TECHNICAL SPECIFICATION

IEC TS 62239

First edition
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Process management for avionics – Preparation of an electronic components management plan

Gestion des processus pour l'avionique – Préparation d'un plan de gestion des composants électroniques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROCESS MANAGEMENT FOR AVIONICS – Preparation of an electronic components management plan

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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 liasing with the IEC also participate in this preparation. The 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 62239, 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:

Enquiry draft	Report on voting
107/19, 19A/DTS	107/20/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 technical specification cancels and replaces IEC/PAS 62239 published in 2001. This first edition constitutes a technical revision.

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 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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

INTRODUCTION

This document is intended to help aerospace equipment manufacturers, subcontractors, maintenance facilities, and other aerospace component users develop their own Electronic Component Management Plans (ECMPs), hereinafter also referred to as 'plan'. This document states objectives to be accomplished; it does not require specific tasks to be performed, specific data to be collected or reports to be issued. Those who prepare plans in compliance with this document are encouraged to document processes that are the most effective and efficient for them in accomplishing the objectives of this document. In order to allow flexibility in implementing and updating the documented processes, plan authors are encouraged to refer to their own internal process documents instead of including detailed process documentation within their plans.

This component management document is intended for aerospace users of electronic components. This standard is not intended for use by the manufacturers of electronic components. Components selected and managed according to the requirements of a plan compliant to this document may be approved by the concerned parties for the proposed application, and for other applications with equal or less severe requirements.

Organizations that prepare such plans may prepare a single plan, and use it for all relevant products supplied by the organization, or may prepare a separate plan for each relevant product or customer.

PROCESS MANAGEMENT FOR AVIONICS – Preparation of an electronic components management plan

1 Scope

This Technical Specification defines the requirements for developing an Electronic Components Management Plan (ECMP) to assure customers and regulatory agencies that all of the electronic components in the equipment of the plan owner are selected and applied in controlled processes compatible with the end application and that the technical requirements detailed in Clause 4 are accomplished. In general, the owners of a complete electronic components management plan are avionics equipment manufacturers.

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 62240, *Use of semiconductor devices outside manufacturers' specified temperature ranges*

3 Terms definitions and abbreviations

3.1 Terms and definitions

For the purposes of this Technical Specification, the following definitions apply.

NOTE Plan owners may use alternative definitions consistent with convention within their company in their plan.

3.1.1
avionics equipment environment
applicable environmental conditions (as described per the equipment specification) that the equipment shall be able to withstand without loss or degradation in equipment performance during all of its manufacturing cycle and maintenance life (the length of which is defined by the equipment manufacturer in conjunction with customers)

3.1.2
capable
term used to indicate that a component can be used successfully in the intended application

3.1.3
certified
indicates assessment and compliance to an applicable third party standard and maintenance of a certificate and registration (i.e. CECC, JAN, IECQ)

3.1.4
characterization
process of testing a sample of components to determine the key electrical parameter values that can be expected of all produced components of the type tested

3.1.5
component application
process that assures that the component meets the design requirements of the equipment in which it is used

3.1.6
component manufacturer
organization responsible for the component specification and its production

3.1.7
component obsolescence management
range of management actions taken to avoid or resolve the effects of components not being procurable due to the manufacturer(s) ceasing production. Component obsolescence management should be considered an element of component dependability

3.1.8
component qualification
process used to demonstrate that the component is capable of meeting its specification for all the required conditions and environments

3.1.9
component quality assurance
all activities and processes to provide adequate confidence that each individual component meets the performance and environmental requirements

3.1.10
component selection
process of choosing a specific component for a specific application

3.1.11
dependability
capability of a product enabling it to achieve the specified functional performance at the appropriate time and for the planned duration, without damage to itself or its environment

NOTE Dependability is generally characterised by the following four parameters: reliability, maintainability, availability, safety.

3.1.12
distributor
organization contractually authorized by a manufacturer to store, split, repack and distribute completely finished components which have been declared by the manufacturer as conforming to their specifications. The distributor is responsible for providing any technical information and traceability information supplied by the component manufacturer

3.1.13
Electronic Components Management Plan
ECMP
equipment manufacturer's document that defines the processes and practices for applying components to an equipment or range of equipment. Generally, it addresses all relevant aspects of controlling components during system design, development, production, and post-production support

3.1.14
electronic components
electrical or electronic devices that are not subject to disassembly without destruction or impairment of design use. They are sometimes called electronic parts, or piece parts

EXAMPLES Resistors, capacitors, diodes, integrated circuits, hybrids, application specific integrated circuits, wound components and relays.

