TECHNICAL REPORT

EIA-STD-4899	REV. B
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(R) Requirements for an Electronic Components Management Plan

RATIONALE

This standard was created to define consistent electronic components management requirements for developing electronic component management plans. This revision clarifies and updates these requirements to better address current electronic components issues.

FOREWORD

This document defines the requirements for developing an Electronic Components Management Plan (ECMP), hereinafter also called the Plan, to assure customers and regulatory agencies that all of the electronic components in the equipment of the Plan owner are selected and applied using controlled processes compatible with the end application: aerospace, defense, and high performance (ADHP) equipment. This is accomplished by documenting and implementing the processes required in Clause 3 of this document.

In this document, electronic components are defined as "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."

Electronic components may be either commercial-off-the-shelf (COTS) or custom-designed for the application. A COTS electronic component is defined as "*An electronic component developed by a supplier for multiple customers, whose design and configuration are controlled by the supplier's or an industry specification.*" While there are still some electronic components that are custom-designed for ADHP applications, the vast majority of electronic components used in ADHP applications are COTS components[1]. Thus, for the majority of ADHP applications, it will be impossible for the organization that integrates the electronic component into the application to flow down the requirements of Clause 3 to the component manufacturer, and they must be accomplished by the integrator. In the minority of cases where the requirements of Clause 3 can be flowed down to the component manufacturer, the integrator has the choice of either accomplishing the requirements for those components, or flowing them down.

The Plan documents the processes that the Plan owner has available to address the requirements of this document. For each instance of electronic component integration into ADHP equipment, the Plan owner selects which of the documented processes will be used, based on the application requirements.

NOTE: Appendices A and B are not subject to copyright restrictions.

[1] COTS components are not to be confused with COTS assemblies, which are defined as: *"An assembly developed by a supplier for multiple customers, whose design and configuration is controlled by the supplier's or an industry specification."* COTS assemblies are further described in Reference 1.

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1. SCOPE

This document applies to the development of Plans for integrating and managing electronic components in equipment for the military and commercial aerospace markets; as well as other ADHP markets that wish to use this document.

Examples of electronic components, as described in this document, include resistors, capacitors, diodes, integrated circuits, hybrids, application specific integrated circuits, wound components, and relays.

It is critical for the Plan owner to review and understand the design, materials, configuration control, and qualification methods of all “as-received” electronic components, and their capabilities with respect to the application; identify risks, and where necessary, take additional action to mitigate the risks.

The technical requirements are in Clause 3 of this standard, and the administrative requirements are in Clause 4.

2. REFERENCES

For dated references, only the revision cited applies. For undated references, the latest revision of the referenced document (including any amendments) applies.

1. Standard for Preparing a COTS Assembly Management Plan, TechAmerica EIA-933.
2. Process management for avionics – Electronic components capability in operation – Part 1: Temperature uprating, IEC TR 62240-1.
3. Long-term Storage of Electronic Devices, TechAmerica GEIA-STD-0003.
4. Environmental Conditions and Test Procedures for Airborne Equipment, RTCA DO-160, Radio Technical Corporation of America.
5. High Temperature Storage Life, JESD22-A103, JEDEC©.
6. Temperature, Bias, and Operating Life, JESD22-A108, JEDEC©.
7. Low Temperature Storage Life, JESD22-A119, JEDEC©.
8. Temperature Cycling, JESD22-A104, JEDEC©.
9. Process management for avionics- Atmospheric radiation effects, IEC 62396, Parts 1-5, International Electrotechnical Commission.
10. Measurement and Reporting of Alpha Particles and Terrestrial Cosmic Ray-Induced Soft Errors in Semiconductor Devices, JESD89, JEDEC©.
11. Cycled Temperature-Humidity-Bias Life Test, JESD22-A100, JEDEC©.
12. Accelerated Moisture Resistance-Unbiased HAST, JESD22-A120, JEDEC©.
13. Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices, J-STD-020, JEDEC©.
14. Measurement of Electromagnetic Emissions, IEC 61967 series, International Electrotechnical Commission.
15. Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices**,** JESD625, JEDEC©.
16. ESD Association Standard for the Development of an Electrostatic Discharge Control Program, ANSI/ESD S20.20, Electrostatic Discharge Association.

17. Application Specific Qualification Using Knowledge Based Test Methodology, JESD94, JEDEC©.

18. Stress Test Qualification for Automotive-Grade Integrated Circuits, CDF-AEC Q100, Chrysler-Delco-Ford Automotive Electronics Council.

