

Electrical, Electronic, and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program

International Space Station



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NASA/ASI

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ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND
MECHANICAL PARTS MANAGEMENT AND IMPLEMENTATION PLAN FOR
SPACE STATION
OCTOBER 20, 1998**

For NASA

DATE

For ASI Concurrence

DATE

Changes from SSP 30312, Revision D and/or Revision E requirements do not impact previous NASA and ASI "Meet or exceed EEE parts requirements" agreements.

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“Meet or exceed EEE parts requirements” agreements.

PREFACE

SSP 30312, Electrical, Electronic, and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program establishes the approaches, policies, and activities for effectively managing and implementing EEE and mechanical parts control for space station.

The EEE and Mechanical Parts Management and Implementation Plan contains an introduction and sections on technical requirements, data requirements to be used for proving compliance with the technical requirements, implementation of Parts Control Board activities, Parts Control Board responsibilities, and the government/industry data exchange program.

The contents of this document are intended to be consistent with the tasks and products of the Prime Contractor and Space Station Program participants as dictated by the requirements in SSP 41000, Space Station System Specification. The EEE and Mechanical Parts Management and Implementation Plan for Space Station Program shall be implemented on all new Space Station Program contractual and internal activities and shall be included in any existing contracts through contract changes. This document is under the control of the Space Station Control Board (SSCB), and any changes or revisions shall be approved by the Program Manager.

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SPACE STATION PROGRAM OFFICE
ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND
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LIST OF CHANGES

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All changes to paragraphs, tables, and figures in this document are shown below:

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TABLE OF CONTENTS

PARAGRAPH		PAGE
1.0	INTRODUCTION	1 - 1
1.1	SCOPE	1 - 1
1.2	PURPOSE	1 - 1
1.3	APPLICABILITY	1 - 1
1.4	DEFINITION OF EEE PARTS	1 - 2
2.0	APPLICABLE DOCUMENTS	2 - 1
2.1	NASA DOCUMENTS	2 - 1
2.2	MILITARY STANDARDS AND SPECIFICATIONS	2 - 1
3.0	ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND MECHANICAL PARTS REQUIREMENTS	3 - 1
3.1	EEE PARTS CONTROL PLANS	3 - 1
3.2	EEE PART SELECTION	3 - 1
3.3	NONSTANDARD EEE PARTS	3 - 5
3.4	NONSTANDARD EEE PARTS SPECIFICATIONS	3 - 6
3.5	EEE PARTS QUALIFICATION	3 - 7
3.6	EEE PART PRE-AWARD SURVEYS	3 - 7
3.7	DESTRUCTIVE PHYSICAL ANALYSIS (DPA)	3 - 8
3.8	EEE PARTS STRESS	3 - 9
3.9	IONIZING RADIATION	3 - 10
3.10	EEE PARTS PROCUREMENT	3 - 12
3.11	EEE PART COORDINATED PROCUREMENT	3 - 13
3.12	INCOMING INSPECTION	3 - 14
3.13	EEE PARTS HANDLING	3 - 14
3.14	EEE PARTS IDENTIFICATION AND TRACEABILITY DATA	3 - 14
3.15	EEE PARTS LISTS	3 - 15
3.16	OFF-THE-SHELF (OTS) EQUIPMENT AND OFF-THE-SHELF DESIGN	3 - 15
3.17	REPORTING PARTS AND MATERIALS PROBLEMS AND ASSESSING ALERTS	3 - 16
3.18	NONCONFORMING AND NONCOMPLIANT PARTS	3 - 16
3.19	ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL PART FAILURES	3 - 17

TABLE OF CONTENTS (Continued)

PARAGRAPH		PAGE
3.20	MECHANICAL PARTS	3 - 18
3.21	STATUS REPORTS	3 - 18
4.0	DATA REQUIREMENTS	4 - 1
4.1	NONSTANDARD PART APPROVAL	
	REQUESTS/NONSTANDARD PART SPECIFICATIONS	4 - 1
4.2	QUALIFICATION TEST REPORTS	4 - 1
4.3	PRE-AWARD SURVEYS	4 - 1
4.4	DESTRUCTIVE PHYSICAL ANALYSIS (DPA)	4 - 2
4.5	EEE PARTS STRESS	4 - 2
4.6	IONIZING RADIATION	4 - 2
4.7	EEE PARTS IDENTIFICATION AND TRACEABILITY DATA	4 - 3
4.8	EEE PARTS LISTS	4 - 3
4.9	OFF-THE-SHELF (OTS) EQUIPMENT	4 - 3
4.10	ALERTS	4 - 3
4.11	EEE PART FAILURES	4 - 4
4.12	STATUS REPORTS	4 - 4
4.13	SSQ SPECIFICATIONS	4 - 4
5.0	PARTS CONTROL BOARD	5 - 1
5.1	PARTS CONTROL BOARD ANALYSIS AND INTEGRATION	
	TEAM (PCB AIT)	5 - 1
5.2	SSP 30423, SPACE STATION APPROVED EEE PARTS LIST	5 - 2
5.3	SPACE STATION QUALITY (SSQ) STANDARD EEE PART SPECIFICATIONS	5 - 4

APPENDICES

APPENDIX		PAGE
A	ABBREVIATIONS, ACRONYMS, AND DEFINITIONS	A - 1
B	EEE PARTS STRESS DERATING CRITERIA	B - 1
C	EEE PARTS SUPPLIERS AND MANUFACTURERS SURVEYS	C - 1
D	ISS PROGRAM APPROVED EXCEPTIONS	D - 1

1.0 INTRODUCTION

1.1 SCOPE

This document establishes the requirements, approaches, policies, and activities for effectively managing and implementing Electrical, Electronic, and Electromechanical (EEE) and mechanical parts controls for Space Station Program (SSP) to be implemented by the Prime Contractor and all Product Group contractors. The responsibilities of each are detailed herein. International Partners/ Participants parts control requirements shall be demonstrated to National Aeronautics and Space Administration (NASA) as meeting or exceeding those herein.

1.2 PURPOSE

The purpose of the activities presented in this document is to provide maximum support to the Prime Contractor in meeting its parts program objectives, which involves ensuring that the following occur:

1.2.1 Parts control requirements are implemented in a timely and cost-effective manner with maximum coordination among the Tier 1 contractor organizations.

1.2.2 All parts used in SSP designs are of the highest level of reliability available, consistent with their functional requirements and program cost and schedule constraints.

1.2.3 The overall parts program is accomplished with minimum total life-cycle cost, with minimum duplicative efforts, and within a reasonable timeframe.

1.2.4 SSP designs involve the minimum number of part type combinations (e.g., combinations of part types, manufacturers, and controlling documents), minimum duplicative specifications, and minimum duplicative procurement actions.

1.3 APPLICABILITY

The controls described herein are consolidated and managed under the direction of the Prime Contractor and are applicable to all SSP Tier 1 and subtier contractors. The Tier 1 contractors shall apply these controls to SSP flight and environmental qualification hardware EEE and mechanical parts, hereafter called parts, EEE parts, and/or mechanical parts. The Tier 1 contractors shall be responsible for implementing applicable requirements to the lowest component-level suppliers, and demonstrating compliance with requirements herein to the Prime Contractor. Controls for Ground Support Equipment (GSE) will be at the discretion of the Tier 1 contractors, except as stated in paragraph 3.2.4. Controls for functional qualification, engineering model, and developmental hardware is at the discretion of the Tier 1 contractors.

1.4 DEFINITION OF EEE PARTS

EEE parts are limited to the following Federal Stock Classes (FSC):

Part Types		FSC
Capacitors		5910
Circuit Breakers		5925
Connectors	5935	
Crystals and Crystal Oscillators		5955
Diodes		5961
Fiber Optic Accessories	6070	
Fiber Optic Cables		6015
Fiber Optic Conductors	6010	
Fiber Optic Devices		6030
Fiber Optic Interconnects	6060	
Filters		5915
Fuses		5920
Inductors		5950
Hybrids/Multi-Chip Modules (MCMs)	5999 (misc.)	
Microcircuits	5962	
Relays		5945
Resistors		5905
Switches		5930
Thermistors	5905	
Transformers	5950	
Transistors		5961
Wire and Cable		6145

2.0 APPLICABLE DOCUMENTS

The following documents are applicable to the extent specified herein. The applicable issue shall be that identified herein.

2.1 NASA DOCUMENTS

DOCUMENT NO.	TITLE
SSP 30423:	Space Station Approved Electrical, Electronic, and Electromechanical Parts List
Rev. F	
(March 31, 1995)	
SSP 30513	Space Station Ionizing Radiation Environment Effects Test and Analysis Techniques
Rev. B	
(June 3, 1994)	
Reference paragraphs:	3.9.3, 3.9.3.1

2.2 MILITARY STANDARDS AND SPECIFICATIONS

DOCUMENT NO.	TITLE
MIL-STD-970	Standards and Specifications, Order of Preference for the Selection of
Rev. Basic	
(October 1, 1987)	
Reference paragraphs:	3.20.2
MIL-STD-1686:	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
Rev. A	
(August 8, 1988)	
Reference paragraphs:	3.13

3.0 ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND MECHANICAL PARTS REQUIREMENTS

3.1 EEE PARTS CONTROL PLANS

The Boeing Parts Control Board Analysis and Integration Team (PCB AIT) (see Section 5.1 herein) shall approve and oversee the administration of Space Station parts control plans and monitor the status at all levels of parts selections, procurements, fabrications, and tests to assure that all parts procurement plans are properly and expeditiously approved and implemented.

3.1.1 Subcontractor parts control plans shall be developed and implemented for: controlling the parts selection and reducing the number of part types; controlling and reviewing parts specifications, applications, and deratings; controlling and reviewing parts procurement and parts manufacturers; conducting part failure analyses; establishing stocking and handling methods, and reliability requirements for EEE parts to be used in new design hardware; and addressing part obsolescence, especially for unique and nonstandard high technology parts (e.g., hybrids, MCMs, Very Large Scale Integration (VLSI) microcircuits, Application Specific Integrated Circuits (ASICs), memory devices, microprocessor-based parts, limited life items) and low production parts with special process items (e.g., process documents, jigs/fixtures, masks, test tapes, packages). Parts control plans shall be available for review by the PCB AIT.

3.2 EEE PART SELECTION

EEE parts selections shall be driven by the performance demands, environmental and circuit application, reliability (necessary for the satisfactory performance of the systems in which they are used), and maintenance allocations defined by the equipment specification. The subcontractors are responsible for verifying proper controls or design alternatives are established to eliminate part level failures in the worst case circuit application over the required operational life defined by the equipment specification. Steps shall be taken to reduce the risk or impacts of a part level failure. EEE parts shall be selected based on the suitability for their applications and proven qualifications (by test or similarity) to the requirements of their specifications. Selection shall minimize the number of styles and generic types. Parts with proven technologies and with inherent reliability features shall be selected. In order to support projected life of Space Station Program parts, selections of obsolete or impending obsolescent devices or technologies are to be avoided. Space Station Program Grade 1 and Grade 2 Standard Parts are those defined in SSP 30423, Space Station Approved Electrical, Electronic, and Electromechanical Parts List, as Approved Standard Parts. SSP 30423 shall be updated and maintained by the PCB AIT.

3.2.1 EEE parts shall be selected and controlled to Grade 1 reliability or equivalent criteria according to the order of precedence provided in the following subparagraphs. Selections shall enhance or maintain equipment reliability. Nonstandard parts require nonstandard parts approval. For standard parts identified in SSP 30423 as requiring additional screening, they shall be rescreened prior to use in accordance with SSP 30423, Appendix B.

3.2.1.1 Standard Parts shall be selected from Grade 1 Standard Parts identified in SSP 30423, Product Assurance Class "S" parts listed in the current Military Qualified Products List (QPL), Class "V" microcircuits listed in the current Military Qualified Manufacturer List (QML), Class "K" hybrids, Established Reliability Grade 1 passive devices, Space Station Quality (SSQ) specification parts, and parts produced on the Lockheed Monitored Line Program (MLP). Quality Conformance Inspection (QCI) is not required for MLP parts, but the procuring agency shall re-verify the baseline at re-procurement.

3.2.1.2 Nonstandard parts shall be selected in accordance with the following order of precedence. A Nonstandard Part Approval Request (NSPAR) is required except as noted. Approved Source/Specification Control Drawings (SCD) will be added to SSP 30423.

- a. Approved Grade 1 (or equivalent SCDs) nonstandard parts listed in SSP 30423. QCI shall include Group A electrical testing. Remaining QCI requirements: may be reduced for developmental parts at the discretion of the Tier 1 contractor to eliminate duplicative testing; or, shall be at the discretion of the Tier 1 contractor for non-developmental parts, based on engineering judgement, failure histories, and other experience with the part or supplier.
- b. Parts procured to a SCD with the technical requirements of the closest Grade 1 specification, including screening, that are procured from sources approved by the Tier 1 contractors. QCI shall include Group A electrical testing. Remaining QCI requirements: may be reduced for developmental parts at the discretion of the Tier 1 contractor to eliminate duplicative testing; or, shall be at the discretion of the Tier 1 contractor for non-developmental parts, based on engineering judgement, failure histories, and other experience with the part or supplier.
- c. Grade 2 Standard Parts upscreens in accordance with the PCB AIT Upgrade Screening specification identified in SSP 30423, by an approved screening lab as defined in paragraph 3.6 herein (NSPAR not required unless the part is available to higher order of precedence requirements).
- d. Grade 2 equivalent parts upscreens in accordance with the PCB AIT Upgrade Screening specification by an approved screening lab as defined in paragraph 3.6 herein, and controlled by a SCD.

