

Table 5-4: Documentation for Class 2 components

Document	Clause	Customer	Comments
New *:* RFD	5.2.2.2	Approval	For pure tin termination.
New ***:Pure tin lead finish risk analysis***	5.2.2.2	Information	In accordance with clause 8.2a.
New *:* Mitigation plan	5.2.2.2	Approval	Approved through the RFD.
New *:* Procedure for hot solder dip process	5.2.2.2	Approval	For retinning operation.
New *:* Internal supplier's specification	5.2.3.1.i	Approval	Applicable to the preliminary and final internal supplier's specification.
PAD : not applicable	5.2.4	-	-
New *:* Justification Document	5.2.4	Approval	-
New *:* Procedure for screening flow	5.3.3	Approval	-
Procedure for customer precap : not applicable	5.3.4	-	-
New *:* Procedure for construction analysis	5.2.3.3	Approval	-
New *:* Lot acceptance report	5.3.5	Information (on request)	-

6
Requirements for class 3 components

6.1 Component programme management		
	6.1.1. General	
6.1.1a		Applicable
	6.1.2 Components control programme	
	6.1.2.1 Organization	
6.1.2.1a		Applicable
	6.1.2.2 Component control plan	
6.1.2.2a		Applicable
6.1.2.2b		Applicable
	6.1.3 Parts control board	
6.1.3a		Applicable
	6.1.4 Declared component list	
6.1.4a		Applicable
6.1.4b		Applicable
6.1.4c		Applicable
6.1.4d	After equipment CDR, all modifications affecting the JD information shall be implemented, in the "as design" DCL, through the CN / CR process and submitted to the customer for approval. NOTE For JD generation, see requirement 6.2.4.d.	Modified
6.1.4e		Applicable
6.1.4f		Applicable
6.1.4g		Applicable
	6.1.5 Electrical and mechanical GSE	
6.1.5a		Applicable
6.1.5b		Applicable
6.2 Component selection, evaluation and approval		
	6.2.1 General	
6.2.1a		Applicable
6.2.1b		Applicable

6.2.2 Manufacturer and component selection		
6.2.2.1 General rules		
6.2.2.1a		Applicable
6.2.2.1b		Applicable
6.2.2.1c		Applicable
6.2.2.1d		Applicable
6.2.2.1e	For the assessment of commercial components, the supplier shall collect the available data on the manufacturer and the component in the JD specified in the requirement 6.2.4.d. NOTE It is important to check the exhaustiveness of the manufacturer documentation & data sheet with respect to the following items: • component marking, • mechanical description, • electrical and thermal description	New
6.2.2.1f	For Deep Sub-Micron Technologies (<90nm) the detailed test definition shall identify the technology through the construction analysis and the application. NOTE 1 It is important to ensure that the test conditions remain as close as possible to application. NOTE 2 This requirement is important due to the specificities of Deep Sub-Micron Technologies (<90nm).	New
6.2.2.2 Parts and material restriction		
6.2.2.2a		Applicable
6.2.2.2b		Applicable
6.2.2.2c		Applicable
6.2.2.2d	For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used: 1. EEE components with pure tin (less than 3% Pb in case of SnPb alloy) used as a finish on the leads, terminations and external surfaces of components and packages. NOTE For EEE components with pure tin, see also requirements 6.2.2.2h and 6.2.2.2i. 2. Hollow core resistors 3. Potentiometers (except for mechanism position monitoring) 4. Non-metallurgically bonded diodes 5. Semiconductor dice with unglassivated active area 6. Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case	Modified

	7. Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions 8. Wire link fuses < 5A 9. TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside.	
6.2.2.2e		Applicable
6.2.2.2f		Applicable
6.2.2.2g		Applicable
6.2.2.2h	The use of pure tin (inside or outside the part) shall be declared in the JD.	Modified
6.2.2.2i	To assess Pb free with tin finish whisker risk, the following actions shall be performed by the supplier: 1. In order to verify information from manufacturer (included in the JD), as part of the incoming inspection, check the lead finish of all procured lots as per ESCC 25500 basic specification. 2. When confirmed during incoming, access individually each use of pure tin termination through a RFD. 3. Collect and synthesize all information participating to the risk analysis in conformance with the Clause 9. 4. Based on the risk analysis, elaborate a mitigation plan, submitted to the customer for approval. 5. Include into the mitigation plan one or a combination of the following solutions (not limited to): (a) Retinning of terminations with complementary evaluation in conformance with Figure 8-5 from the requirement 8.1a, and lot acceptance test in conformance with Figure 8-6 from the requirement 8.1a. NOTE Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation, it is required that the termination is coated over its entire length, right up to the package surface (no stand off). (b) In case of both retinning and screening, perform the screening on retinned components. (c) Tin whisker sensitivity evaluation. (d) Conformal coating. (e) Design modification.	New

	6. In case of retinning of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval. 7. Through RFD submit the mitigation plan and results for the customer approval.	
	6.2.2.3 Preferred sources	
6.2.2.3a		Applicable
	6.2.2.4 Radiation hardness	
6.2.2.4a		Applicable
6.2.2.4b		Applicable
6.2.2.4c		Applicable
6.2.2.4d		Applicable
6.2.2.4e		Applicable
6.2.2.4f		Applicable
6.2.2.4g		Applicable
6.2.2.4h		Applicable
6.2.2.4i		Applicable
	6.2.2.5 Derating	
6.2.2.5a		Applicable
6.2.2.5b		Applicable
	6.2.2.6 Temperature range	
6.2.2.6a	Commercial parts shall be selected in the highest available temperature range.	New
6.2.2.6b	A minimum 10°C margin shall be used between the maximum manufacturer temperature range and the application temperature range (including worst cases).	New
6.2.2.6c	In case |(manufacturer max temperature range – used max temp)|< 10°C, an electrical characterisation shall be performed at used temperature with an additional margin of 10°C during the evaluation step. NOTE 1 Example: for a manufacturer -40°C/+85°C temperature range with an application up to +80°C, then an electrical characterisation is performed at +90°C. NOTE 2 Example for a manufacturer -40°C/+85°C temperature range with an application down to -35°C, then an electrical characterisation is performed at -45°C.	New
	6.2.3 Component evaluation	
	6.2.3.1 General	
6.2.3.1a	For class 3 components, the evaluation shall be limited to construction analysis and radiation tests.	Modified
6.2.3.1b		Applicable
6.2.3.1c		Not applicable

6.2.3.1d	An evaluation plan shall be sent to the customer for approval, and include the following elements:	Modified
	1. Construction Analysis	Applicable
	2. Evaluation testing	Not applicable
	3. Radiation Hardness	Applicable
6.2.3.1e		Applicable
6.2.3.1f		Applicable
6.2.3.1g		Applicable
6.2.3.1h		Applicable
6.2.3.1i	The supplier shall review the evaluation results to determine their impact on the content of the lot acceptance tests.	Modified
6.2.3.1j		Applicable
6.2.3.2 Component manufacturer assessment		
6.2.3.2a		Not applicable See 6.2.2.1e
6.2.3.3. Construction analysis		
6.2.3.3a		Applicable
6.2.3.3b	The Construction analysis shall be documented by a procedure to be sent to the customer for approval. NOTE Annex H provides guidelines for such procedure.	Modified
6.2.3.3c		Applicable
6.2.3.4 Evaluation testing		
6.2.3.4a		Not applicable
6.2.3.4b		Not applicable
6.2.3.4c	Evaluation tests shall be performed as specified in Table 6-1.	New
6.2.3.4d	Omission of any of the elements of tests specified in Table 6-1, or the introduction of alternative activities, shall be justified in the JD. NOTE For mounting process (including baking for PED), see ECSS-Q-ST-70-38 and ECSS-Q-ST-70-08.	New
6.2.3.4.e	Evaluation of retinned components shall be performed in accordance with Figure 8-5 from the requirement 8.1a.	New

Table 6-1: Evaluation tests for Class 3 components

	TEST	SAMPLING	METHOD / CRITERIA	COMMENTS
1	Construction analysis	5 parts	As per clause 6.2.3.3 See Annex H	-
2	Radiation evaluation	i.a.w. ECSS-Q-ST-60-15	See ECSS-Q-ST-60-15	-