19. Stress Test Qualification for Automotive-Grade Discrete Semiconductors, CDF-AEC Q101, Chrysler-Delco-Ford Automotive Electronics Council.

20. Stress Test Qualification for Automotive-Grade Passive Components, CDF-AEC Q200, Chrysler-Delco-Ford Automotive Electronics Council.

21. Stress-Test-Driven Qualification of Integrated Circuits, JESD47, JEDEC©.

22. Process management for avionics – Electronic Components for aerospace, defence, and high performance (ADHP) applications – Part 1: General requirements for high reliability integrated circuits and discrete semiconductors, IEC TS62686-1, International Electrotechnical Commission.

23. Process management for avionics – Aerospace qualified electronic components (AQEC) – Part 1: Integrated circuits and discrete semiconductors, IEC TS 62564-1, International Electrotechnical Commission.

24. Guidelines for Development of Civil Aircraft Systems, ARP4754, SAE International.

25. Guidelines for Preparing Reliability Assessment Plans for Electronic Engine Controls, ARP5890, SAE International.

26. Reliability Prediction of Electronic Equipment, MIL-HDBK-217.

27. Electronic Reliability Design Handbook, MIL-HDBK-338.

28. General Guidelines for Electronic Equipment, MIL-HDBK-454.

29. Reliability Program Standard for Systems Design, Development, and Manufacturing, GEIA-STD-0009, SAE International.

30. Failure Mechanisms and Models for Semiconductor Devices, JEP122, JEDEC©.

31. Early Life Failure Rate Calculation Procedure for Electronic Components, JESD74, JEDEC©.

32. Physics of Failure Reliability Predictions, ANSI/VITA 51.2-2011, VITA.

33. Quality Management Systems – Fundamentals and Vocabulary, ISO 9000.

34. Quality Management Systems – Requirements for Aviation, Space and Defense, SAE AS9100, SAE International.

35. Derating of Electronic Components, GEIA-STD-0008, TechAmerica.

36. Application Thermal Derating Methodologies, JEP149, JEDEC©.

37. Performance Standard for Aerospace and High Performance Electronic Systems Containing Lead-free Solder, GEIA-STD-0005-1, SAE International.

38. Process Management for Avionics – Aerospace and Defence Electronic Systems Containing Lead-free Solder – Part 1: Preparation of a Lead-free Control Plan, IEC TS 62647-1, edition 1.0, International Electrotechnical Commission.

39. Standard for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems, GEIA-STD-0005-2, SAE International.

40. Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 2 – Mitigation of deleterious effects of tin, IEC TS 62647-2, International Electrotechnical Commission.

41. Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition, SAE AS5553, SAE International.

42. Process management for avionics – Counterfeit prevention – Part 1, Avoiding the use of counterfeit, fraudulent and recycled electronic components, IEC TS 62668-1, International Electrotechnical Commission.

43. Standard for Preparing a DMSMS Management Plan, TechAmerica STD-0016, SAE International.

3. TECHNICAL REQUIREMENTS

An Electronic Components Management Plan, hereinafter called the "Plan", compliant to this document ***shall*** include documented processes that are available for use by the Plan owner to accomplish the requirements of this clause. These requirements apply to all electronic components, including COTS, custom, and subcontracted components.

3.1 Component Application

The documented processes ***shall*** assure that the electronic component performs the function(s) allocated to it by the application design, reliably throughout its manufacturing, operating, storage, and transportation lifetime, using appropriate risk mitigations when required. Allocated functions include, but are not limited to, inputs and outputs for electrical, electronic, electromechanical, electro-optical signals, duty cycle, etc.

3.1.1 Operating, Storage, and Transportation Environmental Stresses

The documented processes ***shall*** assure that the electronic component satisfies its application requirements with respect to each of the manufacturing, operating, storage, and transportation stresses listed below, using appropriate risk mitigations as required.