3.2.2 Parts selected for use in hardware designed to meet the end item reliability shall be of sufficient quality and reliability to allow the hardware to meet its allocated performance requirements. Alternate selection criteria shall be based on the ability to satisfy equipment specification and ISSA Program requirements by analysis for risk, life cycle cost, functionality, reliability, environment (including radiation), standardization, and resource allocation. Alternate selection criteria shall, as a minimum, meet or exceed those for parts used in Grade 2 applications, unless available data justifies use of less than Grade 2 EEE parts in manned space applications. Tier 1 contractors shall submit a Request for EEE Grade Revision Evaluation and Trade Study to the PCB AIT for approval prior to parts procurement. It shall include failure rates based on data sources contractually acceptable for reliability predictions, maintainability impacts, etc., supporting the rationale for alternate selection criteria. The Request shall be submitted via contract letter early enough to support procurement of Grade 1 parts if the Request is disapproved. The PCB AIT will coordinate with other teams as necessary to evaluate the request. Additional data may be requested by the PCB AIT. Alternate selection criteria may be applied to environmental qualification hardware at the discretion of Tier 1 contractors and does not require approval by the PCB AIT, however the Tier 1 contractors are responsible for ensuring such part selections are adequately documented.

3.2.3 Parts for Space Station Grade 2 applications shall be selected in accordance with the order of precedence in the following subparagraphs. If the Tier 1 contractor demonstrates to the satisfaction of the PCB AIT (with the concurrence of Prime Contractor Safety and Mission Assurance) that equipment is non-critical (i.e. not essential to Space Station Manned Base (SSMB) or astronaut safety, or mission success), such equipment will be identified by PCB AIT as a Grade 2 Application in SSP 30423. A contract letter shall document the estimated SSP cost savings along with the technical justification for accepting the alternate selection criteria.

3.2.3.1 Space Station Program Grade 2 standard parts include product assurance class JANTXV semiconductors, JAN class "B" microcircuits, class "Q" microcircuits listed in the current Military QML (excluding plastic encapsulated parts), class "H" hybrids and Grade 2 passive devices. All diodes shall be Category I, Category II (brazing alloys only) or Category III metallurgically bonded except where prohibited by design. Devices with cavities containing conductive elements shall be subjected to positive conductive particle control provisions. These methods may consist of embedment, conformal coating, particle getters using approved materials, special cleaning/ultrasonic cleaning, electrically monitored vibration screening and vibration screening with Particle Impact Noise Detection (PIND) Condition A of the applicable Military Standard method. The requirement and assurance methods shall be documented in the SCD or Selected Item Drawing (SID) procurement drawing.

3.2.3.2 Nonstandard Grade 2 Parts shall be selected in accordance with the following order of precedence:

- a. Parts which have been identified by existing specifications as being technically equivalent to Grade 2 parts.
- b. Those parts requiring a new compliant specification drawn to Space Station Program requirements as stated herein. SCDs shall be used specifying design, construction, screening, and qualification in full conformance with the technical requirements of a Grade 2 part. The approved SCD will be added to SSP 30423.
- c. Lower grade parts procured to an existing specification and upgraded by application of the PCB AIT Upgrade Screening specification identified in SSP 30423.

3.2.4 For GSE, commercial end items or parts may be used when they satisfy the GSE function, will not degrade the safety or reliability of the flight system, and are used in a manner consistent with their documented design intent. GSE and Test Support Equipment (TSE) connectors that physically interface with flight hardware shall be of at least compatible dimensions and materials so as not to damage or change the properties of the flight connectors as verified by parts engineering. The use of connector savers on flight hardware is recommended.

3.2.4.1 Standard part qualification for compliance with contractual Materials & Processes AIT requirements shall be promulgated by the PCB AIT to the Tier 1 contractors (reference paragraph 3.5.2 herein). These data shall include the material code and any required Material Usage Agreement (MUA) information.

3.2.5 The following modified 100% test requirements may be used at the discretion of the Tier 1 contractors for cost reduction, in consideration of experience with the product, manufacturer, and application.

3.2.5.1 100% Non-Destructive Bond Pull (NDBP) is not required for active devices (diodes, transistors, microcircuits, hybrids/MCMs, etc.), provided the part manufacturer demonstrates good statistical process control.

3.2.5.2 Verification of acceptable construction may be done by alternate methods to 100% radiographic inspection (x-ray).

3.2.5.3 Serialization of parts is not required, provided lot traceability is maintained. This may impact availability of read and record data, which may require attention when considering its use for custom parts.

3.2.5.4 For large geometry semiconductor die, Scanning Electron Microscope (SEM) inspection and element evaluation samples may be reduced to: at least 10 devices per wafer lot, and 1% or 1 die whichever is greater from each wafer up to a maximum of 3 die per wafer except as required to meet the 10 piece requirement for the wafer lot.

3.3 NONSTANDARD EEE PARTS

NSPAR and supporting documentation, including specifications, shall be submitted for approval prior to procurement in accordance with paragraph 4.1 herein. NSPARs shall identify and provide rationale for nonstandard EEE part selections, clearly documenting justification for use, suitability for the application and environment, and qualification status. Procurement and/or use of parts prior to approval shall be at the subcontractor's risk. Approval of NSPARs and supporting documentation for Grade 2 or equivalent EEE parts used in Grade 2 applications is not required, and is at the discretion of the Tier 1 contractor.

3.3.1 The Tier 1 contractor shall assure that an approved part does not exist as a potential alternate for the application described within the NSPAR.

3.3.2 If existing applicable specification/drawing or modification is available, it is desirable to submit the document with the NSPAR. If no specification/drawing exists, extensive effort to develop such documentation is not recommended until the Tier 1 contractor concurs with the selection justification for the NSPAR.

3.3.3 The Tier 1 contractors shall be responsible to assure that all changes to nonstandard parts procurement plans are properly and expeditiously approved.

3.3.4 The Tier 1 contractor is responsible for determining additional screening, acceptance, and qualification test requirements, to satisfy program reliability and schedule objectives.

3.3.5 Part Qualification shall be accomplished on all nonstandard parts to verify their ability to meet their intended use. Failure analysis shall be performed, if required by the Tier 1 contractor, on problems which occur during testing. The cause of the failure shall be identified and understood, and corrective action shall be defined and implemented in accordance with the failure analysis reporting requirements herein. Parts shall not be installed in hardware prior to successful completion of qualification in accordance with paragraph 4.2 herein.

3.4 NONSTANDARD EEE PARTS SPECIFICATIONS

All selected nonstandard parts shall be controlled by Tier 1 approved specifications. The basis for developing new specifications shall be the closest space qualified military specification for an equivalent part. The following subparagraphs are provided for developing, preparing, and modifying specifications for controlling SSP nonstandard parts:

3.4.1 Each nonstandard EEE part shall be controlled by a specification (or combination of specifications) which delineates as a minimum and as applicable to the specific part type (1) complete identification of the part; (2) physical, material, environmental, and performance requirements; (3) reliability and quality requirements including qualification inspections and tests, acceptance inspections and tests with reject criteria, and manufacturers configuration controls, process controls, and quality system; (4) special explicit requirements such as screening and burn-in, X-ray, radiation, and positive particle protection [coating, PIND]; (5) packaging, storage, and handling requirements, including ElectroStatic Discharge (ESD) controls compliant with the applicable military specification; (6) part identification data (marking) requirements; (7) data identification, retention and submittal requirements; (8) source inspection; (9) specify rights of source inspection (i.e., NASA or its delegate); and (10) access to data.

3.4.2 If a combination of specifications is used to provide all the above requirements for a single part type, the detailed specification (slash sheet or specification control drawing) for that part type shall provide detailed cross references to all other applicable specifications.

3.4.3 Each specification shall be identified by a unique number and shall be subject to a formal system of change control and shall be a book form drawing.

3.4.4 Specifications controlling hybrids and MCMs shall include an element list identifying part numbers, nomenclature, reference designator and manufacturer. Particle getter materials shall be restricted to those for which the manufacturers' getter application process has received Defense Electronics Supply Center (DESC) QML approval. Departures from this shall be approved by the PCB AIT on a case-by-case basis.

3.5 EEE PARTS QUALIFICATION

All selected parts shall be supported by qualification at the parts level. Parts shall be qualified on the basis of test or similarity as follows:

3.5.1 Qualification of EEE parts shall be at the part level to the specification requirements. The qualification requirements for nonstandard parts shall be identified in the procurement specification. Qualification test reports shall be submitted for approval in accordance with paragraph 4.2 herein, and shall be retained by the Tier 1 contractor.

3.5.2 Part qualification status shall be maintained by the PCB AIT for the life of SSP. It shall identify the basis for and substantiates the status of qualification for each nonstandard or SSQ Specification EEE part type used. Qualification status of each nonstandard or SSQ specification part shall be documented in SSP 30423. SSP 30423 shall document the qualification status for all parts specified on SSQ drawings (reference paragraph 3.2.5 herein) and all nonstandard parts by part number and supplier. Approval for use of nonstandard parts shall be as directed by Tier 1 contractors. The file for each part type shall include part specification and/or NSPAR change history. Parts shall be re-qualified for new procurements when a Class 1 change in design, materials, manufacturing processes, or quality controls is implemented or when facilities are relocated. The parts re-qualification shall require retesting or analyses corresponding to the extent of the change. The applicable NSPAR will be revised and resubmitted to identify the respective change.

3.6 EEE PART PRE-AWARD SURVEYS

All sites for suppliers and manufacturers shall be surveyed for the value-added service or product being procured, excepting those identified in paragraph 4.3 herein, and approved in accordance with paragraph 4.3 herein prior to placement of the purchase order for the value-added service or product. This is applicable for parts used in flight or qualification hardware, except this is not required for Grade 2 or equivalent EEE parts used exclusively in Grade 2 applications and is at the discretion of the Tier 1 contractors. Surveys shall be performed after coordination with the PCB AIT to allow additional participation using the checklist and procedure of Appendix C herein, or an equivalent approved by the PCB AIT. The survey team shall require responses from the supplier or manufacturer within 30 days after the survey. Responses shall include objective evidence of the corrective actions being completed, and shall be included in the survey results.

Pre-award surveys shall also be performed for all screening/test facilities, Destructive Physical Analysis (DPA), failure analysis and radiation laboratories, and value-added services (for each site). Approved pre-award surveys are valid for 2 years of inactivity, after which delta surveys shall be performed to assess changes in the manufacturer's approved baseline. Approval status of pre-award surveys shall be documented in SSP 30423.

3.7 DESTRUCTIVE PHYSICAL ANALYSIS (DPA)

DPA shall be performed on every lot of nonstandard EEE parts and on every lot of Grade 2 EEE parts used in environmental qualification or flight hardware that require DPA (reference paragraphs 3.7.1.1 and 3.7.1.2 herein) in accordance with the PCB AIT DPA specification identified in SSP 30423. All data shall be approved in accordance with paragraph 4.4 herein. DPA can be used as a data source in problem evaluation, failure analysis, manufacturer comparison, corrective action, and improvement in manufacturing processes, controls, and screening test procedures. DPA should identify changes in design, construction, materials, or processes that may affect the reliability or end-item application of the part.

3.7.1 DPA may be performed in accordance with a document approved by the Tier 1 contractor that meets or exceeds the PCB AIT DPA specification. Requests for exemptions or stratification plans shall be included in the document. Tier 1 contractors shall assess pre-existing DPA results and associated specifications for compliance with the requirements of the PCB AIT DPA specification, and shall coordinate with the PCB AIT as applicable in accordance with paragraph 3.18.1 herein.

3.7.1.1 DPA shall be performed on semiconductors, microcircuits, metal film and wire-wound resistors, resistor networks, capacitors, relays, filters, power switches, circuit breakers, contactors, fuses, hybrids, MCMs, and hybrid oscillators, except as specified in paragraph 3.7.1.2 herein.

3.7.1.2 DPA shall not be required for the following part types: composition resistors, monolithic glass capacitors, coils, inductors and transformers, except in the presence of concern regarding manufacturer or part type design or failure history which could be verified or eliminated by appropriate DPA investigation. The Tier 1 contractor is responsible for requiring DPA when such action is considered warranted in the interest of Space Station Program reliability. DPA shall not be required for part lots already possessing an approved Space Station DPA.

3.7.1.3 Parts procured from DESC Class S stocking will already have met DPA requirements and will not require an additional DPA.

3.7.2 Only facilities which have been approved by the PCB AIT, as documented in SSP 30423, shall perform the DPA.

3.7.3 DPA reports which show evidence of anomaly or concern shall be submitted to the Tier 1 contractor for approval prior to release of parts for stocking. Any part with a discrepant or anomalous condition is a nonconforming part, and shall be handled in accordance with the requirements for nonconforming parts (ref. paragraph 3.18 herein). For DPA reports submitted to the PCB AIT for disposition (ref. paragraph 3.18.1 herein), any part that has been disapproved is a noncompliant part and shall be handled in accordance with the requirements for Deviations and Waivers (ref. paragraph 3.18.2 herein).

3.8 EEE PARTS STRESS

EEE parts stress analyses shall provide sufficient data to verify EEE parts are adequately derated to insure long term reliability, and are not overstressed in worst case environments, operating conditions, and duty cycles. These data shall be part of and prerequisite to flight hardware design reviews, and are available for part problem analyses. Stress analyses shall be performed to the reference designator level, and address electrical, environmental, and thermal stresses, manufacturer's maximum ratings, and if applicable projected sensitivity of a part to a specific application.