3.1.15
electronic equipment
item produced by the plan owner, which incorporates electronic components

EXAMPLES End items, sub-assemblies, line-replaceable units and shop-replaceable units.

3.1.16
obsolete component
component which is no longer manufactured, and may or may not still be available

3.1.17
package type
generic package family describing the physical outline and lead style

EXAMPLES Plastic quad flat-package, ball grid array, chip scale package, SOIC package, SOT23 etc.

3.1.18
plan owner
original design authority responsible for all aspects of the design, functionality and reliability of the delivered equipment in the intended application and is responsible for writing and maintaining their specific ECMP

3.1.19
risk
measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints

3.1.20
single event effect
response of a component caused by the impact of galactic cosmic rays, solar enhanced particles and/or energetic neutrons and protons. The range of responses can include both non-destructive (for example upset) and destructive (for example latch-up or gate rupture) phenomena

3.1.21
subcontractor
person or entity to whom the holder of obligations under a contract has delegated part or all of such obligations

3.1.22
substitute component
component used as a replacement in equipment after the equipment design has been approved

NOTE In some contexts, the term “alternate component” is used to describe a substitute component that is “equal to or better than” the original component.

3.1.23
validation
method of qualifying components at the equipment manufacturer, when no in service data from prior use is available and there is no manufacturer’s qualification data to analyse

3.2 Abbreviations

DSCC – Defence Supply Center Columbus

ECMP – Electronic Components Management Plan

EMC – Electromagnetic Compatibility

ESS – Environmental Stress Screening

NSI – National Supervising Inspectorate

OEM – Original Equipment Manufacturer

4 Technical requirements

The plan shall document the processes used by the plan owner to accomplish the following requirements. These requirements shall apply to all electronic components, including off-the-shelf components, which are defined by the component manufacturer data sheet, and custom components, which are defined by the original equipment manufacturer.

1) Component selection,
2) Component application,
3) Component qualification,
4) Component quality assurance,
5) Component dependability,
6) Component compatibility with the equipment manufacturing process,
7) Component data,
8) Configuration control.

The plan shall state clearly, concisely, and unambiguously:

- what the plan owner does to accomplish each of the requirements;
- how compliance to the plan is demonstrated; and
- the evidence that is available to show that the requirements have been accomplished.

The plan shall document the processes used to address each of the requirements listed above and described in 4.1 to 4.8. Depending on program or product line requirements, the plan owner may, with appropriate justification, amend the above list of requirements by adding or deleting requirements. If this is done, then the plan shall be assessed according to the amended list of requirements stated in the plan.

The only type of amendment permitted is to add or delete entire requirements (those designated and described in 4.1 to 4.8). Modification of any of the requirements listed above and described in this Clause is not permitted.

All the requirements given in this Clause apply to deliverable flight equipment or subassemblies for the avionics industry as stated in 5.6. The Original Equipment Manufacturer (OEM plan owner) has the responsibility of satisfying the requirements given in the list above. These requirements may be accomplished by either the OEM or may be subcontracted. In either case, the OEM has the responsibility for ensuring all requirements are met.

NOTE Ground support test equipment, flight demonstrator assemblies, and prototypes are typically exempt from these requirements, unless the plan owner states otherwise in their plan, see 5.6.

The plan must satisfy the requirements of this Clause, regardless of the source from which the plan owner obtains components.

4.1 Component selection

All components shall be selected according to documented processes and shall satisfy the requirements of this Subclause regardless of additional criteria such as standardisation, order of preference, etc.

NOTE 1 Because of the highly individual nature of most plan owners' administrative processes, no detail is included here. It may include the use of a standard component list, provided the requirements of this Subclause are met when the components are placed onto the standard list. Components should then be selected from the standard list for use in specific applications. The selection process may include levels of preference. This may refer to another process document describing how parts are selected. A preference list may be included in a contract document.