	Stress	Application Consideration	Guidance Standards (Ref. No.)
3.1.1.1	Temperature limits	Components usage outside the temperature limits specified by the component manufacturer is discouraged. Damage can occur when specified maximum or minimum temperature limits are exceeded during manufacturing, operation, storage, or transport.	IEC TR 62240 (2) GEIA-STD-0003 (3) RTCA DO-160 (4) JESD22-A103 (5) JESD22-A108 (6) JESD22-A119 (7)
3.1.1.2	Temperature variations	Temperature cycling over long periods of time can cause damage due to mismatches of thermal coefficients of expansion between the component and other materials in an assembly.	JESD22-A104 (8)
3.1.1.3	Heat dissipation and cooling	Proper heat dissipation and cooling methods may be required to prevent damage to the component assemblies. When the application thermal analysis has successfully implemented the thermal and stress analysis process, in conjunction with the component manufacturer specifications, the component is considered to be used within the manufacturer's rating.	JEP149
3.1.1.4	Mechanical shock	Mechanical stress limits may be exceeded when components are exposed to mechanical shock. This includes mechanical fit, as well as the ability to withstand mechanical shock, and mechanical stresses including those generated by mismatches of coefficients of thermal expansion of the different materials.	

	Stress	Application Consideration	Guidance Standards (Ref. No.)
3.1.1.5	Mechanical vibration	Damage can occur due to long term exposure to certain mechanical vibration profiles. This includes mechanical fit, as well as the ability to withstand vibration, and mechanical stresses including those generated by mismatches of coefficients of thermal expansion of the different materials.	
3.1.1.6	Natural radiation	Radiation due to cosmic rays, neutrons, heavy ions, etc., may cause Single Event Effects (SEE).	IEC 62396 series (9) JESD89A (10)
3.1.1.7	Induced radiation	Damage can result from exposure to nuclear radiation and x-ray inspection.	
3.1.1.8	Moisture and corrosion	Damage can result from exposure to moist and/or corrosive environments, particularly when elevated temperatures are experienced.	JESD22-A100 (11) JESD22-A120 (12) J-STD-020 (13)
3.1.1.9	Electromagnetic capability	Assemblies can produce electromagnetic noise through electrical transitions, and assemblies can be susceptible to electromagnetic interference.	IEC 61967 series (14)
3.1.1.10	Electrostatic Discharge	Handling of components can induce electrostatic discharge that can cause component damage.	ESD-S20.20 JESD 625
3.1.1.11	Other relevant stresses	As applicable from system use environment or customer specifications.	

3.2 Component Selection

The documented processes ***shall*** assure that all components are selected to satisfy all the requirements for the deliverable equipment allocated to the component level, as well as the requirements of this clause.

3.2.1 Component Specification

The documented processes ***shall*** assure that the capabilities of all components are defined, uniquely identified, and documented to the extent required to assure that they satisfy the application requirements.

3.2.2 Component Availability

The documented processes ***shall*** assure that availability and level of obsolescence risk are considered as major component selection criteria.

3.2.3 Standardization

At each level of design authority, the documented processes ***shall*** minimize distinct part numbers and part manufacturers to the extent practical to meet performance requirements, and reduce logistics, sustainment, and production costs.

3.2.4 Qualification

The documented processes ***shall*** define the component qualification process, qualification plan, test procedures, sampling plan, criteria of acceptance, and test results to assure all components meet the application and/or customer requirements.

(See JESD94, AEC Q100, AEC Q101, AEC Q200, JESD47, IEC TS62686-1, and IEC TS 62564-1 for guidance on qualification.)

3.2.5 Reliability

The documented processes ***shall*** assure that the Plan owner verifies the reliability of the component in the system, based on (1) credible data from testing the component, or from use of similar components in similar environments; and (2) analysis comparing the available data to the application.

(See SAE ARP4754, SAE ARP5890, MIL-HDBK-217, MIL-HDBK-338, MIL-HDBK-454, and GEIA-STD-0009 for guidance on reliability analysis.)

3.2.6 Life-limited Components

The documented processes ***shall*** describe the methods used to identify all the components in a given design that are susceptible to wearout prior to the end of the design life of the application. This includes, but is not limited to, all semiconductor devices with feature sizes less than 50 nm; and susceptible to at least one of the following wearout mechanisms:

a. Electromigration,

b. Dielectric breakdown,

c. Hot carrier injection, and

d. Bias temperature instability.

The documented processes ***shall*** describe the methods used to assure that all relevant life-limiting or early wearout failure mechanisms are properly understood and addressed.

(See References JEDEC JEP122, JEDEC JESD74, and ANSI/VITA 51.2-2011 for guidance regarding this requirement.)

For each component identified by the processes above, the Life-limited Components Report shown in Appendix C (or equivalent) ***shall*** be completed and documented as part of the equipment design record.