3.8.1 EEE part electrical and thermal derating shall be in accordance with Appendix B herein. Duty cycle, period, and magnitude of repetitive and non-repetitive transients that exceed derating requirements shall be identified, and rationale provided justifying the acceptability of the condition. EEE part types not addressed by Appendix B shall be derated using the requirements applicable to the closest similar part type. Parts with no comparable types listed in Appendix B shall be derated using the requirements of a similar document that as a minimum: requires derating to 75 percent of electrical parameter maximum ratings; limits junction temperatures to $T_j = +125$ degrees centigrade or $T_{jmax} - 20$ degrees centigrade, whichever is less, where T_{jmax} is the maximum device junction temperature rating; and, requires a 20 degree centigrade margin of derating between the upper worst case thermal stress and the specified maximum thermal rating. Contractors shall submit these similar documents' derating criteria to the PCB AIT for approval, identifying to what part types it is proposed to apply. The part shall not be stressed below its lower temperature level as established by part qualification. See Appendix D for ISS Program approved exceptions to this paragraph.

3.8.2 Part stress levels in the design of each component (black box) shall be analyzed, and action shall be taken to correct identified deficiencies or provide justification for each such usage.

3.8.3 Part applications in each component (black box) shall be reviewed. The part application review should be a continuous iteration process of design review rather than a one-time end-of-design check. The reviews shall include the anticipated life requirements, functional and environmental usage stresses, and historic and current failure experience (i.e., results of analyses of parts failures that have occurred in higher level assemblies on the same system or other projects). Special attention shall be given to nonstandard parts. Results of the reviews shall be used to make technical and management decisions regarding circuit redesigns, alternative parts selections, and plans for additional qualification and acceptance testing.

3.8.4 EEE parts stress analyses and application reviews shall be submitted for approval in accordance with paragraph 4.5 herein. Part applications with stress levels equal to or less than the derating requirements are preapproved. Part applications with stress levels exceeding derating requirements but below manufacturer maximum ratings shall be approved by the Tier 1 contractor. Part applications that exceed manufacturer maximum ratings, or that have been submitted to the PCB AIT for disposition (ref. paragraph 3.18.1 herein) and disapproved, are noncompliant (ref. paragraph 3.18.2 herein).

3.9 IONIZING RADIATION

3.9.1 The configuration of the orbits of both the Space Station and its Orbiters, coupled with the very extended mission durations, make the Space Station missions subject to serious problems with EEE part performance in an ionizing radiation-induced environment. Part performance degradation caused by total dose accumulative effects and Single Event Effects (SEE) are of primary concern.

3.9.2 EEE parts application (ref. paragraph 3.8.1 herein) shall take into consideration the expected ionizing radiation environment such that all EEE parts will function within specification during and after exposure to Earth radiation belts, solar proton events, galactic cosmic radiation and other identified sources. Parts selections shall be reviewed to determine if radiation test data on same or similar parts exists to sufficiently predict part behavior in the radiation environment of the Space Station. Technology review, recommendations and coordination of existing test data shall be coordinated by the Tier 1 subcontractor. Where sufficient or adequate radiation data does not exist they shall be coordinated with the PCB AIT.

3.9.3 The PCB AIT shall direct ionizing radiation characterization of EEE parts using the environment defined in equipment specifications by Tier 1 contractors. Recommended test methods are contained in SSP 30513, Space Station Ionizing Radiation Environment Effects Test and Analysis Techniques. Delegation of testing by Tier 1 contractors must be specifically approved by the PCB AIT. All Ionizing Radiation (IR) Test and Analysis Plans, Procedures, and Reports shall be approved in accordance with paragraph 4.6 herein. The PCB AIT shall track part selection lists, test schedules, facility usage, and maintain an electronic database for retention of test results summaries. A preliminary assessment of parts showing upset, latchup, anomalous functional behavior or significant parametric shift during test shall be conducted and reported to the PCB AIT.

3.9.3.1 Documentation shall describe the details of tests and analyses based on the general IR design requirements, hardware location, lifetime, redundancy, and applicable shielding. It shall include:

- a. calculated part application radiation exposure showing the derivation

- b. methods of test and analysis used to demonstrate part compliance with the part application radiation environment
- c. description of radiation test facilities
- d. equipment failure criteria as derived from the circuit, system or subsystem effects
- e. detailed technical justification for any analytical or test methods other than those in SSP 30513 (which shall be prior coordinated with the PCB AIT and Environments AIT)

3.9.3.2 The Procedure and Reports shall be unique to a given part number. Part family procedures may be used at the discretion of the Tier 1 contractors. Tests and analyses shall be performed in accordance with the approved documentation. Procedures and Reports shall define the environment exposure and method (e.g., Co-60 source, duration of exposure, up/down time, shielding, ions used, exposure angle, exposure sequencing, scattering foils, etc.), the specific electrical tests used (e.g., test equipment, schematic, program listing, stimuli, etc.), and post-exposure evaluation (e.g., annealing required, etc.).

3.10 EEE PARTS PROCUREMENT

EEE parts shall be procured to Tier 1 approved specifications (standard part specifications, or NSPAR and SCD approved) from Tier 1 approved suppliers (pre-award survey completed and approved).

3.10.1 Purchase orders shall specify supplier delivery of data as required in the specification. NASA or designated representative shall be provided the opportunity to review and approve purchase contract agreements, a minimum of two (2) normal working days, to verify inclusion of all EEE part requirements.

3.10.2 Parts shall be procured through the Defense Logistics Agency Class S stocking program whenever possible. When the Class S stocking program is not used, parts shall be procured directly from the manufacturer source. When procurement directly from the manufacturer source is not possible, or is precluded by program schedule constraints, parts shall be procured from a manufacturer authorized distributor and shall have lot traceability back to the manufacturer. Distributors identified in the DESC Qualified Products Lists for a given manufacturer is considered an approved authorized distributor for that given manufacturer. Certificates of compliance are not considered adequate to assure traceability.

3.10.3 No parts shall be manufactured until the purchase order has been placed and the Defense Contract Management Command representative at the parts manufacturer has been notified. This does not apply to parts procured through the Defense Logistics Agency Class S stocking program, or to Military standard parts.

3.10.4 The contractor shall accept management responsibility for the delivery schedule, timely placement of purchase orders to meet schedule needs, and conformance to the specification. Tier 1 Contractor Source Inspection may be delegated to any other Tier 1 contractor by PCB AIT direction, or by agreement between the Tier 1 contractors. Tier 1 contractors shall provide a list of resident and field sources inspectors and their capabilities (part types) for this purpose.

3.10.5 No changes to a specification shall be imposed by a purchase order, unless specifically directed by the PCB AIT.

3.10.6 Acceptability of DPA shall be submitted for approval in accordance with paragraph 4.4 herein.

3.10.7 The contractor shall notify the PCB AIT in accordance with paragraph 4.12 herein of all schedule, technical problems, and any Class I changes to the manufacturing baseline.

3.11 EEE PART COORDINATED PROCUREMENT

All procuring activities shall participate in coordinated procurement as directed by the PCB AIT. Coordinated procurement will allow for volume pricing, consolidation of lot-related activities (e.g., DPA and source inspection), and homogeneity of parts used throughout the program. Consolidated procurement may be used at the discretion of Tier 1 contractors.

3.11.1 The PCB AIT shall make available a centralized as-designed EEE parts list, which will be included in the EEE Parts Information Management System (EPIMS) (see paragraph 5.1.5 herein). It is dependent on each Tier 1 contractor providing that data with EPIMS inputs. Each Tier 1 contractor is responsible for their subcontractors' access to the information.

3.11.2 For any part used by more than one subcontractor, subcontractors shall coordinate negotiation and placement of purchase contracts within some defined time window acceptable to the supplier. Master purchase agreements should be negotiated with major manufacturers.

3.11.3 The PCB AIT shall continually monitor coordinated procurement to insure its proper implementation.

3.12 INCOMING INSPECTION

Incoming inspection shall be performed by the procuring activity on each EEE part lot procured for use in Space Station Program hardware. Verification shall be made that the part meets the requirements of the specification to which it was procured and has sustained no physical damage and that the proper quantity of parts was received. The requirement to verify that the part meets the specification requirements may be deleted at incoming inspection according to the following criteria:

- a. The requirements have been verified at the part manufacturer by a customer source inspector prior to shipment.
- b. Parts are procured through Defense Logistics Agency Class S stocking program.
- c. Parts are SSP Grade 1 standard parts.

3.13 EEE PARTS HANDLING

All ElectroStatic Discharge Sensitive (ESDS) EEE parts shall be handled in accordance with MIL-STD-1686, Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices), except procuring activity approval is not required for ESD control plans and handling procedures. Procedures which include minimum requirements shall be established and implemented for control of parts storage, stocking, and installation. These controls shall prevent the use of parts that may be in a questionable condition and prevent degradation of parts due to environments, faulty equipment, or manufacturing/assembly techniques. Handling and storage procedures shall assure that susceptible devices are adequately protected from ESD. Mechanical alterations after receipt and acceptance shall be in accordance with program requirements for manufacturing operations.

3.14 EEE PARTS IDENTIFICATION AND TRACEABILITY DATA

Identification and traceability data shall be submitted for approval for all EEE parts in accordance with paragraph 4.7 herein. Provisions shall be made to record and retrieve information relating to the specific tests performed, test results, and processes on each lot of parts.

Identification of the part number, part manufacturer's name or Commercial And Government Entity (CAGE) code, and manufacturer's lot date code and/or serial number traceable to the next assembly shall be available for each part installed in deliverable end items, including qualification and flight articles.

3.15 EEE PARTS LISTS

3.15.1 Component as-designed EEE parts lists shall be developed, submitted, approved, and maintained in accordance with paragraph 4.8 herein. Submittal requirements include delivery in electronic format. Parts selected for use shall be incorporated within a reasonable timeframe.

3.15.2 Component as-built EEE parts lists shall be developed, submitted, approved, and maintained in accordance with paragraph 4.8 herein. Submittal requirements include delivery in electronic format. This list shall be retained by the PCB AIT for logistics support throughout the life of SSP.

3.16 OFF-THE-SHELF (OTS) EQUIPMENT AND OFF-THE-SHELF DESIGN

The Tier 1 contractor shall be responsible for assuring flight OTS hardware and design compliance to the EEE part selection criteria for the proposed applications and corresponding criticalities. The Tier 1 contractor shall differentiate between OTS hardware or design that has not been used in spaceflight versus previously flown spaceflight hardware and indicate if the item will be modified OTS. The Tier 1 contractor shall provide a risk assessment for all OTS items including safety and reliability in accordance with paragraph 4.9 herein, including the following data to the extent practical.

- a. A review of the as-designed/as-built EEE parts list (or equivalent) as applicable, and supporting documentation (e.g., procurement specifications, upgrade specifications, waivers, deviations, etc.); identifying to the PCB AIT all EEE parts which do not meet the selection criteria for the corresponding criticality.
- b. A review identifying construction history, Government-Industry Data Exchange Program (GIDEP) alerts, and manufacturer for the EEE parts.
- c. Identification of EEE parts that are obsolete or which may be nearing obsolescence.
- d. Any other available data which may be pertinent to the review process (e.g., parts application reviews (derating/worst case analysis of the design)).
- e. An assessment of EEE part radiation susceptibility.

- f. A review process considering and identifying any available prior history of successful operations, failures, and causes of failures for EEE parts in the proposed hardware. For Commercial OTS (COTS) items, identification of Underwriters Laboratory (UL) approval, Consumer Product Safety Commission history, and user community operation performance are good sources of information.
- g. An identification of any known life limiting factors that may affect the intended useful life of the hardware in the application; providing to PCB AIT the failure mode and/or mechanism where available.
- h. Rationale for establishing part qualification.

3.17 REPORTING PARTS AND MATERIALS PROBLEMS AND ASSESSING ALERTS

3.17.1 The Prime Contractor and each Tier 1 and Tier 2 contractor shall be a member of GIDEP and receive ALERTs (DD Form 1938) and Failure Experience Reports directly from the GIDEP electronic system or the NASA Alert Reporting System (NARS).

3.17.2 Problems with parts, materials, equipment, or diminishing sources, which are of mutual concern to NASA and associated contractors, shall be reported via GIDEP ALERTs and Failure Experience Reports. Copies of contractor-initiated ALERTs shall be provided to the PCB AIT in accordance with paragraph 4.10 herein.

3.17.3 Previously published ALERTs will be reviewed by subcontractors to assure that generic problems and technical issues will be avoided. GIDEP distributed ALERTs and General Document Summary Sheets shall be evaluated and responses provided by a systematic closed loop approach. Where use of an item reported in an ALERT is established for a given unit of hardware, a problem report shall be prepared in accordance with problem reporting requirements for Nonconforming Articles and Materials. When a contractor/subcontractor does not have electronic access to GIDEP, the contractor's/subcontractor's acquisition activity will provide hardcopies of ALERTs to the contractor/subcontractor.

3.18 NONCONFORMING AND NONCOMPLIANT PARTS

3.18.1 Approval of design data, and hardware use-as-is and/or repair dispositions shall be coordinated with the PCB AIT for part variations from requirements herein that may have negative impacts on safety, reliability, and/or mission success. Tier 1 contractors may request PCB AIT review and disposition for any parts data.