NOTE 2 It is recommended that:

– the number of component types be minimised;

– components be selected from those readily available and produced in large volume;

– components be selected from those in a preferred stage of their lifecycle.

The conditions for use of the component shall be adequately identified, from the component specification based on the component manufacturer's data sheet and any additional requirements to ensure suitability in the end application.

Availability and level of obsolescence risk should be considered as major component selection criteria.

If additional performance is required (for example upscreening, uprating, additional parameters defined), then the component shall be considered as a specific one and shall be uniquely identified.

Each selected component shall be comprehensively identified within the selection process:

- For off-the-shelf components, as a minimum, the component manufacturer data sheet, component manufacturer technical and application notes, packaging, reliability and availability data, producibility data (including storage, soldering conditions, etc.) shall be identified.
- For components specified by the equipment manufacturer, the specific documentation (including specification, manufacturer data and process, reliability, specific tests and screening, and associated in-house continuous monitoring) shall be identified.

4.2 Component application

Listed here are some categories of component application processes that may be documented in a plan. Not all of the categories listed below are relevant to every component application; therefore, the requirements listed below are applicable only if relevant to the given application. The plan shall document the processes that are expected to be applicable to the majority of the plan owner's products, with the understanding that some of the documented processes may not be used for specific programs or specific functionality of products.

In each case, the documented processes shall verify if the equipment containing the component shall continue to meet its performance requirements and specifications throughout the manufacturing, full service storage, and operating lifetime. In order to determine design suitability of equipment, there shall be a formal design review. At the design review, consideration for each component shall be given to all design aspects including those given in 4.2.1 to 4.2.6. A documented report shall be prepared against each of the following design aspects:

4.2.1 Electromagnetic compatibility (EMC)

EMC is demonstrated by analysis, testing and simulation to customer requirements. The component performance shall be capable of EMC compliance at equipment level.

NOTE Certain components, for example high power switching components, may produce more electromagnetic signal than other types and additionally certain components can be more susceptible to electromagnetic interference than others. Component level EMC aspects have been addressed in IEC 61967-1.

4.2.2 De-rating and stress analysis

The documented processes shall verify that the component is used within the operating limits specified by the component manufacturer per a documented set of derating criteria.

When the component manufacturer provides derating criteria and methods, they shall be used where applicable. If the component manufacturer does not provide this information, or if it is not applicable, then the plan owner shall develop and document appropriate derating criteria and methods. All instances in which a component is not used within the limits defined above shall be documented in the design records. In all such instances, either corrective action shall be taken, or justification for not satisfying the criteria shall be documented.

4.2.3 Thermal analysis

The documented processes shall verify that the component is used within the temperature limits specified by the component manufacturer, or by the plan owner.

If components are used outside the temperature ranges specified by the component manufacturer, then the supplier shall demonstrate how he controls this process. Recommendations and guidelines on how to do this are contained in IEC/PAS 62240 and may be used in addition to the plan prepared according to this document. Equivalent procedures from other documents may also be acceptable.

NOTE 1 A common maximum temperature for semiconductor devices is the junction temperature. In some instances, other limiting temperatures may be specified for semiconductor devices, and other types of components.

NOTE 2 In some instances, the manufacturer may not specify the maximum temperature. However the maximum temperature may be calculated from other information supplied by the component manufacturer.

NOTE 3 Verification processes may include analysis, modelling, thermal survey, simulation, or testing.

4.2.4 Mechanical analysis

The documented processes shall verify that the component is mechanically compatible with the application. This includes mechanical fit, as well as the ability to withstand vibration, mechanical shock, and mechanical stresses including those generated by mismatches of coefficients of thermal expansion of the different materials.

NOTE Verification processes may include analysis, modelling, simulation, or testing.

4.2.5 Testing, testability, and maintainability

The documented processes shall assure testability and maintainability of the equipment by the plan owner.

NOTE 1 The focus here is on testing and testability with regard to component verification, not on software or system verification. Examples include board level or sub-assembly level testing, provision for test pins, and that other equipment level tests will be available to verify component function at the appropriate level. Exhaustive testing of complex components is not always realistic, but documented processes should assure some level of evaluation of all components at appropriate points in the production flow.

NOTE 2 This requirement also includes design for maintainability, for example, placement for ease of component replacement, mounting that minimises the risk of damage during maintenance and assures equipment quality following maintenance or repair by equipment manufacturer.