3.2.7 Component Manufacturer and Distributor Quality System

The documented processes ***shall*** assure that the component manufacturers and component distributors have documented quality management systems that satisfy the relevant parts of the ISO 9000 and SAE AS9100 family, or equivalent, validated by suitably trained auditors, and address any risks of the component manufacturer or distributor quality management system.

3.2.8 Component Manufacturer Process Management

The documented processes ***shall*** identify the methods used to qualify component manufacturers, including the component manufacturer's internal manufacturing and quality processes that demonstrate that the components produced meet the component specifications with demonstrable repeatability.

(See ISO 9000 and SAE AS9100 for guidance regarding this requirement.)

3.2.9 Using Components Outside the Manufacturer's Specified Temperature Range

The documented processes ***shall*** describe methods to limit the practice of using components outside the manufacturers' specified temperature ranges.

(This practice is commonly called uprating or upscreening. Recommendations and guidelines on how to do it are contained in IEC TR 62240-1, and may be used in addition to the Plan prepared according to this standard.)

3.2.9.1 Configuration Control for Components Used Outside the Manufacturer's Specified Temperature Range

The documented processes ***shall*** assure that all components used outside the temperature range specified by the component manufacturer are clearly identified by the Plan owner with unique part number identifications with the capability to provide supporting data upon request.

3.2.9.2 Report for Components Used Outside the Manufacturer's Specified Temperature Range

For each instance of a component used outside the manufacturer's specified temperature range, the Uprating Report shown in Appendix B (or equivalent) ***shall*** be completed and documented as part of the equipment design record.

3.2.10 Derating

The documented processes ***shall*** assure that the derating criteria and methods used for the component are appropriate for the application.

(See MIL-HDBK-338, MIL-HDBK-454, GEIA-STD-0008, and JEDEC JEP149 for additional guidance about derating.)

3.2.11 Compatibility with Assembly/Manufacturing Processes

The documented processes ***shall*** assure that the component is compatible with the equipment/manufacturing assembly processes, including repair and rework.

3.2.12 Maintainability and Testability

The documented processes ***shall*** assure that the maintainability and testability of the component in the application are consistent with the application requirements.

3.2.13 Materials

The documented processes ***shall*** assure that the materials used in the component (including material changes throughout the production life) are consistent with the application requirements, including prohibited materials, hazardous materials, environmentally sensitive materials, flammability, etc.

3.2.14 Lead-free Finishes

The documented processes ***shall*** assure that the use of lead-free component termination materials are controlled to meet system requirements according to GEIA-STD-0005-1 or IEC TS62647-1, or equivalent.

(GEIA-STD-0005-2, IEC 62647-2, and GEIA-STD-0006 provide additional guidance for this requirement.)

3.3 Component Life Cycle Management

The documented processes ***shall*** assure that all components included in delivered equipment meet the system requirements for the application life cycle.

3.3.1 Procurement

The documented processes ***shall*** assure procurement of components that meet the allocated system requirements as verified by clauses 3.1 and 3.2.

3.3.2 Counterfeit Parts

The documented processes ***shall*** assure that use of counterfeit parts in equipment is avoided, and that potential counterfeit parts are controlled.

(See SAE AS5553 and IEC TS 62688-1 for guidance.)

3.3.3 Plan Owner In-house Continuous Monitoring

The documented processes ***shall*** assure investigation of component failure issues, when those failures indicate a trend and the hardware is not exempted by the Plan, to determine root cause and take appropriate corrective actions.

3.3.4 Plan Owner Component Manufacturer Change Monitoring

The documented processes ***shall*** include detecting, tracking, and monitoring the component manufacturer's design and manufacturing material and process changes to the extent required by the application criticality and/or sensitivity to change, to determine the effects of these changes on equipment performance and any required appropriate corrective actions.

3.3.5 Component Obsolescence

The documented processes ***shall*** assure that the potential obsolescence[2] of the component is managed to avoid or mitigate the risk of the component not being procurable due to the manufacturer ceasing or substantially altering production.

(For guidance, see GEIA_STD-0016.)

3.3.6 Component Data

The documented processes ***shall*** include collection, storage, retrieval, analysis, and reporting of all relevant data for the component, equipment design, equipment manufacturing, and equipment usage in service; and for making the data available for customer review and/or regulatory requirements for the specified service life of the equipment.