3.18.2 Noncompliant parts are parts rejected via the nonconformance control system, not approved by the Tier 1 contractor, and/or disapproved by the PCB AIT (including those in paragraph 3.18.1 herein with dispositions unacceptable to the PCB AIT). Use of noncompliant parts requires approval in accordance with contract quality assurance requirements.

3.19 ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL PART FAILURES

3.19.1 EEE part failures shall be reported in accordance with contract problem reporting and corrective action requirements and as follows:

- a. EEE part failures occurring during or after components/assemblies acceptance testing shall be reported to the PCB AIT within 2 working days.
- b. Primary failures of parts procured from the Defense Logistics Agency JAN Class S stocking program shall be reported immediately to DESC, the PCB AIT, and the acquisition activity.

3.19.2 Failure analyses shall be performed on parts failing during assembly acceptance testing and at the direction of the PCB AIT to analyze primary failure trends or generic problems. Parts failing during or after equipment acceptance testing shall be analyzed to determine the secondary effects of the failure and assure that other parts have not been damaged or degraded. The significance of the failure as related to like parts or materials used elsewhere in the system and the possibility of the occurrence of additional failures shall be determined and documented as part of the disposition in accordance with reporting requirements for Nonconforming Articles and Materials.

3.19.2.1 Failures shall be analyzed to the extent necessary to understand the failure mode and cause, to detect and correct out-of-control processes, to determine the necessary corrective actions, and to determine lot disposition. Corrective actions shall be coordinated with the PCB AIT Co-chairs.

3.19.2.2 All facilities performing failure analyses shall be approved in accordance with paragraph 4.3 herein. This shall include the failure analysis procedures used by the facility.

3.19.2.3 Copies of all failure analysis reports for part failures during or after equipment acceptance testing shall be submitted for approval in accordance with paragraph 4.11.3 herein.

3.19.2.4 ALERTs shall be issued where applicable in accordance with requirements for Reporting Parts and Materials Problems and Assessing ALERTs.

3.20 MECHANICAL PARTS

3.20.1 Mechanical parts control plans shall be developed and available for PCB AIT review. Tier 1 contractors shall prepare a preferred mechanical parts selection list, and shall provide guidance to their subcontractors in the selection of mechanical parts. The PCB AIT shall approve alternate methods of control that meet the intent of this requirement.

3.20.2 MIL-STD-970, Standards and Specifications, Order of Preference for the Selection of, shall apply in selecting specifications for standard mechanical parts.

3.21 STATUS REPORTS

Status reports shall be provided to the PCB AIT per paragraph 4.12 herein. Status reports provided to the PCB AIT shall be that data normally prepared in response to internal management requirements and practices as defined in the individual Team Execution Plans and shall be provided in native electronic format when available or hardcopy if not.

4.0 DATA REQUIREMENTS

Content, format, method of transmittal, and submission frequency of the following data shall be in accordance with the applicable contract Supplier Data Sheet (SDS) and its associated Supplier Data Requirements List (SDRL). The Tier 1 contractors shall be responsible for requiring data from lower tier contractors as necessary to support compliance with the requirements herein.

4.1 NONSTANDARD PART APPROVAL REQUESTS/NONSTANDARD PART SPECIFICATIONS

All NSPARs and nonstandard EEE part specifications shall be submitted to the Tier 1 contractors for approval in accordance with contract requirements (ref. paragraphs 3.2, 3.3, and 3.4 herein), except this is not required for Grade 2 or equivalent EEE parts used exclusively in Grade 2 applications; rights of approval shall not be given to any subtier contractors unless specifically authorized by the PCB AIT.

4.2 QUALIFICATION TEST REPORTS

Qualification test reports shall be submitted to the Tier 1 contractor for review and approval (ref. paragraph 3.5 herein). All qualification test plans shall be combined into the part specification(s). Copies of the Qualification Test Reports on SSQ parts shall be sent to the PCB AIT chairman for inclusion in the SSQ files. Qualification status of all nonstandard parts shall be provided by the Tier 1 contractors to the PCB AIT for inclusion in SSP 30423 (reference paragraph 3.5.2 herein).

4.3 PRE-AWARD SURVEYS

Survey results shall be submitted to Tier 1 contractors for approval in accordance with contract requirements (ref. paragraph 3.6 herein). Manufacturing line surveys are considered pre-approved and do not require a Pre-Award Survey for manufacturing lines with any of the following:

- a. Existing qualification for the specific part number being procured.
- b. Existing approved pre-award survey as listed in SSP 30423.
- c. Existing DESC QPL certification/QML validation applicable to the product assurance class being procured.
- d. Parts are used exclusively in Grade 2 applications.

All manufacturing line surveys shall be approved by the Tier 1 contractors. All surveys for screening/test facilities, DPA, failure analysis, and radiation laboratories, and value-added services shall be approved by the PCB AIT.

4.4 DESTRUCTIVE PHYSICAL ANALYSIS (DPA)

4.4.1 DPA facility Pre-Award Surveys shall be submitted to the PCB AIT for approval via contract letter.

4.4.2 The DPA control sample, residue from the analysis, and original DPA reports shall be submitted to the Tier 1 contractor for retention as directed by the Tier 1 contractor (ref. paragraph 3.7 herein). DPA reports which show evidence of anomaly or concern shall be submitted to the Tier 1 contractor for approval prior to release of parts for stocking. For DPA reports submitted to the PCB AIT for disposition (ref. paragraph 3.18.1 herein), any part that has been disapproved by the PCB AIT is a noncompliant part, and shall be handled in accordance with paragraph 3.18.2. The Tier 1 contractor shall ensure parts used in DPA are maintained for at least 10 years or contract completion which ever comes first. At the end of the 10 year period or upon contract completion the data and associated parts shall be transferred to NASA unless otherwise directed by the PCB AIT. Storage conditions for the DPA samples shall not allow the parts to degrade over the retention period. DPA report summaries shall be provided to the PCB AIT upon request.

4.5 EEE PARTS STRESS

Stress analyses and application reviews of EEE parts shall be submitted to the Tier 1 Contractor for approval in accordance with contract requirements (ref. paragraph 3.8 herein). Part applications that exceed manufacturer maximum ratings, or have been submitted to the PCB AIT for disposition (ref. paragraph 3.18.1 herein) and disapproved, are noncompliant (ref. paragraph 3.18.2 herein).

4.6 IONIZING RADIATION

IR Test and Analysis Plan, IR Test and Analysis Procedures and IR Test and Analysis Reports shall be submitted to the Tier 1 contractors for approval in accordance with contract requirements (ref. paragraph 3.9 herein). Radiation Test data shall be provided in electronic format as directed by the PCB AIT, and will be incorporated into EPIMS for general use. A preliminary assessment of parts showing upset, latchup, anomalous functional behavior or significant parametric shift during test shall be conducted and reported to the PCB AIT.

4.7 EEE PARTS IDENTIFICATION AND TRACEABILITY DATA

EEE Part identification and traceability data shall be derived from the As-built Configuration section of the Acceptance Data Package (ADP), SDS SS-PC-008.

4.8 EEE PARTS LISTS

4.8.1 Component As-Designed EEE Parts List shall be submitted for approval in accordance with SDS SS-EE-010 (ref. paragraph 3.15 herein), including submittal by Tier 1 contractors to the PCB AIT using the Tabulated ASCII Format and method defined by the Tier 1 contractors. Electronic copies shall be provided to NASA by the PCB AIT.

4.8.2 Component As-Built EEE Parts List shall be submitted for approval in accordance with the applicable ADP Data Requirement (DR), including submittal of electronic data to the PCB AIT when available in native electronic format in accordance with SDS SS-EE-010. Tier 1 contractors shall submit identification of approved substitutions to the PCB AIT for concurrence in accordance with SDS SS-EE-010. NASA and Prime Contractor will develop a SSP as-built EEE parts list by integrating the final component as-designed EEE parts list with the Tier 1 approved substitutions and electronic as-built data, and data entry of hard copy as-built configuration data.

4.9 OFF-THE-SHELF (OTS) EQUIPMENT

Data for the evaluation of OTS designs or OTS hardware shall be submitted to the PCB AIT for approval via contract letter (ref. paragraph 3.16 herein). All OTS equipment data shall be approved by the PCB AIT.

4.10 ALERTS

The Tier 1 contractors will provide courtesy copies of SSP contractor-initiated ALERT documentation when action is sent to the GIDEP representative. SSP contractor-initiated ALERT documentation that makes reference to NASA or SSP shall be submitted to the PCB AIT for review and concurrence prior to release in the GIDEP system.

4.11 EEE PART FAILURES

4.11.1 Tier 1 contractor reviews and assessments of EEE part failures occurring during DPA, in-process assembly testing, storage/handling and pre-acceptance hardware component/assembly testing shall be available for PCB AIT review (ref. paragraph 3.19.1 herein). The PCB AIT shall provide a copy of the summary to NASA within 5 working days after review by the PCB AIT.

4.11.2 EEE part failures occurring during or after components/assemblies acceptance testing shall be reported in accordance with the contract requirements.

4.11.3 Reproducible copies of all failure analysis reports for part failures during or after equipment acceptance testing, including color reproductions of all photographs, shall be available for PCB AIT review (ref. paragraph 3.19.2.3 herein). All original failure analysis reports including part residue and color photographs, shall be retained by the Tier 1 contractor. The PCB AIT reserves the right to request copies of all failure analysis reports.

4.11.4 Failed parts shall be retained in bonded stores until a decision is made by the Problem Review Team (PRT) relative to a part problem trend.

4.12 STATUS REPORTS

Status reports shall be provided to the PCB AIT as requested to support PCB AIT meetings (ref. paragraph 3.21 herein).

4.13 SSQ SPECIFICATIONS

SSQ specifications (new and changes) shall be submitted for approval in accordance with SDS SS-EE-014 (ref. paragraph 5.3.2.1 herein). These inputs will be coordinated by the PCB AIT with Tier 1 contractors prior to release.

5.0 PARTS CONTROL BOARD

5.1 PARTS CONTROL BOARD ANALYSIS AND INTEGRATION TEAM (PCB AIT)

The Prime Contractor shall establish a PCB AIT. The Prime Contractor and the acquisition activity (NASA) shall appoint the Co-Chairs of the PCB AIT. All Space Station Program contractors and subcontractors shall support the PCB AIT performing and implementing the decisions, findings and action items of the PCB AIT. The PCB AIT shall be responsible for the planning, management, and coordination of the selection, application and procurement requirements of all EEE and mechanical parts intended for use in the deliverable end items. PCB AIT findings, decisions and directions shall be within the contractual requirements, and shall be binding on all applicable contractors and subcontractors (PCB AIT direction to sub-tier contractors shall be through the Tier 1 contractors).

5.1.1 The Prime Contractor shall prepare and distribute PCB AIT meeting agendas, conduct PCB AIT meetings, prepare and distribute meeting minutes and manage the PCB AIT.

5.1.2 The PCB AIT membership shall include the PCB AIT Co-Chairs and one voting member from each Tier 1 contractor. Each member shall be supported in technical matters as required. Each member shall have the authority to commit their activity, organization or company to PCB AIT decisions within the scope of the applicable contract. Representation at individual meetings shall be required, consistent with the scheduled subject matter on the agenda. The acquisition activity Delegated Agency and Prime Contractor Quality Assurance representatives shall be afforded the opportunity for attendance at all PCB meetings.

5.1.3 The authority to conduct PCB's may be delegated by the PCB AIT to major contractors/subcontractors. Each organization so delegated shall supply the responsible activity with PCB meeting minutes documenting decisions in a timely manner. All information shall be made available to each higher acquisition activity. Each higher acquisition activity retains the right of disapproval of delegated PCB decisions.

5.1.4 The PCB AIT shall conduct meetings as follows:

- a. Regularly scheduled meetings shall be held as determined necessary by the PCB AIT Co-Chairs. These meetings shall address, as a minimum, predefined agenda items for discussion.
- b. Special PCB AIT meetings may be called by the PCB AIT Co-Chairs to discuss special items which may require expeditious resolution. Adequate notification shall be provided to all PCB AIT members.

- c. PCB meetings may be accomplished either in person, via telephone, or other media such as tele/video conference.
- d. All PCB AIT decisions shall be documented in the meeting minutes. All supporting technical analyses will be provided and any additional analyses and test in accordance with PCB AIT direction will be conducted and attached to the meeting minutes.

5.1.5 PCB AIT responsibilities include but are not limited to:

- a. The PCB AIT shall manage the implementation of the requirements specified herein.
- b. The PCB AIT shall have the authority to conduct audits of subtier contractor parts activities.
- c. The PCB AIT shall establish a Team Execution Plan (TEP) in accordance with the requirements herein.
- d. The PCB AIT shall review and disposition all data submitted in accordance with sections 3 and 4 herein.
- e. The PCB AIT shall ensure the review of the results of Material Review Board (MRB) actions, failure analyses, waivers and deviations, and any other details pertaining to parts.
- f. The PCB AIT shall ensure the timely identification of long lead and other problem procurements, and monitor coordinated procurement activities.
- g. The PCB AIT shall accomplish a coordinated evaluation of aspects related to obsolescence of EEE parts in support of design activity parts selection tradeoffs, design decisions regarding planned design lifetime/design obsolescence, logistics/maintainability planning and spares provisioning, life-cycle costing, and maintenance operations.
- h. The PCB AIT shall develop and maintain EEE parts information in the NASA EPIMS, including as a minimum the component as- designed EEE parts lists. Other data will be included as agreed on by the PCB AIT.

5.2 SSP 30423, SPACE STATION APPROVED EEE PARTS LIST

SSP 30423 defines SSP Grade 1 and Grade 2 Standard Parts.

