

TECHNICAL SPECIFICATION

Process management for avionics – Aerospace and defence electronic systems containing lead-free solder –

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Part 21: Program management – Systems engineering guidelines for managing the transition to lead-free electronics

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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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IEC TS 62647-21-2013

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containing lead-free solder – **(standards.iteh.ai)**

**Part 21: Program management – Systems engineering guidelines for managing
the transition to lead-free electronics**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE



ICS 03.100.50; 31.020; 49.060

ISBN 978-2-8322-1019-2

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PROCESS MANAGEMENT FOR AVIONICS –
AEROSPACE AND DEFENCE ELECTRONIC
SYSTEMS CONTAINING LEAD-FREE SOLDER –**

**Part 21: Program management –
Systems engineering guidelines for managing
the transition to lead-free electronics**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC/TS 62647-21, which is a technical specification, has been prepared by IEC technical committee 107: Process management for avionics.

The text of this technical specification is based on the following documents: IEC/PAS 62647-21 and GEIA-HB-0005-1.

This technical specification cancels and replaces IEC/PAS 62647-21, published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Coherence with IEC/TS 62647-1 definitions.
- b) Reference to IEC 62647 documents when already published.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
107/204/DTS	107/215/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62647 series, published under the general title *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Due to a variety of real and potential health issues, many constituent materials used in the production of electronic products have come under scrutiny. The European Union (EU) has started a process with two directives: 2002/95/EC Restriction of Hazardous Substances (RoHS) and 2002/96/EC Waste Electrical and Electronic Equipment (WEEE) that restrict or eliminate the use of various substances in a variety of products that are produced after July 2006. Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment is an updated / recast version of the Directive 2002/95/EC.

One of the key materials restricted is lead (Pb), which is widely used in electronic solder and electronic piece part terminations. While these regulations may appear to only affect products for sale in the EU, due to the reduced market share of the Aerospace, Defence and High Performance (ADHP) electronics industry, many of the lower tier suppliers have changed their products because their primary market is consumer electronics. Additionally, several U.S. states have enacted similar “green” laws and many Asian electronics manufacturers have recently announced completely green product lines.

Since the ADHP electronics industry is one of the few major industrial sectors that still repair circuit card assemblies (CCAs) and since Pb-free materials and processes are relatively immature and poorly understood, an aerospace-wide approach to the transition was deemed to be highly valuable.

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PROCESS MANAGEMENT FOR AVIONICS – AEROSPACE AND DEFENCE ELECTRONIC SYSTEMS CONTAINING LEAD-FREE SOLDER –

Part 21: Program management – Systems engineering guidelines for managing the transition to lead-free electronics

1 Scope

This part of IEC 62647 is designed to assist program management and/or systems engineering management in managing the transition to lead-free (Pb-free) electronics to assure product reliability and performance.

Manufacturers of Aerospace, Defence and High Performance (ADHP) electronics may inadvertently introduce Pb-free elements (including piece part finish, printed wiring board (PWB) or printed circuit board (PCB) finish, or assembly solder) if careful coordination between buyer and supplier is not exercised. For example, piece part manufacturers may not always change part numbers to identify Pb-free finishes, especially if the previous tin-lead (Sn-Pb) finished piece part has been discontinued. Detailed examination of piece parts and documents at receiving inspection, while crucial, may not be sufficient to identify Pb-free piece parts.

NOTE 1 Pb-free technology can impact any program regardless of whether the program itself is exempt or bound by environmental regulations. The industry conversion to Pb-free solder technology may affect an ADHP program in one or both of the following ways:

- 1) if the program is required to implement Pb-free technology (contract requirement, environmental regulation, etc), then the program manager/lead systems engineer will need to assess the impact of in-house transition with respect to design (performance of products using Pb-free) and process (processes to build Pb-free products);
- 2) if the program purchases COTS (commercial-off-the-shelf) items for its products/systems, then there is a very good chance that these items will contain Pb-free solder or Pb-free finishes on parts, printed wiring boards (PWBs), printed circuit boards (PCB), or circuit cards assemblies (CCA).

The basic principles delineated in this document can be used for program management and/or systems engineering management of any aerospace and/or high performance program. The annexes in the document describe tools that can be used in conjunction with this document.

- 1) Annex A describes a matrix of product tier level versus associated risks with respect to a Pb-free transition.
- 2) Annex B contains links to the European Union Directives and Executive Order 13148.
- 3) Annex C contains a general program manager checklist for dealing with Pb-free issues that summarizes the content of this document.
- 4) Annex D contains a general manufacturing process assessment checklist to assess supplier compliance to IEC/TS 62647-1.
- 5) Annex E describes a recommended program language to assure performance, reliability, airworthiness, safety, and certifiability of Pb-free product(s).

This document is designed to assist a program in assuring the performance, reliability, airworthiness, safety, and certifiability of product(s), in accordance with IEC/TS 62647-1. Please note that the program manager and systems engineer (along with their respective organizations), and the appropriate enterprise authority work together in ensuring that all impacts of Pb-free technology insertion are understood and risks mitigated accordingly.

For the purposes of this document, “program management (or manager) and/or systems engineering management (or manager) and/or the appropriate enterprise authority” are defined as “program manager”.