3.3.7 Configuration Management

The documented processes ***shall*** assure that the equipment configuration is maintained relative to the component usage in the application, including a controlled parts list for each assembly and documentation of all changes.

3.4 Subcontractor Management

The documented processes ***shall*** assure that all components supplied by subcontractors satisfy the requirements of the application and this Standard.

The documented processes ***shall*** assure the flow down of all applicable requirements of this Standard to the lowest applicable tier and verification of compliance.

(See reference 1 for guidance on COTS assemblies.)

4. ADMINISTRATIVE REQUIREMENTS

4.1 Plan Content and Organization

The Plan ***shall*** be organized to address each of the requirements of Clause 3 clearly, concisely, and unambiguously; stating:

- What the Plan owner does to satisfy each requirement, preferably in the form of documented and verifiable processes;
- How the Plan owner demonstrates compliance to the Plan; and
- The evidence that is available to show that the requirements are satisfied.

[2] Obsolescence is also called Diminishing Manufacturing Sources and Material Shortages (DMSMS).

4.2 Plan Compliance Demonstration

The Plan ***shall*** include a matrix that demonstrates compliance to the requirements of this document through (a) references to the Plan owner's internal documents or industry standards that satisfy the requirement, or (b) a complete statement of what the Plan owner does to satisfy the requirement. The format of Appendix A is recommended.

4.3 Plan Focal Point

The Plan ***shall*** identify an organization focal point to:

- Serve as the primary interface between the Plan owner and outside parties in matters pertaining to the Plan;
- Resolve issues related to the Plan in a timely manner; and
- Assure that the Plan is reviewed and updated as necessary.

4.4 Plan References

The Plan ***shall*** include a list of all the documents referred to in the Plan, including this document, other industry and government documents, and the Plan owner’s internal documents.

4.5 Plan Applicability

The Plan ***shall*** document all the component types or technologies and the range of equipment to which the Plan applies. The requirements of this Plan ***shall*** apply to all electronic components integrated into the equipment, whether they are obtained from the component manufacturer, a distributor, or other supplier or subcontractor.

4.6 Plan Implementation

The Plan owner ***shall*** be able to provide objective evidence that the requirements of this document are satisfied, and that the Plan is implemented.

4.7 Plan Acceptance

The Plan ***shall*** be accepted when the Plan owner and the customer agree that the Plan is compliant to this document. Certification by an accredited assessment body such as IECQ may be used as evidence that the Plan satisfies the requirements of this document.

4.8 Plan Modifications

In the event that a Plan is changed, a process ***shall*** be in place to notify all affected parties.

4.9 Plan Terms, Definitions, Abbreviations, Initials, and Acronyms

The terms, definitions, abbreviations, initials, and acronyms used in the Plan ***shall*** be those of Clause 5 of this document, unless they are clearly defined otherwise in the Plan.

5. PLAN TERMS, DEFINITIONS, ABBREVIATIONS, INITIALS, AND ACRONYMS

COMPONENT APPLICATION: The process that assures that the component meets the design requirements of the equipment in which it is used.

COMPONENT MANUFACTURER: The organization responsible for the component specification and its production.

COMPONENT OBSOLESCENCE MANAGEMENT: The 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 risk management.

COMPONENT QUALIFICATION: The process used to demonstrate that the component is capable of meeting its application specification for all the required conditions and environments.

COMPONENT QUALITY ASSURANCE: All activities and processes to provide adequate confidence that each individual component meets the performance and environmental requirements.

COMPONENT SELECTION: The process of choosing a specific component for a specific application.

COMPONENT STANDARDIZATION: The process of developing and agreeing on (by consensus of decision) uniform engineering criteria for products and methods for achieving compatibility, interoperability, interchangeability, or commonality of material. Standardization is used to reduce proliferation of parts in inventory.

COTS (COMMERCIAL-OFF-THE-SHELF) ELECTRONIC COMPONENT: An electronic component developed by a supplier for multiple customers, whose design and configuration are controlled by the supplier's or an industry specification.

DOCUMENTED PROCESS: A process description released in the Plan owner's configuration controlled document system.

DSCC: Defense Supply Center Columbus, now known as Defense Land and Maritime.

DISTRIBUTOR: An organization that stores, splits, repacks, and distributes completely finished components that have been declared by the manufacturer as conforming to their specifications.

ECMP: Electronic Component Management Plan

ELECTRONIC COMPONENTS MANAGEMENT PLAN (ECMP): An equipment manufacturer's document that references or 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.

