



# PUBLICLY AVAILABLE SPECIFICATION

## PRE-STANDARD

**Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 1: Lead-free management**

IEC PAS 62647-1:2011  
<https://standards.iteh.ai/catalog/standards/sist/b82ed45-3f75-47f4-80c9-57f27fb832ee/iec-pas-62647-1-2011>

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 1: Lead-free management**

FOREWORD

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A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC-PAS 62647-1 has been processed by IEC technical committee 107: Process management for avionics.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
107/106/PAS	107/115A/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS is based on GEIA-STD-0005-1 and is published as a double logo PAS. GEIA, Government Electronics and Information Technology Association, has been transformed into TechAmerica Association.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single period up to a maximum of 3 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

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



## INTRODUCTION

This PAS is intended for use by Aerospace and High Performance (AHP) electronics system customers, i.e., aerospace and defence vehicle integrators, operators, and regulatory organizations, and their suppliers, i.e., system original equipment manufacturers (OEMs) and system maintenance facilities as they incorporate Pb-free solder or Pb-free piece part and board finishes.

The Aerospace Industries Association (AIA), the Avionics Maintenance Conference (AMC), and Government Electronics and Information Technology Association (GEIA) formed the Lead-free Electronics in Aerospace Project Working Group (LEAP WG) to generate a series of industry standard documents for the use and handling of Pb-free solder, piece parts and boards in AHP. This PAS – originally published as GEIA-STD-0005-1 – was prepared by the LEAP WG; and was balloted and approved by GEIA G-12 (Solid State Subcommittee) and the GEIA Avionics Process Management Committee. According to agreements between GEIA and IEC, this PAS is extended at international level.

This PAS is intended to work in concert with GEIA-HB-0005-1<sup>1</sup>, GEIA-HB-0005-2<sup>2</sup>, and IEC/PAS 62647-2 (based originally on GEIA-STD-0005-2). Figure 1 shows a schematic representation of their relationships with each other, and with information about lead-free (Pb-free) electronics from sources external to the AHP industries.

This PAS may be referenced in proposals, requests for proposals, work statements, contracts, and other aerospace and high performance industry documents.

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 that are put on the market after July 2006. One of the key materials restricted is lead, which is widely used in electronic solder and electronic piece part terminations. These regulations may appear to affect only products for sale in the EU; however, due to the reduced market share of the AHP industries, many of the lower tier suppliers to those industries will change their products to serve their primary, non-AHP markets. Additionally, several U.S. states have enacted similar “green” laws and many Asian electronics manufacturers have recently announced completely green product lines. Since AHP is one of the few major industrial sectors that still repair Circuit Card Assemblies (CCAs) and the lead-free materials and processes are relatively immature and poorly understood, an aerospace-wide approach to their application is desired.

AHP industries products may be in one of a number of stages of the incorporation of Pb-free electronics, including

- 1) products that have been designed and qualified with traditional tin-lead (SnPb) electronic piece parts, materials, and assembly processes, and that will need to be maintained in the SnPb configuration;
- 2) products that have been designed and qualified with traditional SnPb electronic piece parts, materials and assembly processes, and have incorporated Pb-free electronic piece parts;
- 3) products that have been designed and qualified with SnPb materials, and are incorporating Pb-free materials;
- 4) new products designed with Pb-free materials.

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<sup>1</sup> A future IEC/PAS 62647-21, based on GEIA-HB-0005-1, is in preparation.

<sup>2</sup> A future IEC/PAS 62647-22, based on GEIA-HB-0005-2, is in preparation.



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

## Part 1: Lead-free management

### 1 Scope

This PAS defines the objectives of, and requirements for, documenting processes that assure customers and regulatory agencies that Aerospace and High Performance (AHP) electronic systems containing Pb-free solder, piece parts, and boards will satisfy the applicable requirements for performance, reliability, airworthiness, safety, and certifiability throughout the specified life of performance.

Its goal is to communicate requirements for a Lead-free Control Plan (LFCP), hereinafter referred to as the plan, and to assist suppliers in the development of their own plans. The plan documents the plan owner's (supplier's) processes, that assure their customers, and all other stakeholders that the plan owner's products will continue to meet their requirements<sup>3</sup>.