4.2.6 Avionics radiation environment

The documented processes shall verify that the component will operate successfully in the application with regard to the effects of atmospheric radiation. These include single event upset (SEU), single event latch-up (SEL), single event burnout (SEB) and total dose radiation for any identified application where it is a concern. If radiation effects are accommodated by the equipment design, then the method of accommodation shall be documented in the equipment design records.

4.3 Component qualification

4.3.1 General component qualification requirements

It is desired and expected that the majority of components be obtained from qualified component manufacturers; in which case the requirements of 4.3.2, 4.3.3, and 4.3.4 shall apply. In cases where the component manufacturer is not qualified, the requirements of 4.3.5 shall apply.

4.3.2 Component manufacturer quality management

The plan owner shall verify that the component manufacturer has a documented quality management system.

4.3.2.1 The component manufacturer shall have a quality system assessed to the relevant parts of the ISO 9000 series or equivalent.

4.3.2.2 Where the component manufacturer is not assessed in accordance with 4.3.2.1 above, then the plan owner shall demonstrate how the quality management system of the component manufacturer shall be maintained. Where the plan owner conducts or enables an audit on the component manufacturing facility, then the audit shall be conducted in accordance with the relevant standards of the ISO 9000 series or equivalent system. Suitably trained auditors shall conduct that audit.

4.3.3 Component manufacturer process management approval

The plan owner shall verify that the component manufacturer has a manufacturing process capability utilising manufacturing technologies with demonstrable repeatability.

This may be satisfied by one of the following:

4.3.3.1 Manufacturing approval of the component technologies by a third party (for example CECC, DSCC, and IECQ) or within an international second party system.

4.3.3.2 Where the component manufacturer is not assessed as in 4.3.3.1, then the plan owner shall demonstrate how the process management capability of the component manufacturer is ensured. Where the plan owner conducts or enables an audit on the component manufacturing facility, then the audit shall be conducted in accordance with one of the above systems (as in 4.3.3.1) by suitably accredited auditors.

4.3.3.3 Manufacturers who do not have an appropriate internal quality management system may be used when their products are fully qualified by the plan owner in accordance with 4.3.4.2.

4.3.4 Demonstration of component qualification

The plan owner shall document the component qualification process for each component.

The qualification plan and test procedures, sampling and criteria of acceptance (with the defined margins) shall be described. The approach to quality and reliability required in the application shall be outlined.

This can be demonstrated by any of the following, but the choice shall be justified:

4.3.4.1 Component qualification by an external party

Components qualified in accordance with a second or third party approval system as in 4.3.3.1.

4.3.4.2 Component qualification by the equipment manufacturer

Component qualification by the equipment manufacturer can be demonstrated by one or more of the following:

4.3.4.2.1 Component manufacturer technology qualification data

Component manufacturers perform and record data from initial and regular ongoing qualification testing on significant numbers of components. The plan owner shall review such defined qualification testing with acceptance criteria and resulting data for suitability in the end application. Component manufacturers produce components across a wide range of market sectors, and qualification testing will reflect these. Stress levels in the component qualification should equate to or exceed those of the end application or additional testing will be necessary. In this last case, additional testing shall be defined and documented by the plan owner to the satisfaction of the customer

4.3.4.2.2 In-service experience

Satisfactory performance including reliability of the component in a similar or more harsh environment shall be documented.

4.3.4.2.3 Similarity

Documentary evidence from test data or in-service experience of a previously qualified associated component shall be given. For further details on similarity rules refer to relevant standards.

NOTE For example, EN 100114.

4.3.4.2.4 Equipment manufacturer validation

Validation may be employed particularly if components are from a manufacturer, component technology or package type not previously used before.

The plan owner may need to perform component qualification at component level, with completion at equipment level, for new technologies or package types not used before. New components using existing technology and package styles used previously by the plan owner, can be qualification tested within the equipment assembly qualification testing, without testing at the component level.

Component qualification with completion tests at equipment level shall be documented and used only when none of the other methods specified are possible.

4.3.5 Qualification of components from a supplier that is not qualified

If the component supplier is not qualified, then the plan shall document how the components are qualified.