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 are resistors, capacitors, diodes, integrated circuits, hybrids, application specific integrated circuits, wound components, and relays.

ELECTRONIC EQUIPMENT: An item, produced by the Plan owner, which incorporates electronic components. Examples are end items, sub-assemblies, line-replaceable units, and shop-replaceable units.

IEC: International Electrotechnical Commission

IECQ: International Electrotechnical Commission for Quality

ISO: International Standards Organization

JEDEC: Semiconductor industry standards alliance

MAY: Indicates a course of action that is permissible within the limits of this document.

MIL-HDBK: U.S. Department of Defense handbook

PLAN OWNER: The original design authority responsible for all electronic component aspects of the delivered equipment's design, functionality, and reliability in the intended application. The plan owner is responsible for writing and maintaining their specific ECMP.

RISK: A measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints.

RISK MANAGEMENT: The act or practice of dealing with risk. It includes planning for risk, assessing (identifying and analyzing) risk areas, developing risk handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program.

SHALL: Indicates a requirement that is mandatory.

SHOULD: Offers a guideline or recommendation that might be used or helpful to assure compliance to this document or to an ECMP.

STACK INTERNATIONAL: An international organization coordinating component issues among the members.

SUBCONTRACTOR: A person or entity to whom the holder of obligations under a contract has delegated part or all of such obligations.

UPRATED PART: A part that has been assessed for its capability to meet the performance requirements of the application in which it is used, outside the manufacturer's specified temperature, and has been determined capable of meeting those requirements, as modified according to the results of the assessment.

WILL: Expresses a declaration of intent to be compliant to this document.

6. NOTES

6.1 A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications nor in documents that contain editorial changes only.

PREPARED BY SAE AVIONICS PROCESS MANAGEMENT COMMITTEE (APMC)

APPENDIX A - COMPLIANCE MATRIX

Requirement No.	EIA-STD-4899-B clause or sub-clause	Requirement (restated from Clauses 3 and 4)	Expected Documentation and Relevant Industry Documents (EIA-STD-4899-B Ref. no.)	ECMP Reference (clause no.)	(a) references to the Plan owner's internal documents or industry standards that satisfy the requirement, or (b) a complete statement of what the Plan owner does to satisfy the requirement.
1	3	An Electronic Components Management Plan, hereinafter called the "Plan", compliant to this document ***shall*** include documented processes that are available for use by the Plan owner to accomplish the requirements of this clause.	The Plan defines the procedures to assure configuration control of the Plan that addresses all the requirements of this standard. The Plan specifies the types of components that are required to comply with the Plan. The Plan defines the method of flowing down the requirements within the Plan Owner's organization and company, as well as to other suppliers, such as subcontractors. The Plan defines and document how different applications of the same component meet system requirements.		
2	3.1	The documented processes ***shall*** assure that the electronic component performs the function(s) allocated to it by the application design, reliably throughout the manufacturing, operating, storage, and transportation lifetime, using appropriate risk mitigations when required.	The Plan defines the procedures and methods to flow down system requirements to component requirements. The Plan defines the procedures to document how different applications of the same component meet system requirements.		
3	3.1.1	The documented processes ***shall*** assure that the electronic component satisfies its application requirements with respect to each of the manufacturing, operating, storage, and transportation stresses listed below, using appropriate risk migrations when required.	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level for applicable environmental factors, as identified in 3.1.1.1 through 3.1.1.10.		
4	3.1.1.1	Temperature limits	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
5	3.1.1.2	Temperature variations	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
6	3.1.1.3	Heat dissipation and cooling	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
7	3.1.1.4	Mechanical shock	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
8	3.1.1.5	Mechanical vibration	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
9	3.1.1.6	Natural radiation	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
10	3.1.1.7	Induced radiation	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
11	3.1.1.8	Moisture and corrosion	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
12	3.1.1.9	Electromagnetic capability	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		