6.2.4 Parts approval		
6.2.4a		Applicable
6.2.4b		Applicable
6.2.4c		Applicable
6.2.4d	Prior to procurement of components (or before equipment CDR, at the latest), the approval process by the customer shall be organized as follows:	Modified
	1.	Not applicable
	2.	Not applicable
	3. A Justification Document is required in accordance with Annex F.	Modified
6.2.4e	In case the evaluation results are changing the testing conditions documented in the JD, a new revision of JD shall be submitted to the customer for approval.	Modified
6.3 Component procurement		
6.3.1 General		
6.3.1a		Applicable
6.3.1b		Not applicable
6.3.1c		Not applicable
6.3.1d		Applicable
6.3.1e		Applicable
6.3.1f	Each procured EEE part shall be traceable to a manufacturer assigned trace code. NOTE The procurement of a single trace code per delivery lot should be preferred and encouraged.	New
6.3.1g	Each trace code shall be maintained as is through the entire supply chain including distributor. NOTE As far as possible, commercial parts should be ordered in the manufacturer's standard packing quantities or multiples thereof to avoid distributor re-packing and handling and to preserve the traceability information usually included on the original manufacturer packaging.	New

6.3.1h	The supplier shall ensure that the elements of the JD in accordance with Annex F, including any action plan, are applicable to flight parts.	New
6.3.2 Procurement specification		
6.3.2a	The supplier shall procure EEE components according to controlled specifications. NOTE It can be procurer's in-house specification, a manufacturer's drawing or a datasheet as a minimum.	Modified
6.3.2b		Not applicable
6.3.2c		Not applicable
6.3.2d		Not applicable
6.3.2e		Applicable
6.3.2f		Applicable
6.3.2g		Applicable
6.3.2h	If additional requirements are specified to the manufacturer, they shall be identified in a procurement specification.	New
6.3.3 Screening requirements		
6.3.3a		Applicable
6.3.3b		Applicable
6.3.3c		Applicable
6.3.3d	For commercial parts, screening tests shall be performed in accordance with Table 6-2.	Modified
6.3.3e		Applicable
6.3.3f		Applicable
6.3.3g		Applicable
6.3.3h		Applicable

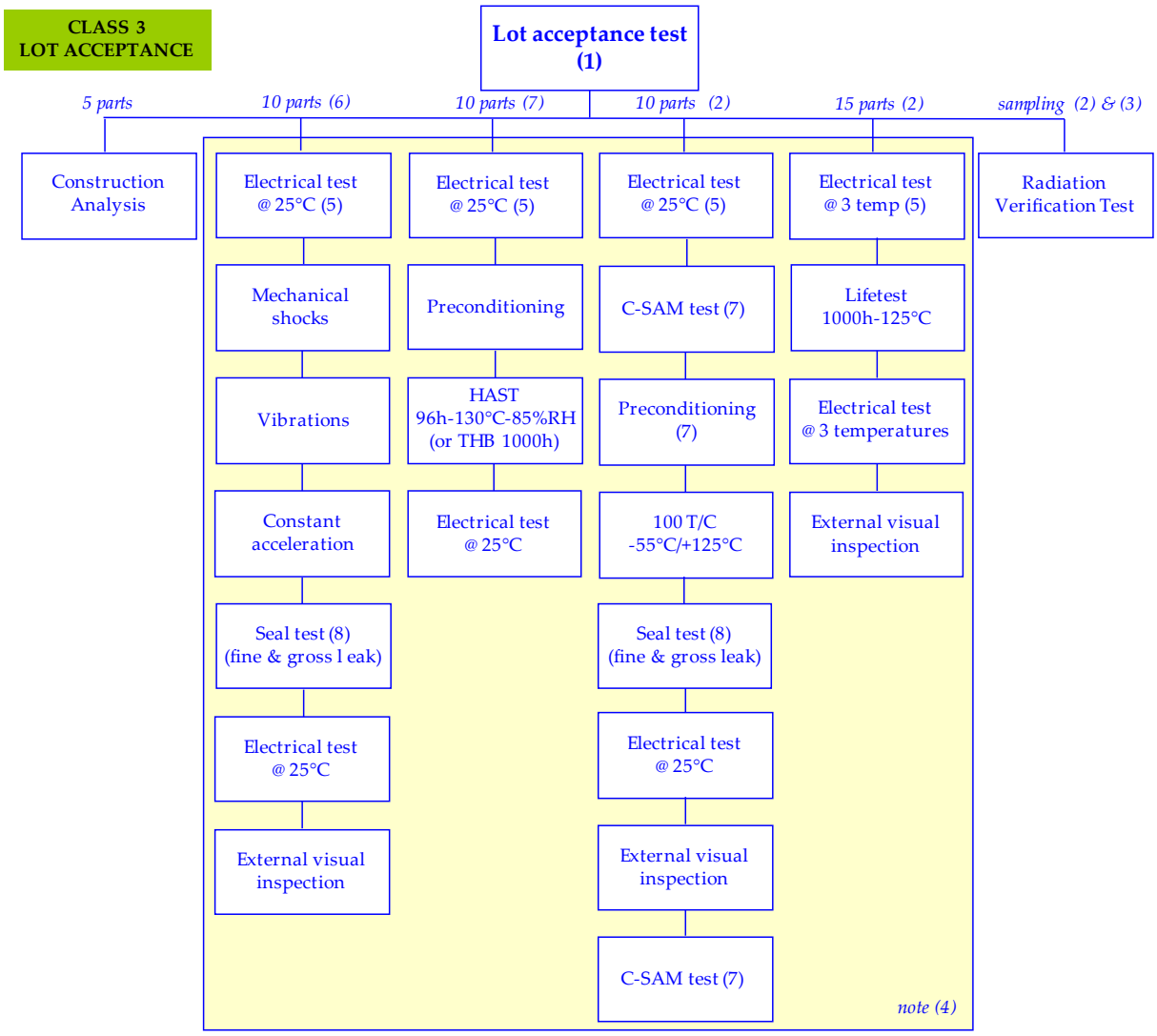
Table 6-2: Screening tests for Class 3 components

	TEST	SAMPLING	METHOD	COMMENTS
1	PIND test	100%	MIL-STD-750 method 2052 cond.A MIL-STD-883 method 2020 cond.A	Applicable to cavity package only.
2	Seal test	100%	MIL-STD-750 method 1071 cond H1 or H2 and C or K. MIL-STD-883 method 1014 cond A or B and C.	Applicable to hermetic & cavity package only. In case of retinning, test to be done after retinning.
3	Electrical test	100%	Electrical test (para-metrical and functional) at 3 temp. as per the datasheet (selected functional tests and parameters).	To be done only in case of retinning.

	TEST	SAMPLING	METHOD	COMMENTS
4	PDA	-	On steps 3. Max acceptable PDA: 5%	To be done only in case of retinning. PDA calculation applies to room temperature measurement only.
5	External visual inspection	100%	MIL-STD-750 method 2071 MIL-STD-883 method 2009	To be done only in case of retinning. The MIL specs are not adapted to visual inspection of plastic encapsulated components, but can be used as reference (mainly for connection corrosion and marking acceptance). In addition, for plastic packages, inspect for the following defects: Package deformation/ Foreign inclusions in the package, voids and cracks in the plastic/ deformed leads.

6.3.4 Initial customer source inspection (precap)		
6.3.4a		Applicable
6.3.5 Lot acceptance		
6.3.5a	The supplier shall ensure that each trace code of EEE parts is submitted to a lot acceptance procedure specified in Figure 6-1 and Table 6-3 according to the following rules:	Modified
	1.	Not applicable
	2.	Not applicable
	3. Commercial components: (a) The content of the lot acceptance is defined according to information provided by the JD. (b) Without any representative data, the tests specified in Table 6-3 are performed. (c) The proposed lot acceptance is approved through the approval process as specified in the clause 6.2.4. (d) The Construction Analysis is documented by a procedure approved by the customer. NOTE Annex H provides guidelines for	Modified

	such procedure. (e) If evaluation test is performed directly on flight lot (and if in conformance with lot acceptance and screening requirements), evaluation data can be used as lot acceptance. (f) The lot acceptance report is sent to the customer, on request, for information.	
6.3.5b		Not applicable
6.3.5c	Lot acceptance of retinned components shall be performed as specified in Figure 8-6 from the requirement 8.1a.	New



(1) : for the lot acceptance of retinned components, see figure 8-6
(2) : screened parts (if any)
(3) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(4) : if representative data are available, these test groups are not required during lot acceptance
(5) : this test is optional to avoid possible duplication with screening, if any (when done by the same entity)
(6) : applicable in case of cavity package
(7) : applicable to plastic package only
(8) : applicable to hermetic & cavity package