NOTE Examples of such processes are the development and implementation of a component qualification process conducted by the plan owner, the component distributor, component manufacturer or a third party.

4.3.6 Distributor quality and process management approval

The plan owner shall verify that the distributors have a documented quality management system.

NOTE The distributor quality management system shall be assessed in a similar way to either 4.3.2.1 or 4.3.2.2 and applicable to distributors. The distributor shall have an approved process management system in a similar way to 4.3.3, for all its activities including storage, component handling, traceability, testing, shipment, information and technical data handling.

4.4 Continuous component quality assurance

4.4.1 General quality assurance requirements

The documented processes shall assure the continuous quality and performance of all components used throughout the production cycle, prior to delivery. This is to assure that the impact of component manufacturer lot to lot variations, lot to lot assembly handling variations, etc. are minimized and controlled. This will assure the delivered components conform to the delivered equipment requirements.

4.4.2 On-going component quality assurance

One or more of the following methods shall be used to assure component manufacturer quality:

4.4.2.1 Qualified and assessed components

Components shall be purchased from sources that have been successfully assessed by an accredited component assessment system, which includes a means to assess continuous quality assurance. Such assessment systems include applicable international and industry consensus standards, or the plan owner's approved process for evaluation of the component manufacturer's internal quality assurance processes.

NOTE Examples of government or industry standards are the DOD qualified manufacturers lists, AEC, BSI, DSCC(JAN), EIA, STACK International and JEDEC standards; examples of international standards are CECC, and IECQ.

4.4.2.2 Component quality assurance data

Where the requirement of 4.4.2.1 is not met, the plan owner shall have a process to assure that compliance to the component specification is maintained, either by component manufacturer test or plan owner test.

- A component manufacturer assessment shall include component test processes, ongoing component qualification test plans and acceptance criteria. The method by which this information is obtained shall be documented.

  NOTE 1 Typical quality assurance processes include statistical process control, periodic qualification testing, component testing and screening, etc.

- Plan owner performs quality assurance tests and has documented quality acceptance criteria. Quality assurance tests can also be at either the equipment level or subassembly level.

  NOTE 2 The following recommendations apply if component level screening is done:

  – The components are subjected to screening conditions of sufficient rigor and duration to detect defects.

  – A process for screening sampling rates may be proposed by the plan owner, provided that sufficient data is available, and the reject rate is low enough.

4.4.3 Plan owner in-house continuous monitoring

The plan owner shall have a process to assure the required performance of components prior to delivery of the equipment. This process includes various levels of processing, assembly and test of the equipment.

A process for identification, recovery and recording of component removals or replacements during in-house processing and testing shall be documented. Significant component replacement trends, equipment repair actions or a pattern of component replacements that are indicative of a potential component problem shall be investigated to determine the root cause. Appropriate corrective actions shall be conducted.

4.4.4 Component design and manufacturing process change monitoring

The process for tracking (or detecting) and monitoring component design and manufacturing process change data shall be documented. The effects of these changes on equipment performance shall be reviewed and assessed. This process could include: direct information from component manufacturers or distributors, sharing technical information sources, other users information, functional or physical analysis during in-house processing. Following analysis appropriate corrective actions shall be conducted. All design changes shall be in accordance with 4.8.

NOTE 1 Most of the components used in aerospace applications are designed, manufactured and targeted for other industries, and are beyond the control of the plan owner. Frequent design and manufacturing changes are made to improve yield, reduce cost, and enhance performance. Although these changes are documented by the component manufacturer and evaluated for their effects on high-volume applications, their effects on the unique applications of the plan owner may not be evaluated or documented by the component manufacturer. The purpose of this subclause is to describe a process to monitor the components to detect any changes that may affect their performance in the applications of the plan owner.

NOTE 2 Typically, the processes will include:

a) Awareness process, such as access to notices of change from the component manufacturer or distributor.

b) An evaluation process, such as periodic functional testing and/or destructive physical analysis or construction analysis (assuming an initial physical analysis) of a sample of each component.

c) Review of the component manufacturer reliability monitor data or quality data to look for failures and other reports of change.

NOTE 3 Alternatively, a process of periodic lot re-qualification of the component may be documented. If used, the periodic lot re-qualification process should be described here and include test frequency, sample size, etc.

