



BSI Standards Publication

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

National foreword

This Published Document is the UK implementation of IEC/TS 62647-21:2013.

The UK participation in its preparation was entrusted to Technical Committee GEL/107, Process management for avionics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2013.
Published by BSI Standards Limited 2013

ISBN 978 0 580 82731 0
ICS 03.100.50; 31.020; 49.060

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 August 2013.

Amendments/corrigenda issued since publication

Date	Text affected
-------------	----------------------



TECHNICAL SPECIFICATION

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE



ICS 03.100.50; 31.020; 49.060

ISBN 978-2-8322-1019-2

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	8
3 Terms, definitions and abbreviations	8
3.1 Terms and definitions.....	8
3.2 Abbreviations.....	11
4 General discussion of program management/systems engineering management concerns.....	11
4.1 General.....	11
4.2 Concerns in accordance with IEC/TS 62647-1.....	12
4.2.1 General	12
4.2.2 Reliability.....	12
4.2.3 Configuration control	12
4.2.4 Risk management.....	12
4.2.5 Detrimental effects of tin	12
4.2.6 Rework/repair and maintenance.....	13
4.3 Additional program management/system engineering management concerns.....	13
4.3.1 General	13
4.3.2 Cost.....	13
4.3.3 Commercial off-the-shelf.....	14
4.3.4 Quality.....	14
4.3.5 Contractual language.....	14
4.3.6 Program constraints.....	14
4.3.7 System engineering management plan	14
5 Requirements definition.....	15
5.1 General.....	15
5.2 Customer requirements.....	15
5.2.1 General	15
5.2.2 WEEE and RoHS Directives.....	15
5.2.3 Executive Order 13148 (green initiative)	15
5.3 Additional prime contractor requirements	15
5.4 Change control	15
6 Use environment(s)	15
6.1 Impact on use environment(s).....	15
6.2 Impact on storage and transport.....	15
7 Decision criteria.....	16
7.1 Program decision concerning Pb-free.....	16
7.2 Compliance to IEC/TS 62647-1	16
7.3 Solder alloy chosen.....	16
7.4 Other programs.....	16
7.4.1 General	16
7.4.2 Percentages of product.....	16
7.4.3 Supplier awareness	16
8 Supplier's lead-free control plan	16

8.1	General.....	16
8.2	Supplier procurement and sub-contractor control	17
	8.2.1 General	17
	8.2.2 Supplier procurement	17
	8.2.3 Supplier sub-contractor control plan	17
8.3	Productibility plan	18
8.4	Manufacturing changes	18
8.5	Manufacturing risk management	18
8.6	Supplier schedule of Pb-free implementation	18
9	Requalification/test plan	18
	9.1 General.....	18
	9.2 Delta qualification or requalification	18
	9.3 Acceptance by analysis/test	18
	9.4 Acceptance by similarity	19
10	Rework/repair and maintenance	19
	10.1 General.....	19
	10.2 Supplier recommendations for rework/repair of Pb-free products	19
	10.3 Maintenance and training documentation	19
11	Risk management.....	19
	11.1 General.....	19
	11.2 Program-level identification of program-level risks	19
	11.3 Risk analyses.....	19
	11.4 Risk mitigation	19
12	Cost	19
13	Presentation to customer.....	20
	13.1 General.....	20
	13.2 Compliance to IEC/TS 62647-1	20
	13.3 System engineering management plan.....	20
	13.4 Other deliverables to the customer.....	20
	Annex A (informative) Matrix of tier level versus associated risk	21
	Annex B (informative) Links to the European Union Directives and Executive Order 13148	23
	Annex C (informative) General program manager checklist for dealing with Pb-free issues	24
	Annex D (informative) General manufacturing process assessment checklist for assessing supplier compliance to IEC/TS 62647-1	26
	Annex E (informative) Recommended program language (subject to contractual agreements)	33
	Bibliography.....	34

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- 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.

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.