Figure 6-1: Lot acceptance test flow chart for Class 3 components

Table 6-3: Lot acceptance tests for Class 3 components

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
1	Construction analysis	5 parts	As per clause 6.2.3.3 see Annex H	In case of retinning, step 1 shall include the SEM "QBSD" mode to check the 100% coverage of SnPb.
2	Preconditioning + 96h HAST (or 1000h THB 85/85)	10 parts 0 defect accepted	HAST 96h-130°C-85%RH (JESD22-A110 with continuous bias) or THB (JESD22-A101). Electrical test (para-metrical and functional) at 25°C as per the datasheet (selected functional tests and parameters) Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Only for plastic package. To be done, except if representative data collected in the JD are available. In case of retinning, step 2 is mandatory.
3	Lifetest [1]	15 parts 0 defect accepted	1000h – 125°C minimum. MIL-STD-750 method 1026 or 1042 MIL-STD-883 method 1005 cond.D. Initial and final electrical test (parametrical and functional) at 25°C as per the datasheet (selected functional tests and parameters).	The lifetest duration shall be 1000h at minimum 125°C. In case of a temperature lower than 125°C, the lifetest duration is extended i.a.w. MIL-STD-883 method 1005. Electrical test on selected parameters. To be done, except if representative data collected in the JD are available. In case of retinning, step 3 is mandatory.
4	C-SAM	10 parts	JEDEC J-STD-020	To be done on the 10 parts of step 5 after the electrical test at 25°C and before preconditioning. C-SAM test only applicable to plastic package. To be done, except if representative data

	TEST	SAMPLING / CRITERIA	METHOD	COMMENTS
				collected in the JD are available.
5	Preconditioning + Thermal Cycling [1]	10 parts 0 defect accepted	100 T/C -55°/+125°C (or to the manufacturer storage temp., whichever is less) MIL-STD-750 method 1051 cond.B. MIL-STD-883 method 1010 cond.B. Electrical test (para-metrical and functional) at 25°C as per the datasheet (selected functional tests and parameters). Preconditioning: i.a.w. JESD-22-A113 for SMD JESD-22-B106 for through hole.	Preconditioning applicable to plastic package only. To be done, except if representative data collected in the JD are available. In case of retinning, step 5 is mandatory.
6	Seal test	10 parts min	MIL-STD-883 TM 1014 condition A or B (fine leak) and condition C (gross leak). MIL-STD-750 TM 1071 condition H1 or H2 (fine leak) and condition C or K (gross leak with cavity) or condition E (gross leak without cavity).	Applicable to hermetic & cavity package. To be done, except if representative data collected in the JD are available. In case of retinning, step 6 is mandatory.
7	C-SAM	10 parts	JEDEC J-STD-020	To be done on the 10 parts of step 5 after thermal cycling and the electrical test at 25°C. C-SAM test only applicable to plastic package. To be done, except if representative data collected in the JD are available.
8	Radiation Verification Test [1]	i.a.w. ECSS-Q-ST-60-15	See ECSS-Q-ST-60-15	-
[1] : Lifetest, thermal cycling and radiation verification test areare performed on screened parts (see 6.3.3).				

6.3.6 Final customer inspection (buy-off)		
6.3.6a		Applicable
6.3.7 Incoming inspection		
6.3.7a		Applicable
6.3.7b		Applicable
6.3.7c		Applicable
6.3.7d		Not applicable
6.3.7e		Applicable
6.3.8 Radiation verification testing		
6.3.8a		Applicable
6.3.8b		Applicable
6.3.8c		Not applicable
6.3.8d		Applicable
6.3.8e		Applicable
6.3.8f	Parts submitted to RVT shall be screened as specified in clause 5.3.3 to be fully representative of flight parts.	New
6.3.9 Destructive physical analysis		
6.3.9a	The DPA shall be performed on 3 samples per lot of commercial parts after relifing as specified in clause 6.3.10. NOTE Annex H provides guidelines for construction analysis and destructive physical analysis.	Modified
6.3.9b		Not applicable
6.3.9c		Not applicable
6.3.9d	The DPA process shall be documented by a procedure to be sent, on request, to the customer for review. NOTE Annex H provides guidelines for the construction analysis and destructive physical analysis.	Modified
6.3.9e		Applicable
6.3.9f		Applicable
6.3.9g		Not applicable
6.3.9h		Applicable
6.3.9i		Applicable
6.3.9j	A DPA shall be conducted during relifing in accordance with the clause 6.3.10.	New
6.3.10 Relifing		
6.3.10a		Applicable
6.3.10b	For components meeting the criteria specified in requirement 6.3.10a, and which have a lot / date code exceeding 7 years, the relifing procedure ECSS-Q-ST-60-14 shall apply to the lot.	Modified
6.3.10c	Humidity test and lifetest shall be performed in accordance with the clause 6.3.5 in case if these tests have not been performed on the	New

	lot during the evaluation or the procurement phase. NOTE Humidity test includes HAST or THB.	
6.3.10d	As part of the relifing process, a DPA on 3 pieces shall be performed on each lot in conformance with the clause 6.3.9.	New
	6.3.11 Manufacturer's data documentation deliveries	
6.3.11a	The manufacturer's or the franchised distributor's CoC shall be delivered to the parts procurer.	Modified
6.3.11b	Any other data, defined in the applicable procurement documents, shall be delivered to the parts' procurer in line with the purchase order.	Modified
6.3.11c	The parts procurer shall store the documentation minimum 10 years after receiption of the components.	Modified
	6.4 Handling and storage	
6.4a		Applicable
6.4b		Applicable
6.4c		Applicable
6.4d		Applicable
6.4e	Plastic encapsulated devices shall be stored in one of the following conditions: 1. Dry Nitrogen 2. Dry and ionised air with RH in a range of 15% to 20% 3. Dry packs as specified in J-STD-033 for dry pack inspection and control	New
	6.5 Components quality assurance	
	6.5.1. General	
6.5.1a		Applicable
	6.5.2 Nonconformances or failures	
6.5.2a		Applicable
6.5.2b		Applicable
6.5.2c		Applicable
6.5.2d		Applicable
	6.5.3 Alerts	
6.5.3a		Applicable
6.5.3b		Applicable
	6.5.4 Traceability	
6.5.4a		Applicable
6.5.4b		Applicable
6.5.4c		Applicable
6.5.4d	The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer's trace code number of the EEE parts actually	Modified

	mounted.	
6.5.4e	The supplier shall be able to provide these information (part type actually installed with its relevant trace code number) within one working day (when the flight system is on launch pad) or within one week (in the other cases).	Modified
	6.5.5 Lot homogeneity for sampling test	
6.5.5a		Applicable
6.6 Specific components		
	6.6.1 General	
6.6.1a	<<deleted>>	Deleted
	6.6.2 ASICs	
6.6.2a		Applicable
	6.6.3 Hybrids	
6.6.3a		Not applicable
6.6.3b		Not applicable
6.6.3c		Not applicable
	6.6.4 One time programmable devices	
6.6.4a		Applicable
6.6.4b	The JD shall allow traceability to the information related to the procurement of blank parts, the programming process and the acceptance of the programmed parts.	Modified
6.6.4c	The programming process and the acceptance of the programmed parts may be part of PCB, for customer approval, if not indicated in the JD.	Modified
6.6.4d		Applicable
6.6.4e		Applicable
6.6.4f		Applicable
6.6.4g		Applicable
6.6.4h		Applicable
	6.6.5 Microwave monolithic integrated circuits	
6.6.5a		Not Applicable
6.7 Documentation		
6.7a	Any result from inspection or control shall be documented (including lot acceptance, incoming, relifing and complementary tests).	Modified

Table 6-4: Documentation for Class 3 components

Document	Clause	Customer	Comments
New *:* RFD	6.2.2.2	Approval	For pure tin termination.
New ***:Pure tin lead finish risk analysis***	6.2.2.2	Information	In accordance with clause 8.2a.
New *:* Mitigation plan	6.2.2.2	Approval	Approved through the RFD.
New *:* Procedure for hot solder dip process	6.2.2.2	Approval	For retinning operation.
PAD : not applicable	6.2.4	-	-
New *:* Justification Document	6.2.4	Approval	-
Procedure for customer precap : not applicable	6.3.4	-	-
New *:* Procedure for construction analysis	6.2.3.3	Approval	-
New *:* Procedure for lot acceptance test	6.2.3.5	Approval	-
New *:* Lot acceptance report	6.3.5	Information (on request)	-