5.2.1 Tier 1 contractors shall propose to the PCB AIT additions to SSP 30423 or restrictions concerning parts listed therein. To be listed as an approved part in SSP 30423, the part shall meet all the following criteria:

- a. Meet the definition in section 3 herein for Space Station Program Grade 1 standard parts or Space Station Program Grade 2 standard parts, as applicable, or meet the definition in section 3 herein for a Space Station approved nonstandard Grade 1 or Grade 2 part, as applicable.
- b. The part is manufactured by a source with an approved pre-award survey as specified herein.

- c. The part has acceptable technical and historical background.
- d. The part has an acceptable specification and available performance data to adequately support selection and application by the Space Station Program design community.

5.2.2 SSP 30423 shall be updated under the direction of the PCB AIT. Tier 1 contractors shall provide early candidates for part types, technology families, and part numbers expected to be used in the design of their space station hardware. The candidate lists will be coordinated and integrated by the PCB AIT.

5.2.3 The initial SSP 30423 update shall be coordinated with Tier 1 contractors. This coordination will assure design selections and applications are adequately addressed and that expertise and experience from the PCB AIT and Tier 1 contractors have been effectively utilized. Tier 1 contractors shall provide lists, within 60 days after award of contract, of part types and part families not in SSP 30423 that are needed to support the design and fabrication of their equipment.

Early potential parts usage data is crucial to PCB AIT coordination, effective development of a comprehensive Space Station Approved EEE Parts List (SSAEPL), and attainment of minimum parts program costs. Recommendations should address product life cycle, Department of Defense and industry standardization, acceptability for space application, and inherent quality and reliability features.

5.2.4 SSP 30423 shall be maintained by the PCB AIT throughout design, development, and acceptance testing of Space Station Program hardware; and, as deemed necessary thereafter to support new design space station hardware/logistics support operations. SSP 30423 will be maintained current by issuing supplements and revisions as required. The maintenance effort will include the following:

- a. Identifying parts which have become obsolete. These parts shall be designated in SSP 30423 as unacceptable for new design as of date and shall be designated as an operational logistics support concern item.
- b. Identifying parts which have an uncorrectable reliability problem. These parts shall be designated in SSP 30423 as unacceptable for new designs as of date.
- c. Identifying parts no longer suitable for space station usage or no longer available to space-quality standards. These parts shall be designated in SSP 30423 as unacceptable for new design as of date.
- d. Identifying parts replaced with a functionally similar device having improved characteristics or increased reliability. These parts shall be designated in SSP 30423 as unacceptable for new design as of date.

- e. Identifying candidate SSAEPL parts from commonality evaluations of Tier 1 contractor component as-designed parts lists, early potential parts usage data or new part types, families, etc., as required, to keep SSP 30423 current with parts industry and equipment design requirements.

5.3 SPACE STATION QUALITY (SSQ) STANDARD EEE PART SPECIFICATIONS

The purpose of the SSQ specification is to reduce the overall cost of the parts procurement activity by:

- a. Reducing the NSPAR activity
- b. Identifying approved manufacturers of the part
- c. Aiding in the consolidated procurement program
- d. Providing standardization and commonality when applicable.

5.3.1 SSQ specifications shall be developed under the direction of the PCB AIT. The development may be delegated to technical groups.

5.3.2 The SSQ specifications shall be coordinated by the PCB AIT with Tier 1 contractors. Coordination through technical groups and Materials and Processes (M&P) for hybrid, MCM, wire, cable and connector SSQ specifications is the responsibility of Tier 1 contractors. The PCB AIT shall ensure that all Tier 1 contractor technical comments and requirements are adequately included.

5.3.2.1 Newly developed SSQ specifications shall be submitted for review and approval in accordance with paragraph 4.13 herein. Released SSQ Change Requests (SSQ CRs) shall be considered part of the SSQ specification. Changes to unreleased SSQs, and unreleased changes to SSQs shall be submitted for review and approval in accordance with paragraph 4.13. Subcontractor direction to SSQ suppliers shall not be given until the PCB AIT approval/comments are provided.

5.3.3 All SSQ specifications shall be managed by the PCB AIT throughout the life of the SSP or until the specific part is identified as a military specification space qualified part or becomes obsolete on the program. The PCB AIT shall have the responsibility for coordinating release processing of new and revised SSQs, including resolution of comments received.. SSQ part qualification test data shall be maintained by the PCB AIT for the life of the SSP, and shall be available for review (reference paragraph 3.5.2 herein). All SSQ specification releases shall be transmitted by the PCB AIT to each Tier 1 contractor, and each Tier 1 contractor shall transmit them to each Tier 2 contractor, etc.

5.3.4 Formal coordination of new SSQs, revised SSQs and SSQ CRs between the PCB AIT and the Tier 1 contractors shall be via the respective Prime and Tier 1 Configuration Management Receipt Desks. Formal release of new SSQs, revised SSQs and SSQ CRs shall be via PCB AIT submittal of a Document Change Notice (DCN) to the Prime Engineering Release Unit (ERU). SSQs and SSQ CRs shall be considered released and applicable for Program use when they have been released via the ERU. The ERU provides vaulting of specification hard copies, and uploads pertinent information into the Program Automated Library System (PALS). SSQs may be viewable in PALS if they are available to the PCB AIT in a suitable electronic format.

5.3.4.1 New SSQs, revised SSQs and SSQ CRs may have impacts that require processing of a document change through the SSCB. SSQs and SSQ CRs so processed shall be considered released and applicable for Program use in accordance with contractual requirements for SSCB controlled documents.

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APPENDIX A ABBREVIATIONS, ACRONYMS AND DEFINITIONS

AC	Advanced CMOS
ac, AC	Alternating Current
ADP	Acceptance Data Package
AID	Altered Item Drawing
AIT	Analysis and Integration Team
ASIC	Application Specific Integrated Circuit
BVEBO	Emitter-Base reverse voltage, Collector open
C	Celsius
CAGE	Commercial And Government Entity
CMOS	Complementary MOS
Co-60	Cobalt-60
COTS	Commercial Off-The-Shelf
dc, DC	Direct Current
DCN	Document Change Notice
DESC	Defense Electronics Supply Center
DPA	Destructive Physical Analysis
DR	Data Requirement
EEE	Electrical, Electronic, and Electromechanical
EMI	Electromagnetic Interference
EPIMS	EEE Part Information Management System
ER	Established Reliability
ERU	Engineering Release Unit
ESD	Electrostatic Discharge
ESDS	Electrostatic Discharge Sensitive
EVA	Extravehicular Assembly
FET	Field Effect Transistor
FSC	Federal Stock Class
GIDEP	Government-Industry Data Exchange Program
GSE	Ground Support Equipment
HC	High Speed CMOS
HCT	High Speed CMOS TTL Compatible
HDBK	Handbook
I _{BW}	Current, Bundled Wire
I _D	Drain Current
IR	Ionizing Radiation

ISW	Current, Single Wire
IVA	Intravehicular Activity
JFET	Junction FET
LED	Light-Emitting Diode
M&P	Materials and Processes
MCM	Multi-Chip Module
MLP	Monitored Line Program
MOS	Metal Oxide Semiconductor
MRB	Material Review Board
μF	Microfarad
MUA	Material Usage Requirement
N	Number of wires
N/A	Not Applicable
NARS	NASA Alert Reporting System
NASA	National Aeronautics and Space Administration
NDBP	Non-Destructive Bond Pull
NSPAR	Nonstandard Part Approval Request
NTC	Negative Temperature Coefficient
OTS	Off-The-Shelf
PALS	Program Automated Library System
PCB	Parts Control Board
PCB AIT	Parts Control Board Analysis and Integration Team
PIN	P-Intrinsic-N
PIND	Particle Impact Noise Detection
PIV	Peak Inverse Voltage
PRT	Problem Review Team
PTC	Positive Temperature Coefficient
QCI	Quality Conformance Inspection
QML	Qualified Manufacturers List
QPL	Qualified Products List
rms	Root Mean Square
SCD	Source/Specification Control Drawing
SEM	Scanning Electron Microscope
SDS	Supplier Data Sheet
SDRL	Supplier Data Requirements List
SEE	Single Event Effects
SID	Selected Item Drawing
SSMB	Space Station Manned Base

SSAEPL	Space Station Approved EEE Parts List
SSCB	Space Station Control Board
SSP	Space Station Program
SSQ	Space Station Quality
SSQCRs	Space Station Quality Change Requests
TBD	To Be Determined
TEP	Team Execution Plan
TFE	Tetrafluoroethylene
TSE	Test Support Equipment
TTL	Transistor-Transistor Logic
UL	Underwriters Laboratory
Vcc	Voltage, power supply
Vdc	Volts dc
VGS	Gate-to-Source Voltage
VLSI	Very Large Scale Integration

COMPONENT

A combination of parts, devices, and structures, usually self-contained, which performs a distinctive function in the operation of the overall equipment. A “black box” (e.g., transmitter, encoder, cryogenic pump, star tracker).

CONTRACTOR

Applies to individuals, commercial ventures, organizations, nonprofit organizations, government activities, and NASA centers which are developing equipment, systems, or experiments for NASA usage or interface under contract to NASA.

DESTRUCTIVE PHYSICAL ANALYSIS (DPA)

The process of destructively disassembling, testing, and inspecting a device for the purpose of determining conformance with applicable design, process, and workmanship requirements.

DEVIATION

Specific written authorization, granted prior to the manufacture of an item, to depart from a particular performance or design requirement of a specification, drawing, or other document for a specific number of units or a specific period of time. A deviation differs from an engineering change in that an approved engineering change requires corresponding revision of the documentation defining the affected item, whereas a deviation does not contemplate revision of the applicable specification or drawing.

EEE PART

Any capacitors, circuit breakers, connectors, crystals and crystal oscillators, diodes, fiber optic accessories, fiber optic cables, fiber optic conductors, fiber optic devices, fiber optic interconnects, filters, fuses, inductors, hybrids/multi-chip modules (MCMs), microcircuits, relays, resistors, switches, thermistors, transformers, transistors, wire, and cable.

LIMITED LIFE PARTS.

Parts which lose important characteristics due to ambient conditions and time-dependent degradation that starts at the completion of part manufacture.

LOT

If no definition of a lot is provided in the part controlling specification, a lot shall be defined as consisting of parts manufactured on the same production line by means of the same production techniques, materials, controls, design, and submitted at one time to determine compliance with the applicable specification. Such parts shall be positively marked for identification purposes and shall be traceable to records of manufacture and performance.

MISSION ESSENTIAL OR CRITICAL GROUND SUPPORT EQUIPMENT

Ground support equipment whose operation is essential to successful mission performance, or whose problem can create a safety hazard adversely affecting mission performance, or cause flight hardware malfunction/damage, or inability to detect a flight hardware or software problem.

NONSTANDARD PART

Any part used outside of its intended design limits or application environment. Also, any part not selected from the following (unless designated by the PCB AIT as Grade 2 equipment):

- (1) Grade 1 Standard Parts identified in SSP 30423
- (2) Product Assurance Class "S" parts listed in the current Military Qualified Products List (QPL)
- (3) Class "V" microcircuits listed in the current Military Qualified Manufacturer List (QML)
- (4) Class "K" hybrids
- (5) Established Reliability Grade 1 passive devices
- (6) List of approved Space Station Quality (SSQ) specifications parts
- (7) Lockheed Monitored Line Program (MLP) parts

OFF-THE-SHELF EQUIPMENT

Any readily available equipment whose configuration and characteristics have been defined and which has been produced prior to the contractor receiving orders or contracts for the sale of the item.

OFF-THE-SHELF DESIGN

Any design whose equipment configuration and characteristics have been defined; however, the equipment is not readily available and must be manufactured and assembled upon receipt of purchase orders.

PART

One piece, or two or more pieces joined together, which are not normally subjected to disassembly without destruction or impairment of designed use.

PARTS CONTROL BOARD AIT

An organization described in the parts control plan and implemented by the contractor to assist in controlling the selection and documentation of parts used in equipment, system, or subsystem designs.

PARTS LIST

As-Built Parts List - A list of the actual parts used to build the delivered component and contract end item. Parts list information to be provided to the serialized component level includes the part number, manufacturer or manufacturer's Commercial And Government Entity (CAGE) Code, specification control drawing number, generic part number, lot date code, circuit designator, next assembly, and if applicable, the part serial number.

As-Designed Parts List - A list of the parts intended for use in the component and in the contract end item. Parts list information includes the procurement part number, specification control drawing number, generic number, manufacturer or CAGE, quantity, next assembly, qualification status, NSPAR number and NSPAR status, applicable waivers, and equipment identification.

PRIMARY FAILURE

A failure of a EEE part to properly function under conditions within its rated operating limits. Failures induced by mishandling or overstress, e.g., are not primary failures.

PROCURING ACTIVITY

The organization contracting for the articles, supplies, or services.

SPECIFICATIONS (DRAWINGS)

The following terms are commonly used for various types of contractor specifications.

Altered Item Drawing (AID) - Applies to completed items that are to be altered. Original item is identified plus the necessary alterations. Information may be on detail assembly drawings. This is basically a physical alteration.

Selected Item Drawing (SID) - Defines an existing standard, design, or vendor activity with further required selection or restriction. Selection may be based on fit, tolerance, performance, or reliability. No physical modification is involved.

Source Control Drawing (SCD) - Defines a commercial or vendor developed part in which the contractor exclusively provides the required performance, installation, and interchangeability characteristics.

Space Station Quality (SSQ) Specifications - PCB AIT controlled SCDs.