4.5 Component dependability

The documented processes shall assure the reliability, availability, obsolescence management and maintainability of the components used throughout the customer agreed warranty period or maintenance period and/or agreed lifetime of the equipment, provided the customer uses the components within the agreed environmental limits. The process for component risk assessment and rating shall be identified by the plan owner and the metrics documented, including the following:

4.5.1 Reliability assessment

The documented processes shall verify that the installed component is compatible with the circuit application requirements for performance and reliability through the processes listed in this document. These processes include component qualification (including a life test requirement), assurance of quality (consistency), equipment reliability assessments, qualification of the equipment (environmental), and equipment reliability monitors.

NOTE This could be produced either by using a standard method, component manufacturer reliability tests, equipment field return data, similarity with any other similar applications, etc.

4.5.2 Component availability and associated risk assessment

The documented processes shall identify risks associated with availability of the component, and methods to mitigate those risks.

NOTE 1 These may include low volume manufacturers, allocation risks, financial stability of manufacturers, single source manufacturers, etc.

Components considered to be at risk shall be rated using appropriate metrics that reflect their susceptibility to technology change and obsolescence.

NOTE 2 Input for consideration of metrics may include: technology risk and maturity, life cycle, level of confidence in the manufacturer, predicted obsolescence, monosource component, manufacturer supply file information, imprecise manufacturer specification of component performance (specified as "typical", not specified, etc.), components other than those readily available in large volumes and identified on avionics technology roadmaps. Use of components outside manufacturers' specifications and component obsolescence are specific risk issues that that may be addressed outside of or included in this subclause.

The documented processes shall include tracking and reporting the status of risk mitigation efforts when required by customer or business needs.

The documented processes shall address logistics supportability and life management issues when required by customer or business needs.

NOTE 3 The following are primary examples of component risk areas that may be addressed in the plan, specifically or generically. These risk areas may be addressed as part of other design, production, procurement or marketing processes or practices:

(a) new technology availability or maturity for meeting the specified requirements,

(b) component delivery and production rate schedules,

(c) component obsolescence during design, production, or support,

(d) lack of qualification or quality assurance data,

(e) qualification test schedule (especially risk of failure),

(f) cost drivers (especially with custom components),

(g) component changes (design or process changes, known and unknown),

(h) quality and reliability of product from a component manufacturer (especially from a new manufacturer),

(i) radiation effects, such as single event upset, and

(j) uprated components.

4.5.3 Component obsolescence

The plan owner shall have a documented process for component obsolescence management which address the following:

- pro-active measures for component obsolescence,
- component obsolescence awareness,
- reaction to component obsolescence (when it has occurred).

The documented processes shall address the following:

4.5.3.1 Pro-active measures for component obsolescence

The plan shall document the processes used by the plan owner to minimise the future impact of component obsolescence.

NOTE This includes pro-active processes used to minimise the impact of component obsolescence. These are usually associated with the equipment design process and may include such activities as inclusion of a component obsolescence forecast for each component during design review, throw-away modules or designs, or design processes to accommodate future components. They may include a review of a plan for the entire life cycle of the equipment during design review. They may also include plans for maintaining a technology roadmap of components with a substantial risk of obsolescence.

4.5.3.2 Component obsolescence awareness

The plan owner shall document the processes utilized for obsolescence awareness.

NOTE This includes processes used to become aware of existing and impending component discontinuance situations, changes in component design or manufacturing processes, and other component manufacturer actions that may result in components becoming unavailable. This may include use of one or more commercial services or in-house processes.

4.5.3.3 Reaction to component obsolescence

The plan shall document the processes used by the plan owner to resolve obsolete component occurrences to assure continued production and support as required.

NOTE This includes processes used to react to component obsolescence occurrences. They may include bridge stock or life-time buy, identification of alternative sources, equipment re-design, etc.

4.6 Component compatibility with the equipment manufacturing process

The documented processes shall assure that the component is compatible with equipment manufacturing processes (without any quality or reliability impact) throughout:

- Component shipping, handling, and storage (short and long term).
- Equipment manufacturing, assembly, shipping, handling, long term storage, test, repair and rework by equipment manufacturer.
- Protection of components from electrostatic discharge (ESD) damage during component storage and handling, during each step of the equipment assembly process. Use of the relevant sections of EN 100015, MIL-HDBK-263, IEC 61340-5-1, and IEC 61340-5-2 will aid in controlling ESD damage.