7
Quality levels

Not applicable

8
Evaluation and lot acceptance for retinned parts

8.1 General

8.1a	In case of retinning of components with pure tin terminations, an evaluation and lot acceptance for these retinned parts for each class of components shall be performed as specified in the flow charts from Figure 8-1 to Figure 8-6.	New

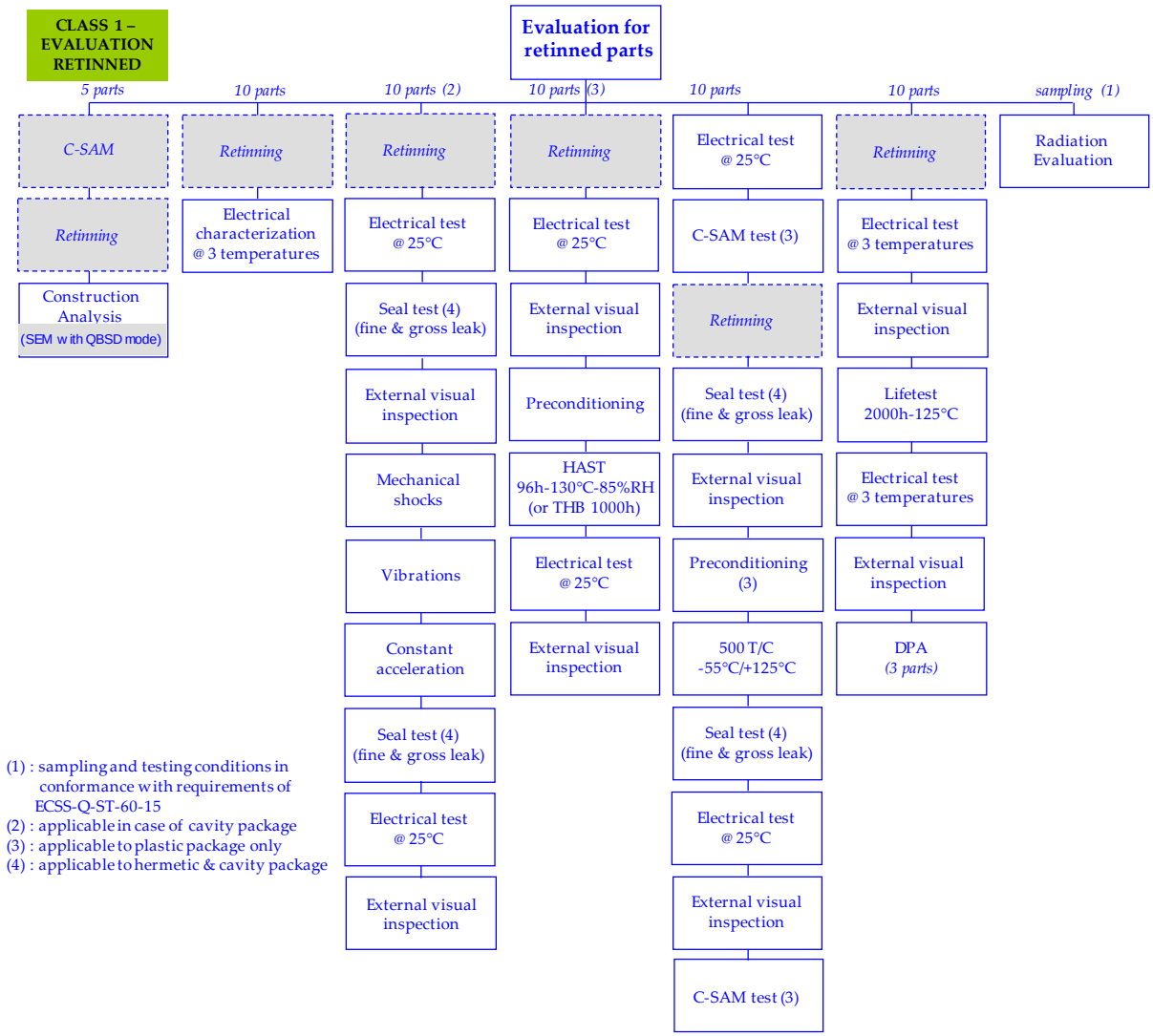
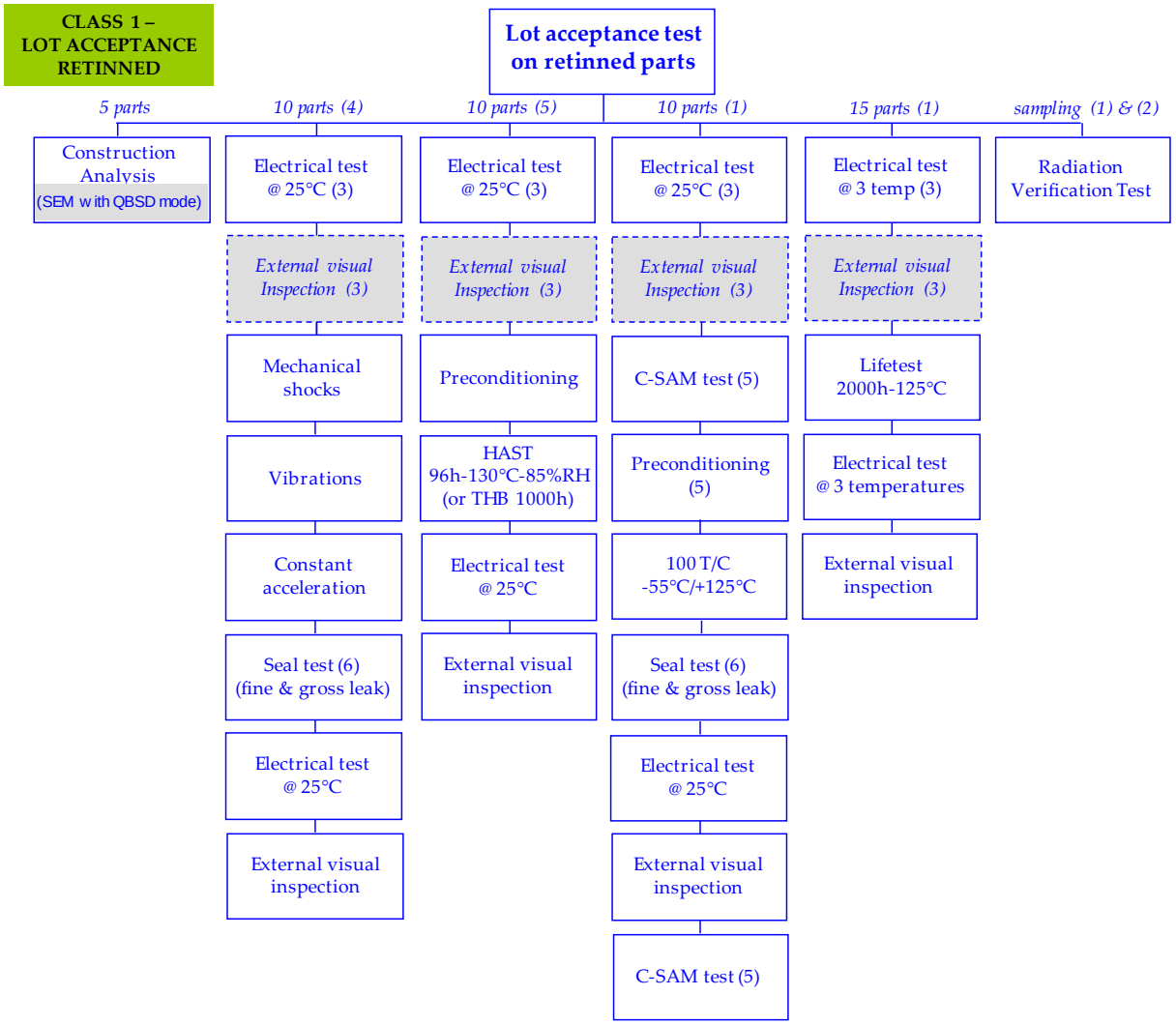
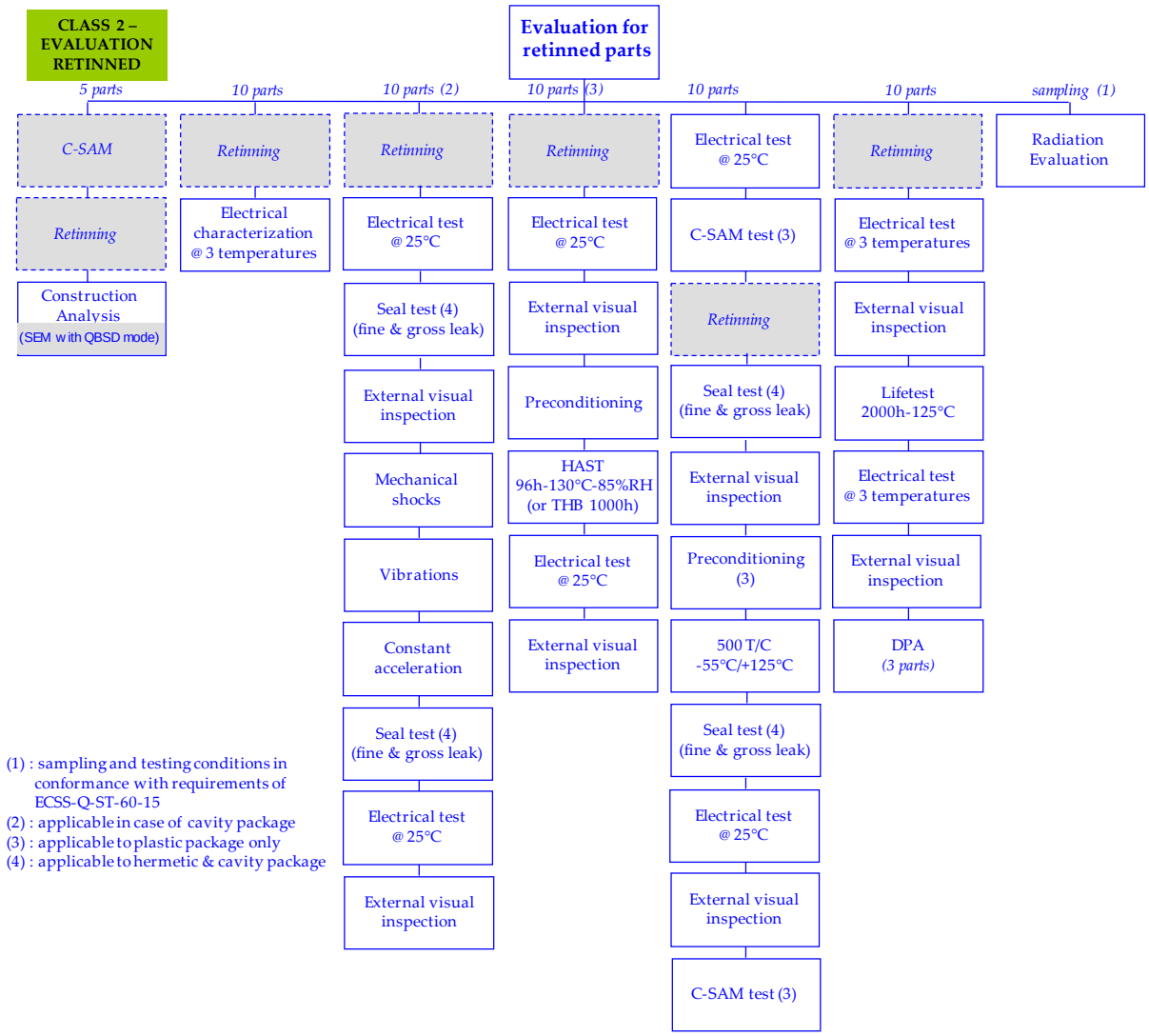