This PAS does not contain detailed descriptions of the processes to be documented but lists high-level requirements for such processes, and areas of concern to the AHP industries that must be addressed by the processes.

This PAS applies only to entities within the control of the AHP electronics system supply chain; and is intended to address issues that are unique to those industries.

Some applications may have unique requirements that exceed the scope of this PAS, and should be covered separately.

### 2 Normative references

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

IEC/PAS 62647-2 (originally published as GEIA-STD-0005-2), *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 2: Mitigation of the deleterious effects of tin*

GEIA-HB-0005-1, *Program Management / Systems Engineering Guidelines for Managing the Transition to Lead-free Electronics* <sup>4</sup>

GEIA-HB-0005-2, *Technical Guidelines for Aerospace and High Performance Electronics Containing Lead-free Solder* <sup>5</sup>

<sup>3</sup> This PAS was developed primarily for aerospace products; however, it also may be applicable, at the discretion of the user, to other products with similar characteristics, e.g., low-volume, rugged environments, high reliability, long lifetime, and repairability. Other industries may use this PAS by substituting the name of their industry for the word "aerospace" in this PAS.

<sup>4</sup> A future IEC/PAS 62647-21, based on GEIA-HB-0005-1, is in preparation.

<sup>5</sup> A future IEC/PAS 62647-22, based on GEIA-HB-0005-2, is in preparation.

IPC-1066, *Marking, Symbols and Labels for Identification of Lead-free and Other Reportable Materials in Lead-free Assemblies*

### 3 Terms and definitions

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

#### 3.1 assemblies

electronic items that require electrical attachments, including soldering of wires or component terminations; examples include circuit cards and wire harnesses

#### 3.2 critical item or function

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

#### 3.3 customer

entity or organization that (a) integrates a piece part, soldered assembly, unit, or system into a higher level system, (b) operates the higher level system, or (c) certifies the system for use. For example, this may include end item users, integrators, regulatory agencies, operators, original equipment manufacturers (OEMs), and subcontractors

#### 3.4 high performance system or product

System or Product which requires continued performance or performance on demand, or equipment down time cannot be tolerated, or end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems

#### 3.5 lead-free

defined as less than 0.1% by weight of lead in accordance with Waste Electrical and Electronic Equipment (WEEE) guidelines

#### 3.6 lead-free control plan

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

#### 3.7 Pb-free tin

tin or any tin alloy with <3% lead (Pb) content by weight. This means that some Pb-free finishes other than Pb-free tin, such as tin-bismuth and tin-copper, are considered to be "tin" for the purposes of this PAS. Many of these alloys have not been assessed for whiskering behavior

#### 3.8 Pb-free tin finish

Pb-free tin final finishes or underplates either external or internal to a device, board or other hardware. This includes all leads and surfaces, even those coated, encapsulated, or otherwise not exposed. 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

**3.9****piece part**

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

**3.10****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

**3.11****rework**

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

**3.12****solder ball technology**

identifies a family of components that employ solder balls or bumps to make mechanical and electrical connections between components and printed circuit boards. Examples are ball grid arrays (BGA), flip chip, and chip scale interconnections

**3.13****soldered assembly**

assembly of two or more basic parts interconnected by a solder alloy. A lead-based soldered assembly is one in which the solder alloys are solely lead-based. A lead-free soldered assembly is one in which the solder alloys are solely lead-free

**3.14****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

**3.15****supplier**

entity or organization that designs, manufactures, repairs, reworks, or maintains a piece part, unit, or system. For example, this includes original equipment manufacturers (OEMs), repair and rework facilities, subcontractors, and piece part manufacturers

**3.16****system**

one or more units that perform electrical function(s)

**3.17****system design authority**

entity responsible for producing and/or maintaining the design of the system

**3.18****tin whisker**

spontaneous crystal growth that emanates from a tin surface. They may be cylindrical, kinked, or twisted. Typically they have an aspect ratio (length/width) greater than two, with shorter growths referred to as nodules or odd-shaped eruptions (OSEs)

**3.19****unit**

one or more assemblies within a chassis to perform electrical function(s)