13	3.1.1.10	Electrostatic discharge	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
14	3.1.1.11	Other relevant stresses	The Plan defines the procedures to document how all applications of all components meet system requirements allocated to the component level.		
15	3.2	The documented processes ***shall*** assure that all components are selected to satisfy all the requirements for the deliverable equipment allocated to the component level, as well as the requirements of this clause.	The Plan defines the procedures and methods to flow down system requirements to component requirements. The Plan defines and documents how different applications of the same component meet system requirements. The Plan defines processes to assure that all pertinent application criteria are considered for each component in the system over the complete system life cycle. The procedure addresses the possibility of different environmental and operating stresses applicable to particular applications for a component. The Plan defines the formal design review process to assure suitable component requirements, and identifies the mechanisms used to retain and allow retrieval of documentation that verifies compliance with and traceability to the application requirements. ISO9000 and AS9100 address data retention time requirements.		
16	3.2.1	The documented processes ***shall*** assure that the capabilities of all components are defined, uniquely identified, and documented to the extent required to assure that they satisfy the application requirements.	The Plan defines the process that assures documentation of the component capability, including component drawings and specifications, component manufacturer data sheet, component manufacturer technical and application notes, availability/obsolescence reports, packaging specifications, testing requirements, reliability and quality data, producibility data (including storage, soldering conditions, etc.), and design reviews detailing how component performance meets system application requirements. The Plan defines the process to assure that unique identification is provided for components that have requirements different than the component specification, such as the data sheet for the marked part number. The Plan defines the process to verify and document that the component performance meets the system requirements. Some requirements can only be effectively verified at higher assembly level.		
17	3.2.2	The documented processes ***shall*** assure that availability and level of obsolescence risk are considered as major component selection criteria.	The Plan meets the intent of GEIA-STD-0016.		
18	3.2.3	At each level of design authority, the documented processes ***shall*** minimize distinct part numbers and part manufacturers to the extent practical to meet performance requirements, and reduce logistics, sustainment, and production costs.	The Plan documents the process to minimize component manufacturers and part numbers, while also preferring components produced in large volume and at optimum stage of life cycle for continued procurement availability. The Plan documents a procedure to assure use of contract specified preference lists.		

19	3.2.4	The documented processes shall document the component qualification process, qualification plan, test procedures, sampling plan, criteria of acceptance, and test results to assure all components meet the application and/or customer requirements.	The Plan defines the process to establish the qualification test and analysis requirements, plans, and procedures, and document test and analysis results, that verify meeting the application requirements. Considerations for establishing qualification requirements include failure mechanisms and acceleration factors for the test conditions relative to the application requirements. Some potential data sources are: 1. Component Qualification by an external party, such as second or third party approval systems (e.g., Defense Logistics Agency, International Electrotechnical Commission Quality, Stack International). 2. Similarity to another qualified component 3. Component Qualification by the Equipment Manufacturer, including assessment of: • Component Manufacturer Data (e.g., initial and regular ongoing qualification testing on significant numbers of components based on JESD 47 and JESD94, IEC/TS-62564-1, IEC/TS-62681-1) • In-Service Experience demonstrating satisfactory performance including reliability of the component in a similar or more harsh environment Application specific component testing		
20	3.2.5	The documented processes ***shall*** assure that the Plan owner verifies the reliability of the component in the system, based on (1) credible data from testing the component, or from use of similar components in similar environments; and (2) analysis comparing the available data to the application.	The documented processes 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 (environments), and equipment reliability monitors. This is accomplished by using a standard method, component manufacturer reliability tests, equipment field return data, similarity with any other similar applications, etc. The plan includes derating criteria for each component type.		
21	3.2.6	The documented processes ***shall*** describe the methods used to identify all the components in a given design that are susceptible to wearout prior to the end of the design life of the application.	The Plan defines the process to meet the requirement.		
22	3.2.6	The documented processes ***shall*** describe the methods used to assure that all relevant life-limiting or early wearout failure mechanisms are properly understood and addressed.	The Plan defines the process to meet the requirement.		
23	3.2.7	The documented processes ***shall*** assure that the component manufacturers and component distributors have documented quality management systems that satisfy the relevant parts of the ISO 9000 and SAE AS9100 family, or equivalent, validated by suitably trained auditors, and address any risks of the component manufacturer or distributor quality management system.	The Plan identifies the process that assures acceptable quality for product provided by component manufacturers and distributors, such as implementation by the component manufacturer and distributor of suitable Quality standards, or verification by the Plan Owner.		