Figure 8-1: Evaluation flow chart for retinned parts – class 1 programmes



(1) : screened parts
(2) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(3) : this test is optional to avoid possible duplication with screening (when done by the same entity)
(4) : applicable in case of cavity package
(5) : applicable to plastic package only
(6) : applicable to hermetic & cavity package

Figure 8-2: Lot acceptance flow chart for retinned parts – class 1 programmes


CLASS 2 – EVALUATION RETINNED
Evaluation for retinned parts
5 parts
10 parts
10 parts (2)
10 parts (3)
10 parts
10 parts
sampling (1)
C-SAM
Retinning
Construction Analysis
(SEM with QBSD mode)
Retinning
Electrical characterization @ 3 temperatures
Retinning
Electrical test @ 25°C
Seal test (4) (fine & gross leak)
External visual inspection
Mechanical shocks
Vibrations
Constant acceleration
Seal test (4) (fine & gross leak)
Electrical test @ 25°C
External visual inspection
Retinning
Electrical test @ 25°C
External visual inspection
Preconditioning
HAST 96h-130°C-85%RH (or THB 1000h)
Electrical test @ 25°C
External visual inspection
Electrical test @ 25°C
C-SAM test (3)
Retinning
Seal test (4) (fine & gross leak)
External visual inspection
Preconditioning (3)
500 T/C -55°C/+125°C
Seal test (4) (fine & gross leak)
Electrical test @ 25°C
External visual inspection
C-SAM test (3)
Retinning
Electrical test @ 3 temperatures
External visual inspection
Lifetest 2000h-125°C
Electrical test @ 3 temperatures
External visual inspection
DPA (3 parts)
Radiation Evaluation
(1) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(2) : applicable in case of cavity package
(3) : applicable to plastic package only
(4) : applicable to hermetic & cavity package