STANDARD PARTS

Parts which meet their intended design applications and are selected from the following (unless designated by the PCB AIT as Grade 2 equipment):

- (1) Grade 1 Standard Parts identified in SSP 30423
- (2) Product Assurance Class "S" parts listed in the current Military Qualified Products List (QPL).
- (3) Class "V" microcircuits listed in the current Military Qualified Manufacturer List (QML)
- (4) Class "K" hybrids
- (5) Established Reliability Grade 1 passive devices
- (6) List of approved Space Station Quality (SSQ) specifications parts
- (7) Lockheed Monitored Line Program (MLP) parts

TIER I CONTRACTORS

The contractors responsible for delivering product to Boeing Prime or NASA.

WAIVER

A written authorization to accept a configuration item or other designated items which, during production or after having been submitted for inspection, are found to depart from specified requirements, but nevertheless are considered suitable for "use as is" or after rework by an approved method.

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APPENDIX B. EEE PARTS STRESS DERATING CRITERIA**TABLE OF CONTENTS**

PARAGRAPH		PAGE
B.1	INTRODUCTION	B - 2
B.2	SCOPE	B - 2
B.3	DERATING CRITERIA	B - 2
B.3.1	PASSIVE PARTS	B - 3
B.3.1.1	CAPACITORS	B - 3
B.3.1.2	RESISTORS	B - 4
B.3.1.3	EMI FILTERS	B - 5
B.3.1.4	THERMISTORS	B - 5
B.3.2	ACTIVE PARTS	B - 6
B.3.2.1	CRYSTALS AND CRYSTAL OSCILLATORS	B - 6
B.3.2.2	DIODES	B - 6
B.3.2.3	PHOTONICS - ACTIVE	B - 6
B.3.2.4	TRANSISTORS	B - 7
B.3.2.5	DIGITAL MICROCIRCUITS	B - 8
B.3.2.6	LINEAR MICROCIRCUITS	B - 9
B.3.2.7	HYBRIDS/MCMS	B - 9
B.3.3	MAGNETIC PARTS	B - 10
B.3.3.1	TRANSFORMERS	B - 10
B.3.3.2	INDUCTORS/COILS	B - 11
B.3.4	PROTECTIVE DEVICES	B - 12
B.3.4.1	FUSES	B - 12
B.3.4.2	CIRCUIT BREAKERS	B - 12
B.3.4.3	RELAYS	B - 12
B.3.4.4	SWITCHES	B - 14
B.3.5	INTERCONNECTION PARTS	B - 14
B.3.5.1	CONNECTOR DERATING CRITERIA	B - 14
B.3.5.2	WIRE AND CABLE DERATING CRITERIA	B - 15
B.3.5.3	PHOTONICS - INTERCONNECTION	B - 15

B.1 INTRODUCTION

Derating is the reduction of electrical, thermal, and mechanical stresses applied to a part in order to decrease the degradation rate and prolong the expected life of the part. Derating increases the margin of safety between the operating stress level and the actual failure level for the part, providing added protection from system anomalies unforeseen by the designer. The specified derating percentages and notes will assist the designer in obtaining reliable operation of parts used in space equipment. It must be emphasized that the user should evaluate all parts to the project requirements and assure that adequate deratings are accomplished. These recommended derating factors are based on the best information currently available.

B.2 SCOPE

The derating criteria of this appendix are applicable to all EEE parts used on Space Station Program, and shall be used in stress analyses and application reviews. Part applications that meet these criteria are pre-approved by the PCB. The cognizant design organization should use more stringent criteria based on its understanding of characteristics unique to the equipment design, part selection, or source of manufacture. Applications that exceed these criteria shall be approved in accordance with paragraph 3.8.4 herein.

B.3 DERATING CRITERIA

The derating criteria contained herein indicate the maximum recommended stress values and do not preclude further derating. When derating, the designer must first take into account the specified environmental and operating condition rating factors, consider the actual environmental and operating conditions of the application, and then apply the recommended derating criteria contained herein. The derating instructions are listed for each commodity in the following paragraphs.

NOTE 1: In the following derating sections, the term "ambient temperature" as applied in low pressure or space vacuum operation, is defined as follows:

For operation under conditions of very low atmospheric pressure or space vacuum, heat loss by convection is essentially zero, so ambient temperature is the maximum temperature of the heat sink or other mounting surface in contact with the part, or the temperature of the surface of the part itself (case temperature).

B.3.1 PASSIVE PARTS

B.3.1.1 CAPACITORS

Voltage derating is accomplished by multiplying the maximum operating voltage by the appropriate derating factor appearing in the chart below.

Type	Military Style	Voltage Derating Factor (2)
Ceramic	CCR (3)	0.60
	CKS	0.60
	CKR (3)	0.60
	CDR (3)	0.60
Glass	CYR	0.50
Plastic Film	CRH (4)	0.60
	CHS (5)	0.60
Tantalum, Foil	CLR25	0.50
	CLR27	0.50
	CLR35	0.50
	CLR37	0.50
Tantalum, Wet Slug	CLR79	0.60
Tantalum, Solid	CSR (1)	0.50
	CSS (1)	0.50
	CWR (1)	0.50

(1) For applications where the effective circuit resistance is less than 1 ohm per volt, contact parts specialist. Parts shall not be used in power supply filter applications, unless otherwise approved by the PCB.

(2) Applies to the nominal DC polarizing voltage, and shall be applied to the maximum rating of the applicable ER specification. An increase of 0.10 in the voltage derating factor is allowed to accommodate sum or peak AC ripple and DC polarizing voltage variations.

(3) For low-voltage applications (<10 Vdc), rated voltage shall be at least 100 Vdc.

(4) This capacitor is not approved for used in circuits where the energy is less than 250 microjoules.

(5) To ensure clearing of breakdown, the circuit in which capacitors of 0.1μF and greater capacitance are intended for use, shall be capable of providing at least 100 microjoules of energy.

B.3.1.2 RESISTORS

The derating factors for resistors are tabulated below:

Type	Derating Factor (1)	Parameter	Applicable Notes
Fixed			(2)
Carbon composition (RCR)	0.60	Power	(3)
Film, high-stability and metal (RM, RNC, RNN, RNR, RLR)	0.60	Power	
Wirewound, power, chassis mount (RER)	0.60	Power	
Wirewound, precision (RBR)	0.60	Power	
1.0%	0.25	Power	
0.1%	0.25	Power	
0.01%			
Wirewound, power (RWR)	0.60	Power	
Adjustable			(4)
Wirewound (RTR)	0.70	Rated current	
Non-wirewound	0.70	Rated current	
Networks (RZO)	0.60	Power	(2)
<p>(1) Under no conditions should the applied voltage exceed the values specified. High-density packaging may require further derating if ambient temperatures are increased.</p> <p>(2) The maximum voltage shall be no more than 80 percent of the MIL-ratings.</p> <p>(3) To prevent corona effects, hollow core resistors are restricted to applied voltages below 100 Vdc. Samples of lots resistors with unknown internal structure shall be subjected to DPA to determine application restrictions.</p> <p>(4) Rated current is defined as $IR = \sqrt{P_{\max} / R_{\max}}$, and by limiting the current to 0.70 rated current, power is limited to 0.5 maximum power. The maximum voltage shall be no more than 80 percent of the MIL-ratings or 80 percent of $E = \sqrt{PR}$, whichever is less, where:</p> <p>E = Max applied voltage (dc or rms (in volts))</p> <p>P = Derated power (in watts)</p> <p>R = The resistance of the portion of the element actually active in the circuit.</p>			

B.3.1.3 EMI FILTERS

The derating factors for EMI filters are tabulated below:

Class	Derating	Maximum Case Temperature
All (1)	0.50 of rated current	+85°C
	0.50 of rated voltage	
(1) For stud-mounted filters, do not exceed the rated torque specification on the stud nut.		

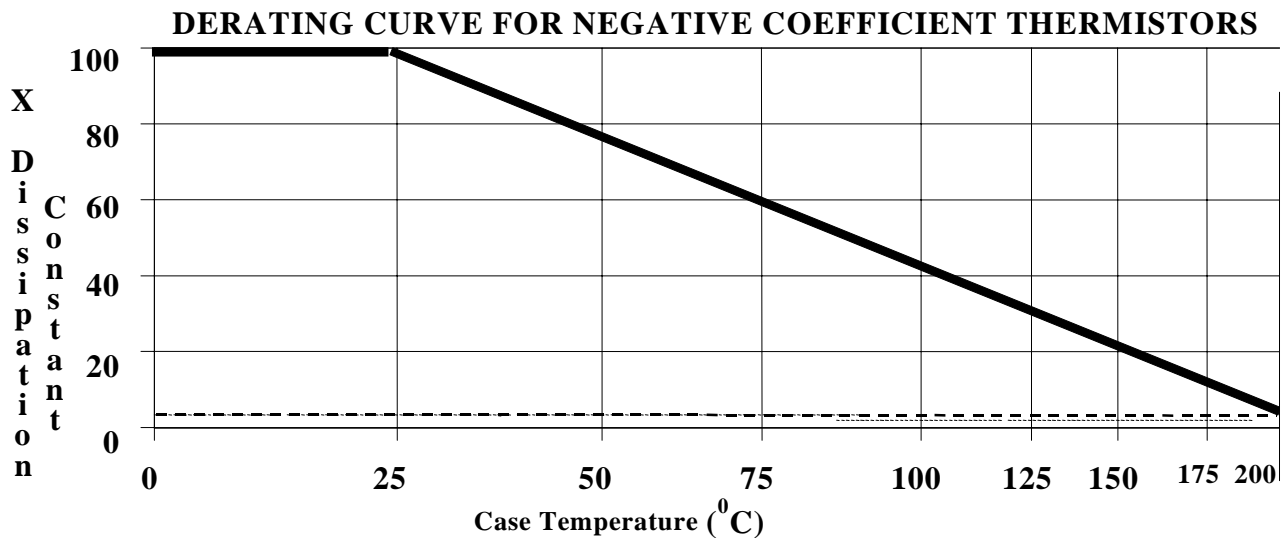
B.3.1.4 THERMISTORS

Positive Temperature Coefficient (PTC)

Positive temperature coefficient thermistors are generally operated in the self-heat mode. Derate to 50 percent of the rated power, or as required by the detailed specification.

Negative Temperature Coefficient (NTC)

Negative temperature coefficient thermistors operated in the self-heat mode shall be derated in accordance with the figure below to prevent thermal runaway. Such parts should be derated to a power level causing a maximum increase of 50 times the dissipation constant, or a maximum part temperature of 100°C, whichever is less.



(1) Applied voltage should not exceed 80% of the maximum rating. ($E_{APP} = 0.8 \sqrt{RP}$)

B.3.2 ACTIVE PARTS

B.3.2.1 CRYSTALS AND CRYSTAL OSCILLATORS

Crystal current shall be limited to 75% of the rated value.

Crystal oscillators shall be derated to the individual component level, and shall comply with the derating criteria herein.

B.3.2.2 DIODES

Derating is accomplished by multiplying the critical stress parameter by the appropriate derating factor appearing in the chart below. Junction temperature shall not exceed +125°C or $T_{JMAX} - 20^{\circ}\text{C}$, whichever is less, where T_{JMAX} is maximum rated operating junction temperature.

Diode Type	Critical Stress Parameter	Derating
General purpose, Rectifier, Switching, PIN/Schottky, and Thyristors	PIV	0.70
	Surge current	0.50
	Forward current	0.50
Varactor	Power	0.50
	Reverse voltage	0.75
	Forward current	0.75
Voltage Regulator	Power	0.50
	Zener current	0.5 ($I_{Zmax} + I_{Znom}$)
Voltage reference	Zener current	N/A (1)
Zener Voltage Suppressor	Steady state power dissipation	0.50
Bidirectional Voltage Suppressor	Steady state power dissipation	0.50
FET Current Regulator	Peak operating voltage	0.80
(1) Operate at the manufacturer's specified zener current (I_{ZT}) to optimize temperature compensation		

B.3.2.3 PHOTONICS - ACTIVE

Derating of photonics active parts is accomplished by multiplying the critical stress parameter by the appropriate derating factor appearing in the chart below. Junction temperature shall not exceed +125°C or $T_{JMAX} - 20^{\circ}\text{C}$, whichever is less, where T_{JMAX} is maximum rated operating junction temperature.

Photonic part type	Power	Reverse Voltage	Forward Current
LED	0.75	0.75	0.75
Photodiode	0.75	0.75	0.75
Laser Diode	0.75	0.75	0.75
Phototransistor	0.75	0.75	0.75

B.3.2.4 TRANSISTORS

Derating of transistors is accomplished by multiplying the appropriate stress parameter by its derating factor. Junction temperature must also be calculated and maintained below +125°C, or $T_{jmax} - 20^{\circ}\text{C}$, whichever is less.