24	3.2.8	The documented processes ***shall*** identify the methods used to qualify component manufacturers, including the component manufacturer's internal manufacturing and quality processes that demonstrate that the components produced meet the component specifications with demonstrable repeatability.	• The Plan defines the method to assure suitable component manufacturer process repeatability, and any additional Plan Owner processes to address inadequate repeatability, including any or all of the following, and other similar elements: Manufacturing process assessment. • Manufacturing approval of the component technologies by a third party (e.g., DSCC, IECQ, STACK) or within an international second party system. • Identification of acceptable quality level. • Equipment production and field failure rates. • Failure reporting and corrective action system process. Risk assessment/management for parts that have poor process capability.		
25	3.2.9	The documented processes shall describe methods to limit the practice of using components outside the manufacturers' specified temperature ranges.	The Plan defines the process to utilize components outside manufacturer's specified stress limits with a general goal to limit this practice. EIA-4900/IEC-TR62240-1 provides guidance on application of parts outside the manufacturer's specified temperature range. JEP149 provides guidance on component temperature limits stress.		
26	3.2.9.1	The documented processes ***shall*** assure that all components used outside the temperature range specified by the component manufacturer are clearly identified by the Plan owner with unique part number identifications with the capability to provide supporting data upon request.	The Plan defines the identification process, and the Plan Owner will make supporting documentation available. The Plan uses Appendix B and retains records.		
27	3.2.9.2	For each instance of a component used outside the manufacturer's specified temperature range, the Uprating Report shown in Appendix B (or equivalent) ***shall*** be completed and documented as part of the equipment design record.	The Plan uses Appendix B and retains records.		
28	3.2.10	The documented processes ***shall*** assure that the derating criteria and methods used for the component are appropriate for the application.	The Plan defines the process to meet the requirement. GEIA-STD-0008 provides baseline derating criteria.		
29	3.2.11	The documented processes ***shall*** assure that the component is compatible with equipment assembly processes, including repair and rework.	The Plan defines the process to meet the requirement. Areas to address include: • Component shipping, handling, and storage • Protection of components from electrostatic discharge (ESD) damage during component storage and handling,		
30	3.2.12	The documented processes ***shall*** assure that the maintainability and testability of the component in the application are consistent with the application requirements.	The Plan defines the process to meet the requirement.		
31	3.2.13	The documented processes ***shall*** assure that the materials used in the component (including material changes throughout the production life) are consistent with the application requirements, including prohibited materials, hazardous materials, environmentally sensitive materials, flammability, etc.	The Plan defines the process to meet the requirement.		

32	3.2.14	The documented processes ***shall*** assure that the use of lead-free component termination materials are controlled to meet system requirements according to GEIA-STD-0005-1 or IEC TS62647-1, or equivalent.	The Plan defines the process to meet the requirement.		
33	3.3	The documented processes ***shall*** assure that components included in delivered equipment meet the system requirements for the application life cycle.	The Plan defines the process to meet the requirement.		
34	3.3.1	The documented processes ***shall*** assure procurement of components that meet the allocated system requirements as verified by clauses 3.1 and 3.2.	The Plans the process to meet the requirement.		
35	3.3.2	The documented processes ***shall*** assure that use of counterfeit parts in equipment is avoided, and that potential counterfeit parts are controlled.	The Plan defines the process to meet the requirement.		
36	3.3.3	The documented processes ***shall*** assure investigation of component failure issues, when those failures indicate a trend and the hardware is not exempted by the Plan, to determine root cause and take appropriate corrective actions.	The Plan maintains data for review that verifies assembly process test and inspection results and field performance to address rework/replacement trends, equipment repair actions, and patterns of component replacements that are indicative of a potential component problem. The Plan includes the processes for determining failure root cause and corrective actions.		
37	3.3.4	The documented processes ***shall*** include detecting, tracking, and monitoring the component manufacturer's design and manufacturing material and process changes to the extent required by the application criticality and/or sensitivity to change to determine the effects of these changes on equipment performance and any required appropriate corrective actions.	The Plan will describe a process to monitor the components to detect any changes that may affect their performance in the applications of the Plan owner. Potential processes include: direct information from component manufacturers or distributors, sharing technical information sources, change notifications, information from other users, functional or physical analysis as part of receiving inspection or during in-house processing. Typically, the processes 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. If used, the periodic lot re-qualification process is described here and includes test frequency, sample size, etc.		
38	3.3.5	The documented processes ***shall*** assure that the potential obsolescence[3] of the component is managed to avoid or mitigate the risk of the component not being procurable due to the manufacturer ceasing or substantially altering production.	The Plan meets the intent of GEIA-STD-0016.		

[3] Obsolescence is also called Diminishing Manufacturing Sources and Material Shortages (DMSMS).