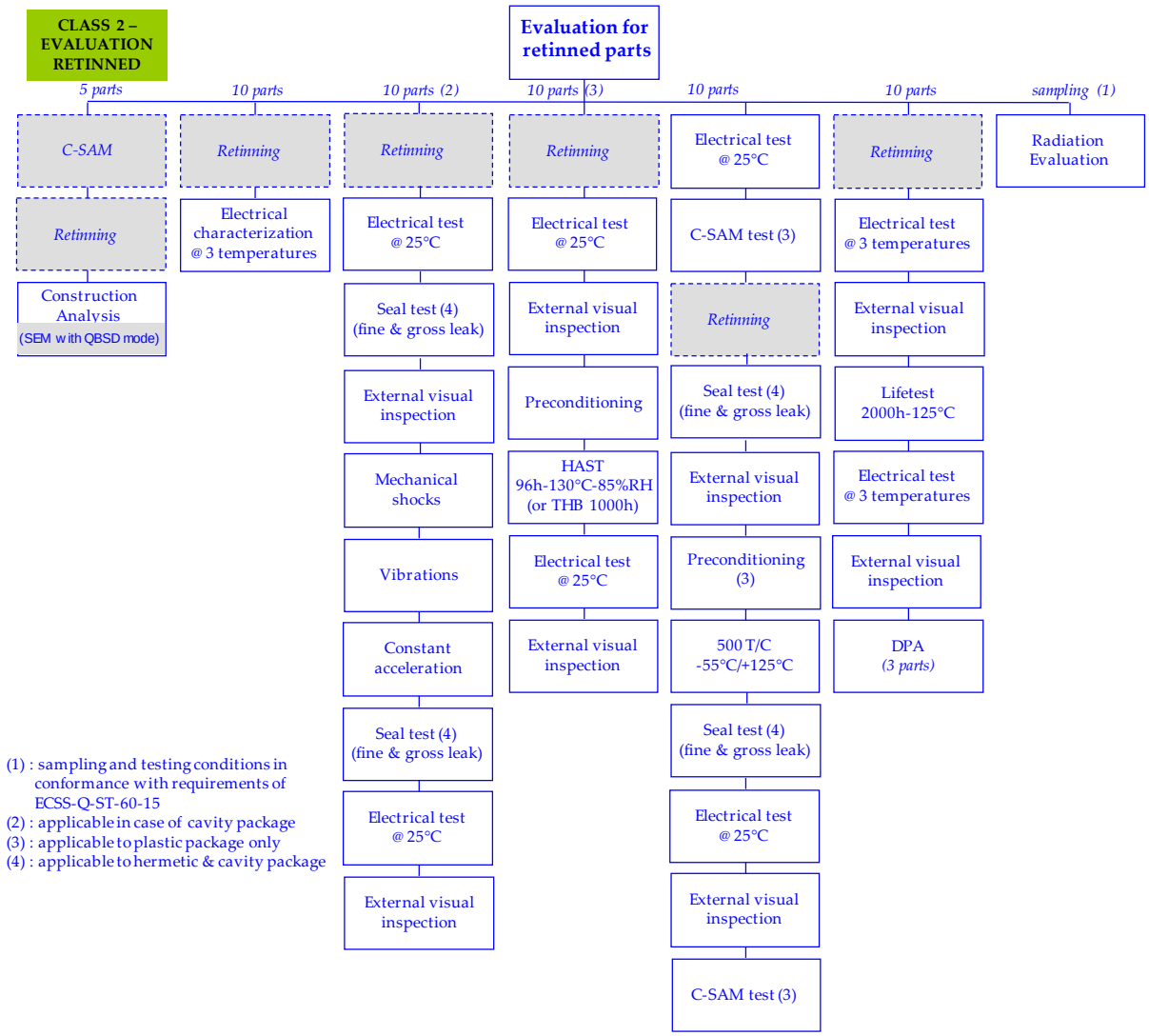
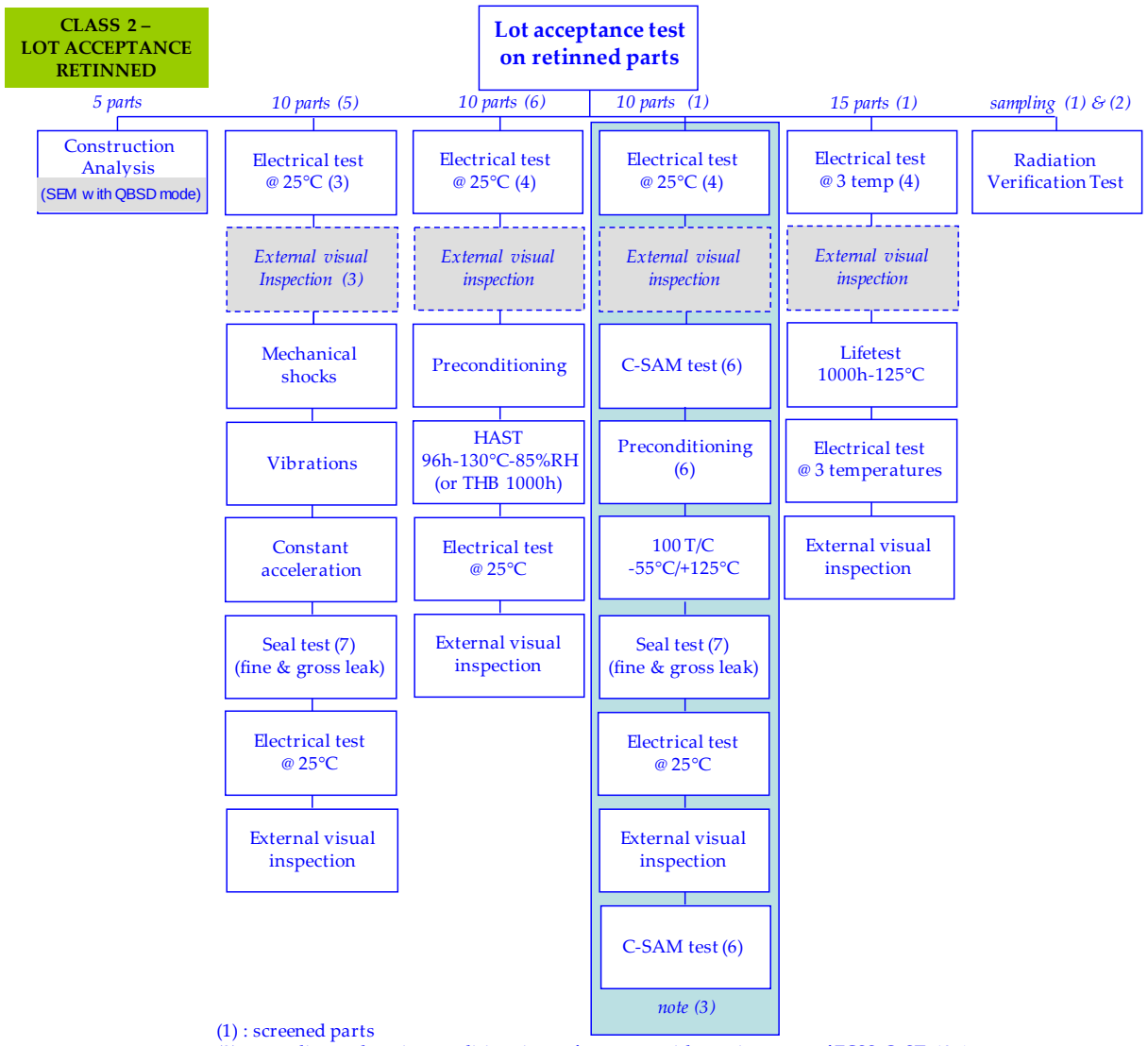
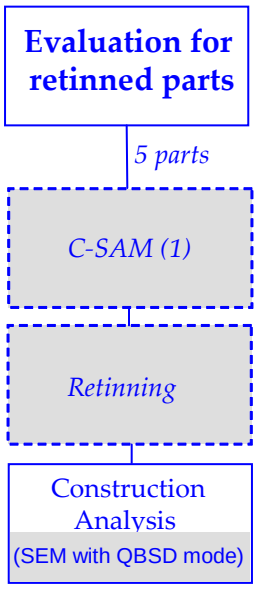


Figure 8-3: Evaluation flow chart for retinned parts – class 2 programmes



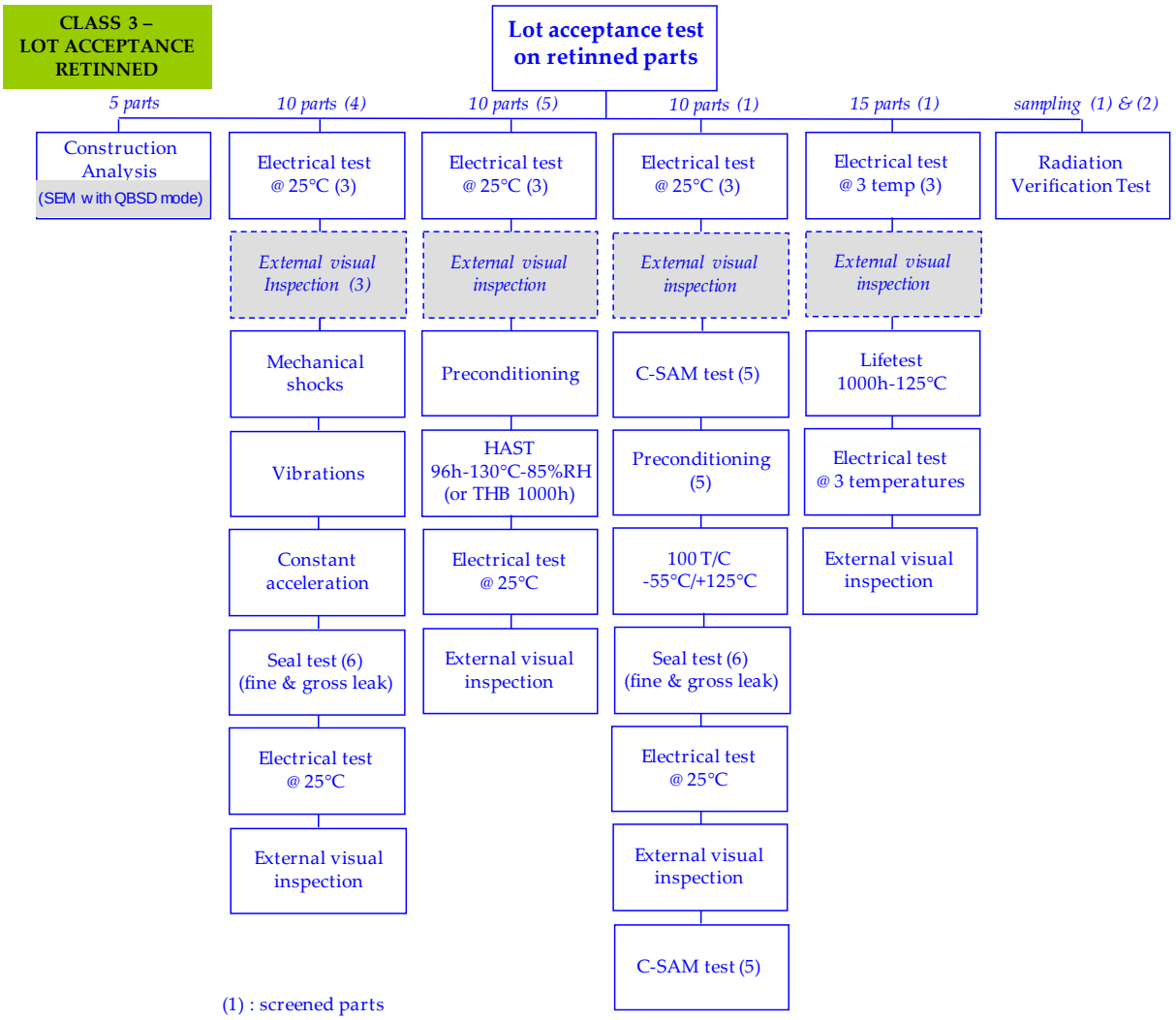
(1) : screened parts
(2) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(3) : the performance of the "thermal cycling" branch will depend on application
(4) : this test is optional to avoid possible duplication with screening (when done by the same entity)
(5) : applicable in case of cavity package
(6) : applicable to plastic package only
(7) : applicable to hermetic & cavity package