NOTE 2 The implications are that the program manager and systems engineering manager (along with their respective organizations) and the appropriate enterprise authority work together in ensuring that all impacts of Pb-free technology insertion are understood and risks mitigated accordingly.

This document may be used by other high performance and high reliability industries at their discretion.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC/TS 62647-1:2012, *Process management for avionics – Aerospace and defence electronic systems containing lead free solder – Part 1: Preparation for a lead-free control plan*

IEC/TS 62647-2, *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 2: Mitigation of deleterious effects of tin*

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3 Terms, definitions and abbreviations

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For the purposes of this document, the following terms, definitions and abbreviations apply.

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3.1 Terms and definitions

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3.1.1

assemblies

electronic items that require electrical attachments, including soldering of wires or component terminations

EXAMPLE Circuit cards and wire harnesses.

[SOURCE: IEC/TS 62647-1:2012, 3.1]

3.1.2

COTS

commercial-off-the-shelf

item whose design and configuration is controlled by the manufacturer and on which the user has no control as to design and configuration

Note 1 to entry: An item may be a component, a subassembly, an assembly, a system.

[SOURCE: IEC/TS 62647-1:2012, 3.3]

3.1.3

critical

state of an item or function, which if defective, will result in the system’s inability to retain operational capability, meet primary objective, or affect safety

[SOURCE: IEC/TS 62647-1:2012, 3.2]

3.1.4**customer**

entity or organization that (a) integrates a piece part, soldered assembly, unit, or system into a higher control level system, (b) operates the higher control level system, or (c) certifies the system for use

EXAMPLE This may include end item users, integrators, regulatory agencies, operators, original equipment manufacturers (OEMs), and sub-contractors.

[SOURCE: IEC/TS 62647-1:2012, 3.5]

3.1.5**high performance**

continued performance or performance on demand where an application (product, equipment, electronics, system, program) down time cannot be tolerated in an end-use environment which can be uncommonly harsh, and the application must function when required

EXAMPLE: Examples of high performance applications are life support or other critical systems.

[SOURCE: IEC/TS 62647-1:2012, 3.7]

3.1.6**lead-free****Pb-free**

less than 0,1 % by weight of lead (Pb) in accordance with reduction of hazardous substances (RoHS) guidelines

[SOURCE: IEC/TS 62647-1:2012, 3.8]

3.1.7**Lead-free control plan****LFCP**

aerospace or military system supplier's document that defines the processes that assure the Plan owners, their customers and all other stakeholders that aerospace, defence and high performance high-reliability electronics systems containing Pb-free solder and Pb-free piece part and PWB finishes will continue to be reliable, safe, producible, affordable, and supportable

[SOURCE: IEC/TS 62647-1:2012, 3.9]

3.1.8**Pb-free tin**

pure tin or any tin alloy with < 3 % lead (Pb) content by weight

Note 1 to entry: Some Pb-free finishes other than pure tin, such as tin-bismuth and tin-copper are considered to be "tin" for the purposes of this specification. Many of these alloys have not been assessed for whiskering behaviour.

[SOURCE: IEC/TS 62647-1:2012, 3.11]

3.1.9**Pb-free tin finish**

final finishes or underplates either external or internal to a device, board or other hardware, including all leads and surfaces, even those coated, encapsulated, or otherwise not exposed

Note 1 to entry: It may include finishes on electrical piece parts, mechanical piece parts, and boards. It does not include Pb-free bulk solders, assembly materials, solder balls, or those devices where the Pb-free tin finish has been completely replaced (consistent with GEIA-STD-0006).

[SOURCE: IEC/TS 62647-1:2012, 3.12]

3.1.10

PCB

printed circuit board

PWB

printed wiring board

substrate using conductive pathways, tracks or signal traces etched from copper sheets laminated, and allowing to connect electrically a set of electronic components to realize a circuit card

3.1.11

piece part

electronic component that is not normally disassembled without destruction and is normally attached to a printed wiring board to perform an electrical function

[SOURCE: IEC/TS 62647-1:2012, 3.14]

3.1.12

repair

act of restoring the functional capability of a defective article in a manner that precludes compliance of the article with applicable drawings or specifications

[SOURCE: IEC/TS 62647-1:2012, 3.17]

3.1.13

rework

action taken to return a unit (SRU/LRU/system) to a state meeting all requirements of the engineering drawing, including both functionality and physical configuration by making repairs

Note 1 to entry: Also used to define the act of reprocessing non-complying articles, through the use of original or equivalent processing in a manner that assures full compliance of the article with applicable drawings or specifications.

[SOURCE: IEC/TS 62647-1:2012, 3.16]

3.1.14

sub-contractor

organization, within the given high-reliability industry, that supplies, maintains, repairs, or supports electronic systems, and is not the direct supplier to the customer or user of those systems

[SOURCE: IEC/TS 62647-1:2012, 3.22]

3.1.15

supplier

entity or organization that designs, manufactures, repairs, or maintains a piece part, unit, or system

Note 1 to entry: This includes original equipment manufacturers (OEMs), repair facilities, sub-contractors, and piece part manufacturers.

[SOURCE: IEC/TS 62647-1:2012, 3.23]

3.1.16

system

one or more units that perform electrical function(s)

[SOURCE: IEC/TS 62647-1:2012, 3.24]