Transistor Type	Critical Stress Parameter	Derating Factor
Bipolar General purpose, Switching, and Power	Power Current Voltage	0.50 0.75 0.75 (1)
Field Effect J FET and MOSFET (2)	Power Current (I_D) Voltage or Avalanche Energy	0.50 0.75 0.75 / 0.85 (1) (3)
<p>(1) The derating factor is applied to the lowest pass voltage as determined by Ionizing Radiation (IR) test or analysis. Derating factor is 0.75 and may be increased to 0.85 when the lot of flight parts is tested with a minimum sample size of 10. Worst-case combination of DC and AC voltages may be allowed to exceed these derated limits, by analysis. Random, non-repetitive transients and low duty factor, repetitive transients may be allowed to exceed these derated limits, by analysis.</p> <p>(2) For power MOSFET devices with gate to source voltage (VGS) rating equal to or greater than 20V, also derate the gate to source voltage (VGS) to 60% of the maximum rated, or 12.5V, whichever is greater. For devices with VGS rated less than 20V, derate to 60% of the maximum rated</p> <p>(3) MOSFET devices with specified absolute maximum rating for repetitive avalanche energy, E_{AR} ($T_j = T_{jmax}$), may be applied using a derating factor of 0.50 for E_{AR} ($T_j = T_j$ applied) in lieu of using a derating factor of 0.75 for drain-to-source reverse breakdown voltage, BV_{DSS}. E_{AR} shall be as defined in the military standard test method identified by DESC for the closest military specification part.</p>		

B.3.2.5 DIGITAL MICROCIRCUITS

Derating of digital microcircuits is accomplished by multiplying the appropriate parameter by its derating factor listed below. Junction temperature shall not exceed +125°C or $T_{JMAX} - 20^{\circ}\text{C}$, whichever is less, where T_{JMAX} is maximum rated operating junction temperature.

Parameters (1), (2)	Bipolar	MOS	CMOS 4000 A&B (3)	CMOS HC & HCT (4)	CMOS AC (5)	Line Drivers and Receivers	Gate Arrays Bipolar MOS
Open collector (or drain DC output voltage	0.80 (6)	N/A	N/A	N/A	N/A	0.75	0.80
Operating AC or DC output current or fanout	0.80 (7)	0.80 (7)	0.80 (7)	0.80 (7)	0.80 (7)	0.80	0.80
Maximum clock frequency	N/A	0.85	0.85	0.85	0.85	0.80	0.80

- (1) Under no circumstances shall the input voltage be allowed to exceed the supply voltage.
- (2) For those technologies where no supply voltage derating is given, in no case shall the device be operated at the absolute maximum supply voltage.
- (3) The operating supply voltage shall not exceed 70% of the absolute maximum voltage.
- (4) The operating supply voltage shall not exceed 79% of the absolute maximum voltage.
- (5) The operating supply voltage shall not exceed 92% of the absolute maximum voltage.
- (6) The derating factor for TTL open collector devices shall be 0.75.
- (7) Further derating may be required for radiation environments (i.e., minimum V_{CC} to insure minimum DC reference for transients).

B.3.2.6 LINEAR MICROCIRCUITS

Derating of linear microcircuits is accomplished by multiplying the appropriate parameter by its derating factor listed below. Junction temperature shall not exceed +125°C, or $T_{jmax} - 20^{\circ}\text{C}$, whichever is less, where T_{jmax} is maximum rated operating junction temperature.

Parameters	Diff Ampl (Oprnl)	Compar- ators	Sense Amp	Current Amp	Voltage Reg	Analog Switches
Supply voltages (1)	0.80	0.90	0.80	0.80		0.90
Power dissipation (percent of rated power at maximum operating temperature)	0.75	0.75	0.75	0.75	0.80	0.80
AC input voltage (1) (percent of rated ac voltage at actual supply voltage)	1.00	1.00	1.00	1.00		
Differential dc input (1) input voltage	0.70 (2)	0.70 (2)	0.70			
Single-ended dc (1) input voltage				0.80	0.90	
Signal voltage referenced (1) to negative supply voltage						0.80
Input-output voltage (1) differenti					0.80	
Output ac voltage	1.00			1.00		
Open collector (or drain) dc output voltage		0.90	0.90			
Operating ac or dc output current	0.80	0.80	0.80	0.80	0.80	0.80
Maximum short-circuit output current sent by external means	0.90	0.90	0.90	0.90	0.90	
(1) Under no circumstances shall the input voltage be allowed to exceed the supply voltage. (2) The input voltage shall not exceed the BV_{EBO} of the transistors in the input circuit. (3) Further derating may be required for radiation environments (e.g., minimum V_{cc} to insure minimum DC reference for transients).						

B.3.2.7 HYBRIDS/MCMs

Derate internal elements in accordance with the requirements herein for the closest similar part type. Additional derating in the application (used-on assembly) is not required.

Vendor off-the-shelf designs shall be analyzed for part stress. Additional derating in the application (used-on assembly) is required.

B.3.3 MAGNETIC PARTS**B.3.3.1 TRANSFORMERS.**

The derating factors for transformers are tabulated below:

Military Specification Rated Temperature	Derated Operating Parameters	
	Temperature (1)	Voltage
85°C	+65°C	50% of maximum rated voltage
105°C	+85°C	
130°C	+105°C	
<p>(1) a) Derated operating temperature equals ambient temperature plus temperature rise of +10°C (allowance for hot spot). Compute temperature rise as follows:</p> $\text{Temperature rise (°C)} = \frac{R-r}{r} (T + 234.5) - (T -t)$ <p>Where R = Winding resistance under load r = no-load winding resistance at ambient temperature T (°C) t = specified initial ambient temperature (°C) T = maximum ambient temperature (°C) at time of power shutoff. (T) shall not differ from (t) by more than +5°C.</p> <p>b) The insulation classes of MIL style inductive parts have maximum operating temperature ratings which are generally based upon a life expectancy of at least 10,000 hours. The derated operating temperatures in this table are selected to extend the life expectancy to 50,000 hours.</p> <p>c) Custom-made inductive devices shall be evaluated on a materials basis and stressed at levels below the maximum rated operating temperature for the materials used. Devices having a maximum rated operating temperature in the range of +85° to +130°C, shall be derated as follows: derated operating temperature (°C) equals 0.75 times maximum rated operating temperature (°C). For devices with maximum rated temperatures outside this temperature interval, consult the project parts engineer for temperature derating recommendations.</p>		

B.3.3.2 INDUCTORS/COILS

The derating factors for inductors/coils are tabulated below:

Military Specification Rated Temperature	Derated Operating Parameters	
	Temperature 1/	Voltage
85°C	+65°C	50% of maximum rated voltage
105°C	+85°C	
130°C	+105°C	
<p>1/ a) Derated operating temperature equals ambient temperature plus temperature rise of +10°C (allowance for hot spot). Compute temperature rise as follows: Temperature rise (°C) = $\frac{R - r}{r} (T + 234.5)$ Where R = Winding resistance under load R = no-load winding resistance at ambient temperature T (°C)</p> <p>b) The insulation classes of MIL style inductive parts have maximum operating temperature ratings which are generally based upon a life expectancy of at least 10,000 hours. The derated operating temperatures in this table are selected to extend the life expectancy to 50,000 hours.</p> <p>c) Custom-made inductive devices shall be evaluated on a materials basis and stressed at levels below the maximum rated operating temperature for the material used. Devices having a maximum rated operating temperature in the range of +85°C to +130°C, shall be derated as follows: derated operating temperature (°C) equals 0.75 times maximum rated operating temperature (°C). For devices with maximum rated temperatures outside this temperature interval, consult the project parts engineer for temperature derating recommendations.</p>		

.3.4 PROTECTIVE DEVICES

B.3.4.1 FUSES

Fuses are derated by multiplying the rated amperes by the appropriate Derating Factor listed below.

Fuse current Rating (amperes)	Derating Factor (1) (2)	Remarks
2 - 15	0.50	Rating at 25°C ambient. Derating of fuses allows for loss of pressure, which lowers the blow current rating and allows for a decrease of current capability with time. (1) (3)
1 & 1.5	0.45	
0.5 & 0.75	0.40	
0.375	0.35	
0.25	0.30	
0.125	0.25	
(1) If calculations result in fractional values, use the next highest standard fuse rating.		
(2) Derating factors are based on data from fuses mounted on printed circuit boards and conformally coated. For other types of mounting, consult the project parts engineer for recommendations.		
(3) There is an additional derating of 0.5 percent/°C for an increase in the ambient temperature above 25°C.		

B.3.4.2 CIRCUIT BREAKERS

Circuit breaker contacts are derated by multiplying the maximum rated contact current (resistive) by the appropriate contact derating factor listed below.

Contact Application	Contact Derating Factor	Maximum Ambient Temperature
Resistive	0.75	20°C below the maximum specified
Capacitive	0.75 (1)	
Inductive	0.40	
Motor	0.20	
Filament	0.10	
(1) Series resistance shall be used to assure that circuits do not exceed the derated level.		

B.3.4.3 RELAYS

The factors provided pertain only to contact loads, and they are intended for derating specified loads established in the governing specifications (resistive, inductive, motor, and/or lamp loads). The users are cautioned to use the contact voltages and nominal coil voltages (currents) prescribed in the governing specifications. Utilization of reduced coil voltages and abnormal contact voltages can potentially reduce the life of the relay and compromise relay operations.

Derating parameters are based on the following factors:

- A. Ambient operating temperature (Table T). This table considers the temperature extremes under which the relay may function.
 - B. Cycle rate per hour (Table R). This table defines a derating factor for nominal cycle rate.
 - C. Load application rate (Table L). This table establishes three categories of load application. They are:
 1. Load A. Make, break, and/or carry loads with an on-time duration of 0 to 500 milliseconds. Off-time is equal to or greater than on-time.
 2. Load B. Carry-only^{1/} loads. Relay does not make or break the load. Maximum on-time is 5 minutes. Off-time is equal to or greater than on-time.
 3. Load C. Make, break, and/or carry. Those loads that do not fall into the category of loads A through B.
- 1/ The word “carry” means that the relay contacts in question are closed, and there is current flowing through the contacts.

TABLE T				
Temp Range	-65° to -21°C	-20° to +39°C	+40° to +84°C	+85° to +125°C
Factor	0.85	1.0	0.85	0.7

TABLE R			
	Cycle Rate Per Hour		
Cycle Rate	<1.0	1.0 to 10	>10
Factor	0.85	0.9	0.85

TABLE L			
Load Application	A	B	C
Factor	1.0	1.5	0.8

The steps for load derating are:

1. Select the appropriate load (resistive, inductive, motor, or lamp) and rating from the military specification. Assume the relay being utilized is MS27400-5, and the type of load is motor. From the specification, the motor load is 4 amps.
2. Determine the temperature range in the application. Select the appropriate factor from Table T.
3. Determine the cycle rate in the application. Select the appropriate factor from Table R.
4. Determine the load application. Select the appropriate factor from Table L.
5. Calculate the derated load by multiplying the various factors together. Using the number from item 1 above, derated load = $4 \times T \times R \times L$.

Other examples are as follows:

Example 1. A 1.0 amp relay is operated in an environment with a temperature range of +25° to +70°C. The relay is cycled at a rate of 5 cycles per hour. The load application is make, break, and carry of a resistive load.

The worst case temperature is 70°C. From Table T select 0.85.

The cycle rate is 5 cycles/hour. From Table R select 0.9.

The load application is specified as make, break, and carry. From Table L select 0.8.

Relay derating factor is $T \times R \times L = 0.85 \times 0.9 \times 0.8 = 0.612$. The derated contact load is $0.612 \times 1.0 = 0.612$ amp resistive load.

Example 2. A 10 amp relay is operated in an environment with a temperature range of -40° to +35°C. The relay is turned on for 3 minutes every 2 hours. The load application is carry only (resistive load).

From Table T select 0.85

From Table R select 0.85

From Table L select 1.5

B.3.4.4 SWITCHES

Derate in accordance with the derating requirements for relay contacts.

B.3.5 INTERCONNECTION PARTS

B.3.5.1 CONNECTOR DERATING CRITERIA

Connectors are derated by limiting the temperature seen by the dielectric insert due to ambient temperature and the effects of resistive heating. See B.3.5.2 for derating of wire and cable.

Operating voltage derating: 25% of the rated Dielectric Withstanding Voltage at Sea Level.

Temperature rating of the dielectric insert shall be at least:

$$T_{\text{(rated)}} = T_{\text{(insert material including ohmic heating)}} + 50^{\circ}\text{C}$$

B.3.5.2 WIRE AND CABLE DERATING CRITERIA

Derating is accomplished by determining a single wire maximum current from a combination of wire size and bundle size as listed below.

Wire Size (AWG)	Single Wire Current (I_{SW}) (A)	Remarks
30	1.3	<ol style="list-style-type: none"> Current ratings are based on wires at +70°C in a hard vacuum. (10-6 to 10-9 torr) When wires are bundled, the maximum design current for each individual wire shall be derated according to: <div style="display: flex; justify-content: space-around;"> <div> <p>For $N < 15$</p> $I_{BW} = I_{SW} \times (29 - N)/28$ <p>Where: N = number of wires</p> <p>I_{BW} = current, bundled wire</p> <p>I_{SW} = current, single</p> </div> <div> <p>For $N > 15$:</p> $I_{BW} = (0.5) \times I_{SW}$ </div> </div> Deratings listed are for insulated wire rated for +200°C. <div style="display: flex; justify-content: space-around;"> <p>A. For 150°C wire, use 80% of value shown in table.</p> <p>B. For 135°C wire, use 70% of value shown in table.</p> <p>C. For 105°C wire, use 50% of value shown in table.</p> </div> Dielectric withstanding voltage rating required: at least two times the highest application voltage. Derating values listed apply only to round single conductors on helically wound bundles. See project parts engineer for derating information for ribbon cable and flat conductors. Circuit protective devices shall not allow sustained current exceeding 130% of derated single wire current. Green wire ground applications shall meet wire derating requirements as defined in NASA TM 102179 dated June 1991 (Shuttle Payloads requirements).
28	1.8	
26	2.5	
24	3.3	
22	4.5	
20	6.5	
18	9.2	
16	13.0	
14	19.0	
12	25.0	
10	33.0	
8	44.0	
6	60.0	
4	81.0	
2	108.0	
0	147.0	
00	169.0	

B.3.5.3 PHOTONICS - INTERCONNECTION

Photonics passive part temperature exposure shall be limited to $T_{JMAX} - 50^{\circ}C$, where T_{JMAX} is maximum rated operating temperature. The application minimum temperature shall not go below minimum rated operating temperature.