Figure 8-4: Lot acceptance flow chart for retinned parts – class 2 programmes



(1) : applicable to plastic package only

Figure 8-5: Evaluation flow chart for retinned parts – class 3 programmes



(1) : screened parts
(2) : sampling and testing conditions in conformance with requirements of ECSS-Q-ST-60-15
(3) : this test is optional to avoid possible duplication with screening (when done by the same entity)
(4) : applicable in case of cavity package
(5) : applicable to plastic package only
(6) : applicable to hermetic & cavity package

Figure 8-6: Lot acceptance flow chart for retinned parts – class 3 programmes

9
Pure tin lead finish – risk analysis

9.1 Overview

9.1	Pure tin finish has a propensity to generate whiskers. A tin whisker is a conductive crystalline structure of tin growing from tin rich surfaces that can induce failures as: • Electrical instantaneous or permanent short circuit • Metal vapour arc in reduced atmospheric pressure conditions and for application with high levels of current and voltage (more than 12V) • Contamination: a free floating whisker may interfere with the movement of mechanical parts or induce contamination of optical surfaces Many parameters can have an impact on whisker growth. The purpose of the risk analysis is to evaluate those parameters.	New

9.2 Requirements

9.2a	A pure tin lead finish risk analysis facing whiskers shall include, as a minimum, the following:	New
	1. Lead material (e.g. alloy 42, copper)	
	2. Underlayer material and thickness(e.g. Ni underlayer, silver underlayer)	
	3. Plating chemistry and thickness(e.g. matte or bright tin, tin thickness)	
	4. Heat treatment by manufacturer (e.g. 1hour at 150 °C for Cu based lead frame)	
	5. Procedure (if any) for SnPb dipping of the parts	
	6. Conformal coating presence and characteristics: material and thickness	
	7. Design criticality (shorter distances between 2 connections or between a connection and an area at another potential)	
	8. Supply voltage and current	
	9. Tin whisker sensitivity results (as per JESD-201 and JESD22- A121A)	
	10. Mission profile: storage, mission duration, thermal cycling	
	11. Previous experiences	

Annex A (normative)
Component control plan (CCP) - DRD

Annex A.1 DRD Identification		
A.1.1 Requirement identification and source document		
A.1.1		Applicable
A.1.2 Purpose and objective		
A.1.2		Applicable
A.2 Expected response		
A.2.1 Scope and content		
A.2.1a		Applicable
A.2.2 Special remarks		
A.2.2a		Applicable

Annex B (normative)
Declared components list (DCL) - DRD

Annex B.1 DRD Identification		
	B.1.1 Requirement identification and source document	
B.1.1		Applicable
	B.1.2 Purpose and objective	
B.1.2		Applicable
B.2 Expected response		
	B.2.1 Scope and content	
B.2.1a		Applicable
	B.2.2 Special remarks	
B.2.2		Applicable

Annex C (normative)
Internal Supplier's specification - DRD

Annex C.1 DRD Identification		
C.1.1 Requirement identification and source document		
C.1.1	This DRD is called up from ECSS-Q-ST-60-13 requirements 4.2.3.1.l and 5.2.3.1.l.	Modified
C.1.2 Purpose and objective		
C.1.2	The purpose of the Internal Supplier's Specification is to establish the tested parameters, test conditions, acceptance criteria, drift limits for the electrical testing during evaluation, screening and lot acceptance.	Modified
C.2 Expected response		
C.2.1 Scope and content		
C.2.1a	The internal supplier's specification shall include or refer to the following information:	Modified
	1.	Applicable
	2.	Applicable
	3.	Applicable
	4.	Not applicable
	5.	Applicable
	6.	Applicable
	7.	Not applicable
	8.	Not applicable
	9.	Applicable
	10.	Not applicable
	11.	Not applicable
	12.	Not applicable
	13.	Not applicable
	14.	Not applicable

	15.	Not applicable
	16.	Not applicable
	17.	Not applicable
	C.2.2 Special remarks	
C.2.2		Applicable

Annex D (normative)
Parts approval document - DRD

Annex D.1 DRD Identification		
D.1.1 Requirement identification and source document		
D.1.1		Not applicable
D.1.2 Purpose and objective		
D.1.2		Not applicable
D.2 Expected response		
D.2.a		Not applicable

Annex E (informative)
EEE documents delivery per review

Annex E (informative)		
Annex E		Not applicable

Annex F (normative)
Justification document - DRD

Annex F.1 DRD Identification		
F.1.1 Requirement identification and source document		
F.1.1	This DRD is called up from requirements 4.2.4.d, 5.2.4.d and 6.2.4.d.	New
F.1.2 Purpose and objective		
F.1.2	The JD is a control document the objective of which is to identify the component and to provide information about it , its evaluation and its acceptability w.r.t.: • component/ manufacturer data • approval status • evaluation tests • procurement inspections and tests • lot acceptance or lot verification tests • radiation hardness data and RVT	New
F.2 Expected response		
F.2.1 Scope and content		
F.2.1.1 General information		
F.2.1.1a	The JD shall include:	New
	1. Family/ sub-family	
	2. Part number (commercial designation)	
	3. Ordering information	
	4. Functional description (major parameters for the application)	
	5. Package	
	6. Manufacturer (country)	
	7. Temperature range	
	8. Absolute maximum rating (Tj max, Pd max, Vcc max,…)	
	9. Procurement specification/ data sheet (revision, date), Application notes & errata sheet	
	10. Manufacturer screening & other manufacturer test on	

	procured lot	
	11. Manufacturer parts traceability (trace-code, date-code, assembly plant, wafer fab, diffusion lot)	
	12. PCN (Service & for selected parts)	
	13. Obsolescence (Yes/No)	
	14. Technology (CMOS, bipolar, and if available process name)	
	15. Life cycle maturity (emerging/maturity/decline)	
	16. Technologies with less than one year introduction (yes/no)	
	17. Moulding characteristics (Tg)	
	18. Moisture sensitivity level	
	19. Internal pure tin (Yes/No)	
	20. Lead finish (RoHs)	
	21. Justification of the need/ Trade off with Hirel and other commercial sources	
	F.2.1.2 Supporting data	
F.2.1.2a	The JD shall include:	New
	1. Qualification status /Hirel or automotive parts (same technology)	
	2. OQ/ EFR/ periodic tests	
	3. Qualification data	
	4. Other data / experiences (evaluation, alert, radiation, assembly,…)	
	5. Demonstration of the representativeness of reliability data	
	6. the supporting data	
	F.2.1.3 Evaluation plan	
F.2.1.3a	The JD shall include:	New
	1. Evaluation plan with flow diagram	
	2. Preliminary and final internal supplier's specification	
	F.2.1.4 Additional test on flight lot	
F.2.1.4a	The JD shall include LAT /screening and RVT plan with flow diagram and test conditions and acceptance criteria (including drift calculation).	New
	F.2.1.5 Procurement data	
F.2.1.5a	The JD shall include traceability information (trace-code, date-code, assembly plant, wafer fab, diffusion lot and die revision).	New

	F.2.1.6 Approval status	
F.2.1.6a	The JD shall include the approval status.	New
	F.2.1.7 Appendix	
F.2.1.7a	The JD shall include:	New
	1. A copy of the procurement specification / data sheet	
	2. Traceability information (CoC, PCN)	
	F.2.2 Special remarks	
F.2.2	None	New

