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colour inside

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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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2: Mitigation of deleterious effects of tin

FOREWORD

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- 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 62647-2, 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 62647-2 and GEIA-STD-0005-2 Revision A.

This technical specification cancels and replaces IEC/PAS 62647-2.

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

Enquiry draft	Report on voting
107/160/DTS	107/193/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.

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- withdrawn,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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 enacted 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 produced after July 2006. One of the key materials restricted is lead (Pb), which is widely used in electronic solder and electronic piece part terminations, and printed wiring boards. 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 industry in electronics, many of the lower tier suppliers are changing their products because their primary market is world-wide consumer electronics. Additionally, several Asian countries and United States (U.S.) states have enacted similar “green” laws. Many Asian electronics manufacturers have recently announced completely “green” product lines.

The restriction of Pb use has generated a transition by many piece part and board suppliers from tin-lead (SnPb) surface finishes to pure tin or other Pb-free finishes. Lead-free tin finishes can be susceptible to the spontaneous growth of crystal structures known as “tin whiskers” which can cause electrical failures, ranging from parametric deviations to catastrophic short circuits, and may interfere with sensitive optical surfaces or the movement of micro-electro mechanical systems (MEMS) for example. Though studied and reported for decades, the mechanism behind their growth is not well understood, and tin whiskers remain a potential reliability hazard. Furthermore, the growing number of piece parts with pure tin finishes means there are more opportunities for whiskers to grow and to produce failures.

It is important to state that that the nature and meaning of ‘risk’ posed by tin whiskers may vary considerably across the range of users of this Specification. As in any assessment of risk, the probability of occurrence and failure and consequence of occurrence and failure should be considered in each application. Potential whisker failure modes for a particular hardware/system application must be carefully considered when making the choice/determination of which control level(s) to apply. For example, whisker-prone leaded parts on circuit card used in a system that is under frequent/continual power may only incur parametric deviations or interrupts as individual whiskers grow and short to an adjacent lead. On the other hand, the same circuit card, employed in a missile subject to years of dormant storage, could grow many long whiskers into potentially catastrophic shorting conditions but the shorts will not occur until the missile is launched toward its target and results in mission failure. For the purposes of this Specification, risk refers to the chance and consequence of a failure due to a whisker, not just the chance of the presence of a whisker.

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

Part 2: Mitigation of deleterious effects of tin

1 Scope

This Technical Specification establishes processes for documenting the mitigating steps taken to reduce the harmful effects of Pb-free tin in electronic systems.

This Technical Specification is applicable to aerospace, defence, and high performance (ADHP) electronic applications which procure equipment that may contain Pb-free tin finishes.

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*[1]

IEC/PAS 62647-3, *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 3: Performance testing for systems containing lead-free solder and finishes*[2]

IEC/PAS 62647-21, *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*[3]

IEC/PAS 62647-22, *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 22: Technical guidelines*[4]

ANSI/GEIA-STD-0006, *Requirements for using solder dip to replace the finish on electronic piece parts*

ANSI Z1.4, *Sampling procedures and tables for inspection by attributes*

IPC J-STD-001, *Requirements for soldered electrical and electronic assemblies*

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1 Previously known as GEIA-STD-0005-1.

2 Previously known as GEIA-STD-0005-3. IEC/PAS 62647-3 is in the process of being revised and will be issued as IEC/TS 62647-3.

3 Previously known as GEIA-HB-0005-1. IEC/PAS 62647-21 is in the process of being revised and will be issued as IEC/TS 62647-21.

4 Previously known as GEIA-HB-0005-2. IEC/PAS 62647-22 is in the process of being revised and will be issued as IEC/TS 62647-22.

IPC-CC-830, *Qualification and performance of electrical insulating compounds for printed wiring assemblies*

JESD201, *Environmental acceptance requirements for tin whisker susceptibility of tin and tin alloy surface finishes*

JESD213, *Standard test method utilizing X-ray fluorescence (XRF) for analyzing component finishes and solder alloys to determine Tin (Sn) – Lead (Pb) content*

MIL-STD-1580, *Destructive physical analysis for electronic, electromagnetic, and electromechanical parts*