The documented processes shall identify the key manufacturing, assembly, shipping, handling, storage, test, repair and rework processes by equipment manufacturer; and the plan shall describe how their impact on components is identified, documented and controlled.

NOTE Of particular concern is the method of storing plastic-encapsulated microcircuits to assure that moisture ingress does not cause pop-corning during assembly. Characterization by component manufacturers of component moisture sensitivity rating in accordance with EIA JESD22-A112 and J-STD-020A will assist in controlling this feature.

4.7 Component data

The plan owner shall include and ensure the completion of a system for collection, storage, retrieval, analysis and reporting of all relevant data from the component manufacturer, equipment design, equipment manufacturing and equipment use in service; and for keeping the data per customer or regulatory requirements.

NOTE 1 The data may not necessarily reside in one database and may be retrieved from several databases or data retrieval systems across the plan owner's business. A relational approach may be used wherein the data system provides access to the data. For example, if the component qualification data is collected and stored by the component manufacturer, the equipment manufacturer's data system could consist of a process, software, and hardware to access that data through the component manufacturer's web page or other source, provided the access is available when needed. As another example, any data that is specific to a program, such as functional simulation results or thermal analysis data, could be accessible via a path through the program data. The plan owner may wish to identify processes that were developed and documented for other initiatives, such as ISO 9000, QS 9000, AS 9000, or IAQS9100 to satisfy this requirement.

NOTE 2 Typical data includes:

- Component data sheet or specification data, for example, input and output parameters, voltage rating, packaging dimensions, availability data, etc.
- Component application data, for example, functional simulation data, breadboard test data, thermal analysis data, structural analysis data, and electromagnetic emission and susceptibility data.
- Component qualification data, for example, component manufacturer qualification test data, component qualification data collected by the equipment manufacturer, or a third party test house, similarity analysis results, and component in-service data used for qualification.

- Component quality assurance data, for example, component manufacturer statistical process control data, component manufacturer component screening data, component screening data collected by the equipment manufacturer or a third party test house, and ESS data from higher-level assembly screening used to reduce or eliminate screening.
- Manufacturing and assembly data, for example, equipment manufacturer statistical process control data, ESS data from manufacturing and assembly, and in-process and final functional test.
- Customer reject data.
- In-service data.

NOTE 3 It is anticipated that this information will be available to the customer upon request.

The documented processes shall ensure that the following are available for each component: data sheet, technical and application notes, conditions of use, qualification and quality monitoring data, packaging data, reliability data, availability information, storage conditions, assembly data (for example, soldering conditions) and any additional information to ensure suitability in the application.

NOTE 4 Most of the above information should be available from the component manufacturer. If the information is modified, or additional information is required to satisfy this objective, then that information falls within this requirement. Examples include results of additional tests or screens conducted by the plant owner or third parties, programming data, or modifications to the data sheet.

4.8 Configuration control

The documented processes shall verify that the equipment configuration control is maintained relative to the component usage in the application. As a minimum requirement, each assembly shall have a controlled parts list.

NOTE It is anticipated that this information will be available to the customer upon request.

4.8.1 Alternative sources

Alternative sources of components may be qualified and identified in the equipment manufacturer component data base to reduce potential risks to component procurement or to solve an obsolescence or unavailability problem of the previous sources.

In this case, the alternative source component performance (fit, form, function and producibility) shall be fully compliant with the component drawing (or the data sheet and technical performance notes) of the previous component, as described within its selection process.

The alternative source component shall be selected to ensure that the reliability, functionality, performance, interchangeability, etc. of the equipment or assembly is not compromised.

NOTE Attention should be paid to detect “false” alternative sources (the same die or component part type could be packaged, tested and distributed by two or more component manufacturers).

4.8.2 Equipment change documentation

All component substitutions shall be documented. The documentation shall include the following information as per agreement between involved parties (typically between the aircraft manufacturer and avionics equipment manufacturer):

a) CN (change notice) number,

b) change date,

c) other related CNs,

d) name of the substitute component manufacturer,

e) reason for change,

f) type of customer notification required (see 4.8.3, it is also anticipated that this information will be available to the customer upon request),