Annex G (informative)
Difference between the three classes

	CLASS 1	CLASS 2	CLASS 3
EVALUATION	**COMPLETE** - Construction analysis - Electrical charact. (3T+10°C margin) - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 2000h-125°C + DPA - Precond + 500T/C -55°C/+125°C - Radiation evaluation (TID, SEE)	**COMPLETE** - Construction analysis - Electrical charact. (3T+10°C margin) - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 2000h-125°C + DPA - Precond + 500T/C -55°C/+125°C - Radiation evaluation (TID, SEE)	**LIMITED** - Construction analysis - Radiation evaluation (TID, SEE)
JD (Justification Doc)	**DATA COLLECTION** - Component manufacturer data - Approval status - Evaluation tests - Procurement inspection and test - Lot acceptance tests - Radiation hardness data and RVT	**DATA COLLECTION** - Component manufacturer data - Approval status - Evaluation tests - Procurement inspection and test - Lot acceptance tests - Radiation hardness data and RVT **DATA COLLECTED** *(EFR, lifetest, thermal cycling)* used for screening reduction	**DATA COLLECTION** - Component manufacturer data - Approval status - Evaluation tests - Procurement inspection and tests - Lot acceptance tests - Radiation hardness data and RVT **DATA COLLECTED** *(lifetest, HAST, thermal cycling)* used for lot test reduction
CUSTOMER PRECAP	no	no	no
SCREENING	**COMPLETE** - X-rays - Serialisation - 10T/C -55°C/+125°C - PIND test (if applicable) - Initial electrical test @ 25°C - Dynamic burn-in 240h-125°C - Final electrical test @ 3T° - PDA (5%) - Hermeticity (if applicable) - External visual inspection	**LIMITED (if data collected)** - PIND test (if applicable) - Hermeticity (if applicable) **+ if no data collected (see JD)** - Serialisation - 10T/C -55°C/+125°C - Initial electrical test @ 25°C - Dynamic burn-in 160h-125°C - Final electrical test @ 3T° - PDA (5%) - External visual inspection	**LIMITED** - PIND test (if applicable) - Hermeticity (if applicable)
LOT TEST **(on screened parts)** **(when applicable)**	**COMPLETE** - Construction analysis - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 2000h-125°C - Precond + 100T/C -55°C/+125°C - RVT (Radiation Verification test)	**COMPLETE (but LT 1000h)** - Construction analysis - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 1000h-125°C - Precond + 100T/C -55°C/+125°C *(may be waived i.a.w. application)* - RVT (Radiation Verification test)	**LIMITED (if data collected)** - Construction analysis - RVT (Radiation Verification test) **+ if no data collected (see JD)** - Precond + HAST 96h or THB 1000h - Lifetest 1000h-125°C - Precond + 100T/C -55°C/+125°C
CUSTOMER BUY-OFF	no (replaced by incoming)	no (replaced by incoming)	no (replaced by incoming)
INCOMING	yes	yes	yes

Annex H (informative) Flow chart for construction analysis and destructive physical analysis

H.1 Overview

This annex is a guideline for Construction Analysis (CA) and Destructive Physical Analysis (DPA) sequences to be adapted on a case by case basis for specific products/ technologies as DSM, BGA packages. Construction analysis goals are specifically oriented: quality/ reliability aspects, detection of counterfeit parts, identification of lead finish (RoHs).

Destructive Physical Analysis allow evaluating impact of life test or long duration storage on the parts.

H.2 Construction analysis and DPA requirements

Table H-1 gives, for the three classes, the steps to be applied for a construction analysis or a DPA.

Table H-1: Construction analysis and DPA

	Class 1 & 2 programmes				Class 3 programmes	
	Evaluation		Procurement		Procurement	
	Initial	After lifetest	Lot acceptance	Relifing	Lot acceptance	Relifing
Construction analysis (see H.3)	X §.4.2.3.3 §.4.2.3.4 §.5.2.3.3 §.5.2.3.4	-	X §.4.2.3.3 §.4.3.5 §.5.2.3.3 §.5.3.5	-	X §.6.3.5.d	-
DPA (see H.4)	-	X §.4.2.3.4 §.4.3.9 §.5.2.3.4 §.5.3.9	-	X §.4.3.9 §.4.3.10 §.5.3.9 §.5.3.10	-	X §.6.3.9 §.6.3.10

H.3 Construction analysis sequence

Table H-2: Construction analysis sequence

TEST	SN1	SN2	SN3	SN4	SN5	PROCEDURE	COMMENTS
External visual inspection	X	X	X	X	X	MIL-STD-750 method 2071 MIL-STD-883 method 2009	MIL specifications are not fitted to visual inspection of PED but can be used as reference (Note 1)
X-ray inspection	X	X	X	X	X	MIL-STD-750 method 2076 MIL-STD-883 method 2012	-
C-SAM test	X	X	X	X	X	JEDEC J-STD-020	Only applicable to plastic package
Permanence of marking	X	X	X	X	X	ESCC 24800	-
PIND test (cavity package)	X	X	X	X	X	MIL-STD-750 method 2052 MIL-STD-883 method 2020	-
Hermeticity (cavity package)			X	X	X	MIL-STD-750 method 1071 MIL-STD-883 method 1014	-
Residual gas analysis (cavity package)			X	X	X	MIL-STD-750 Method 1018 MIL-STD-883 Method 1018	5000 ppm H_2O max at 100°C
Lead finish analysis and pure tin identification	X	X				Energy Dispersive X-ray analysis (EDX), X-ray fluorescence, Microfluorescence, Differential Scanning Calorimeter (DSC)	Analysis to identify lead finish w.r.t. RoHs problematic
Solderability	X	X				MIL-STD-750 method 2026 MIL-STD-883 method 2003	-
Terminal strength	X	X				MIL-STD-750 Method 2036 MIL-STD-883 Method 2004	-
Delidding	X	X	X	X		-	-
Internal visual inspection	X	X	X	X		ESCC 2045000 ESCC 2045010 ESCC 2059000	The die revision shall be identified and recorded

SEM inspection	X	X				MIL-STD-750 method 2077 MIL-STD-883 method 2018	To verify the quality of wire bonding, glassivation integrity, die interconnect metallization
Bond strength (for wedged bonding)	X	X	X			MIL-STD-750 method 2037 MIL-STD-883 method 2011	-
Bond shear (for ball bonding)	X	X	X			JEDEC JASD22-B116	-
Glassivation integrity		X	X	X		MIL-STD-883 method 2021	Make sure that the chemical etchant is suitable for the metallization
Die shear test (cavity package)	X	X	X			MIL-STD-750 method 2017 MIL-STD-883 method 2019	-
Package level cross-sectioning					X	Micro-sectioning of leads shall be performed to assess presence and characteristics of the under-layer	Including die micro-sectioning
Visual, SEM and material analysis					X	-	-

Note 1: In addition to MIL specification criteria, inspect for any evidence of:

- Package deformation
- Foreign inclusions in the package, voids and cracks in the plastic encapsulant
- Deformed leads, peeling, blistering or corrosion of finishing
- Legibility and correctness of marking
- Homogeneity of the lot (package level)

H.4 Destructive physical analysis sequence

Table H-3: Destructive physical analysis sequence

TEST	SN1	SN2	SN3	PROCEDURE	COMMENTS
External visual inspection	X	X	X	MIL-STD-750 method 2071 MIL-STD-883 method 2009	MIL specifications are not fitted to visual inspection of PED but can be used as reference (Note 1 of section H.3)
PIND test (cavity package)	X	X	X	MIL-STD-750 method 2052 MIL-STD-883 method 2020	-
Hermeticity (cavity package)	X	X	X	MIL-STD-750 method 1071 MIL-STD-883 method 1014	-
Solderability	X	X		MIL-STD-750 method 2026 MIL-STD-883 method 2003	-
Delidding	X	X	X	-	-
Internal visual inspection	X	X	X	ESCC 2045000 ESCC 2045010 ESCC 2059000	-
Bond strength (for wedged bonding)	X	X	X	MIL-STD-750 method 2037 MIL-STD-883 method 2011	-
Bond shear (for ball bonding)	X	X	X	JEDEC JASD22-B116	-
Glassivation integrity		X	X	MIL-STD-883 method 2021	Make sure that the chemical etchant is suitable for the metallization
Die shear test (cavity package)	X	X	X	MIL-STD-750 method 2017 MIL-STD-883 method 2019	-

Bibliography

ECSS-S-ST-00	ECSS system - Description, implementation and general requirements
ECSS-Q-ST-70-08	Space product assurance - Manual soldering of high-reliability electrical connections
ECSS-Q-ST-70-38	Space product assurance - High-reliability soldering for surface-mount and mixed technology