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APPENDIX C EEE PARTS SUPPLIERS AND MANUFACTURERS SURVEYS**TABLE OF CONTENTS**

PARAGRAPH		PAGE
C.1	INTRODUCTION	C - 2
C.2	PURPOSE	C - 2
C.3	SCOPE	C - 2
C.4	SURVEY PERFORMANCE	C - 2
C.5	CHECKLISTS	C - 2
C.6	ACTION REQUEST FORM	C - 2
C.7	SURVEY REPORTS	C - 2
C.8	DELTA SURVEYS	C - 3

ENCLOSURES

ENCLOSURE		PAGE
C1	ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PREAWARD SURVEY CHECKLIST FOR GENERAL REQUIREMENTS EVALUATION	C - 4
C2	STANDARD SURVEY ACTION REQUEST FORM	C-27
C3	CAPACITOR CHECKLIST	C-28
C4	CONNECTOR CHECKLIST	C-33
C5	ENGINEERING SURVEY HYBRIDS	C-41
C6	MICROCIRCUIT CHECKLIST	C-48
C7	RELAY CHECKLIST	C-54
C8	SEMICONDUCTOR CHECKLIST	C-56
C9	MAGNETICS CHECKLIST	C-61
C10	MISCELLANEOUS CHECKLIST	C-64
C11	CABLE AND WIRE CHECKLIST	C-68

C.1 INTRODUCTION

This appendix delineates the requirements for preaward surveys that are to be performed on potential suppliers and manufacturers of EEE parts products and services, hereafter called suppliers.

C.2 PURPOSE

Preaward surveys provide assurance of the supplier capability to provide adequate process and quality control throughout all areas of contract performance, i.e. documentation, development, storage, receiving/inspection, fabrication, assembly, inspection, test, maintenance, packaging, and shipping. The quality program, including procedures, processes, and products, shall be subject to review by the government Quality Assurance representative.

C.3 SCOPE

These preaward survey requirements apply to all potential suppliers of EEE parts products and services (manufacturing lines, screening and test facilities, DPA laboratories, failure analysis laboratories, and radiation laboratories). These surveys shall be performed prior to the placement of the purchase order for the service or product. Only those manufacturing lines that meet the requirements of paragraph 4.5 herein for pre-approved surveys are exempted.

C.4 SURVEY PERFORMANCE

Preaward surveys shall be performed after coordination with the PCB, and shall use the General Checklist (enclosure 1), Action Request Form (enclosure 2), and specific checklists (enclosures 3 through 10), as applicable.

C.5 CHECKLISTS

Each paragraph in the General Checklist has an (F), (O), or left blank after the paragraph number. The (F) identifies those paragraphs that are findings, (O) identifies those that are observations, and the blank identifies those that are for information only. Specific checklists use Yes-No-N/A for the items being reviewed, and comment areas for discrepancies or concerns.

C.6 ACTION REQUEST FORM

The Action Request Form shall be used to show discrepancies or concerns found during the survey. A copy will be given to the supplier upon the completion of the survey. The supplier shall identify the person that shall respond to the discrepancies or concerns in the time period agreed upon with the survey team. The supplier shall provide their response to the Action Request within 30 days of receipt, and it shall include corrective action.

C.7 SURVEY REPORTS

Survey reports shall be submitted for approval in accordance with DRD EEE-03, and include the applicable completed forms from this appendix.

C.8 DELTA SURVEYS

Delta surveys shall be performed as required to assess changes in the supplier's baseline, and shall be appropriate to the nature of the change. The survey team shall include the rationale for the survey contents with the survey report, providing justification for exemption from normally applicable portions of the survey requirements herein.

ENCLOSURE 1
ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE)
PREAWARD SURVEY CHECKLIST FOR
GENERAL REQUIREMENTS EVALUATION

1.0 GENERAL INFORMATION

Date _____

VENDOR'S NAME: _____

DIVISION OF: _____ CAGE CODE: _____

ADDRESS: _____ PHONE: _____

CITY: _____ STATE: _____ ZIP CODE: _____

POINT OF CONTACT AT MANUFACTURER: _____

EXT.: _____

1.1. EEE Parts for Consideration: _____

1.2 Survey:

Date ____/____/____ Initial Survey: _____ Resurvey: _____
 Month Day Year

1.3 Survey Team

NAME	COMPANY	DEPARTMENT NAME	PHONE

1.4 Qualified Product List (QPL): List military specification to which the vendor is on the QPL.

MILITARY SPECIFICATION NO.	QPL REPORT NO.	DATE (MONTH/DAY/YEAR)

2.0 PRELIMINARY REVIEW OF VENDOR

2.1 Devices and families to be manufacturer. _____

2.2 Are all manufacturing processes, testing, documents, documentation control, etc., at the location being surveyed?

If the answer to 2.2 is "NO," list the areas of the survey not being performed at this facility.

OTHER LOCATIONS

COMPANY OR FACILITY NAME	ADDRESS CITY STATE	OPERATION PERFORMED	SHOULD SURVEY BE PERFORMED	
			YES	NO

2.3 What experience does the vendor have in manufacturing the subject part(s)?

Length of time: _____

Failure history: _____

Corrective action taken: _____

2.4 (O) Applicable GIDEP Alerts for vendor (include Alerts that address generic problems with similar part types which could affect the subject part or generic problems with the vendor which would affect the part).

GIDEP ALERT NO.	DATE (MONTH/DAY/YEAR)	DESCRIPTION OF ALERT AND CORRECTIVE ACTION

3.0 PRODUCT DESIGN AND TECHNICAL ASSESSMENT

3.1(O) Does the part drawing adequately specify the Space Station requirements and the environment in which the part is intended to be used? Yes _____ No _____

Explain. _____

3.2 (O) Are there any known inherent reliability risks in the part or a part of a similar design?

Yes _____ No _____

Explain. _____

3.3 Briefly explain the physical construction of the part(s) (i.e., standard microcircuit, Grade 5 transformer, vacuum sealed relay, etc.).

3.4 (O) Are there any materials used by the vendor in the manufacturing processes that could impact performance in a space environment? Yes _____ No _____

Explain. _____

3.5 (F) Does the vendor use any unique processing steps that could affect the reliability of the part(s)?

SSP 30312 Revision G

October 20, 1998

Explain. _____

4.0 VENDOR MANAGEMENT

4.1 (O) Is the vendor management willing to manufacture the part(s) to Class "S" requirements?

Explain. _____

4.2 (O) Is the vendor management willing to accept Government Source Inspection on the Space Station parts?

Explain. _____

4.2.1 Does the vendor currently have a Government Source Inspector? Yes____,No____

Resident_____ Itinerant_____

Name _____

Phone No. _____ - _____

4.2.2 Has the vendor experienced any problem with the Government Source Inspector?

Yes _____ No _____

Explain. _____

4.2.3 (O) Has the Government Source Inspector experienced any problem with the vendor?

Yes _____ No _____

Explain. _____

4.3 Does the vendor understand that no manufacturing is to take place until a purchase order has been approved by Government Representative and the local Government Representative resident has been notified?

5.0 DOCUMENTATION CONTROL

5.1 Evaluate the technical expertise in taking a customer's specification and purchase order to develop the manufacturer's in-house specification for fabrication of the part.

Comments. _____

5.2 (F) Are records maintained associated with the articles and materials throughout procurement, processing, fabrication, inspection, and test? Yes _____ No _____

Explain. _____

5.3 (F) Is the procedure for documentation control adequate? Yes _____ No _____

Explain. _____

5.4 (F) Does a system exist for approving changes to documentation [i.e., Document Change Notice (DCN) or Engineering Change Notice (ECN)]? Yes _____ No _____

Explain. _____

5.5 (O) Is an effectivity date assigned to the ECNs? Yes _____ No _____

Explain. _____

SSP 30312 Revision G

October 20, 1998

5.6 (F) Are the ECNs logged, assigned numbers, and expedited when necessary?

Yes _____ No _____

Explain. _____

5.7 (O) Is there a distribution list for ECNs, and is it adequate?

Yes _____ No _____

Explain. _____

5.8 (F) Does documentation on the production and test floor agree with the purchase request requirements and the latest customer drawing/specification? Yes _____ No _____

Explain. _____

5.9 (O) Are uncontrolled documents released and, if so, are they identified as uncontrolled?

Yes _____ No _____

Explain. _____

5.10 (F) Are controlled documents released and, if so, are they identified as controlled?

Yes _____ No _____

Explain. _____

5.11 (F) Is there a procedure to ensure that documents are updated properly?

Yes _____ No _____

Explain. _____

5.12 (O) Is there a system in place for removing obsolete documents? Yes _____ No _____
Explain. _____

5.13 (F) How is the customer notified of changes to the vendor's documentation? Yes _____ No _____

Explain. _____

5.14 (O) What is the time frame for notifying the customer?
Explain. _____

5.15 (O) When the changes to the vendor's documentation affect the part being manufactured, does the vendor stop production of the part to await written approval from the customer to proceed?

Yes _____ No _____

Explain. _____

6.0 PROCUREMENT

6.1 (F) Do the vendor's quality assurance personnel review the procurement documents prior to release to ensure that the appropriate quality requirements have been incorporated?

Yes _____ No _____

Explain. _____

6.2 (F) Do the vendor's quality assurance personnel review their purchase orders to ensure that the appropriate material will be provided from their suppliers (i.e., certification of compliance, laboratory results, traceability information, etc.)? Yes _____ No _____

Explain. _____

6.3 (F) Is there an approved supplier list available? Yes _____ No _____

Explain. _____

7.0 METROLOGY

7.1 (F) Has the vendor established documented procedures for controlling calibration?

Yes _____ No _____

Explain. _____

7.2 (O) How is equipment which has not been calibrated marked?

7.3 (F) Is it effective in preventing the equipment from being used? Yes _____ No _____

Explain. _____

7.4 (F) Has the equipment been calibrated within the calibration time frame?

Yes _____ No _____

Explain. _____

7.5 Are records maintained for each piece of equipment defining:

- | | | | |
|----|-------------------------------------|----------|---------|
| a. | (F) Repair history? | Yes ____ | No ____ |
| b. | (F) Model and manufacturer? | Yes ____ | No ____ |
| c. | (F) Name of calibration technician? | Yes ____ | No ____ |
| d. | (F) Date of calibration? | Yes ____ | No ____ |
| e. | (F) Next calibration due date? | Yes ____ | No ____ |
| f. | (F) Description of problems? | Yes ____ | No ____ |
| g. | (F) Procedure for operation? | Yes ____ | No ____ |
| h. | (F) Procedure for calibration? | Yes ____ | No ____ |

7.6 (F) Is there a recall system to ensure timely calibration of equipment? Yes ____ No ____

Explain. _____

7.7 (O) Does metrology notify quality assurance and the production manager of equipment that is grossly out of calibration and was not detected during the assembly/fabrication process?

Yes ____ No ____

Explain. _____

7.8 (O) Is there a procedure to notify customer of grossly out-of-tolerance condition after the fact?

Yes ____ No ____

Explain. _____

7.9 (F) Are the devices used for calibrating the equipment under calibration control?

Yes ____ No ____

Explain. _____

7.10 (F) Does the vendor have a documented procedure for performing a calibration audit?

Yes _____ No _____

Explain. _____

7.11 (F) Is the accuracy of the calibrating instrument four (4) times greater than the item being calibrated?

Explain. _____

7.12 (F) Are all of the calibration standards used for calibrating the equipment themselves calibrated within a year?
(There are cases where the National Institute of Standards and Technology (NIST) recommends a longer period.)

Explain. _____

7.13 (F) Are the vendor's calibration standards traceable to the NIST? Yes _____ No _____

Explain. _____

7.14 (F) Does the vendor maintain standards in an appropriate environment?

Yes _____ No _____

Explain. _____

8.0 TRAINING

8.1 (F) Does the vendor have a documented procedure for any employee training program?

Yes _____ No _____

Explain. _____

8.2 (O) Is there on-the-job training?

Yes _____ No _____

Explain. _____

8.3 (F) Does the training program identify the skills and processes required by the person being trained to become trained and/or certified?

Yes _____ No _____

Explain. _____

8.4 Does the vendor have a recertification program for the following conditions:

a. (F) Retesting when a person's work is found unsatisfactory? Yes _____ No _____

b. (F) Changes which occur in technique? Yes _____ No _____

c. (F) Changes due to requirement skills? Yes _____ No _____

d. (F) Interrupted work period? Yes _____ No _____

Explain. _____

8.5 Do the training records include the following:

a. (O) Identity of the instructor and qualifications? Yes _____ No _____

b. (F) Objective evidence of satisfactory completion? Yes _____ No _____

c. (F) Status of certified personnel (active, recall, etc.)? Yes _____ No _____

Explain. _____

9.0 INCOMING INSPECTION

9.1 (F) Is there a procedure document for incoming inspection? Yes _____ No _____

Explain. _____

9.2 (F) Does the incoming inspection system ensure performance of applicable preplanned inspection tasks?

Explain. _____

9.3 (F) Does the incoming inspection documentation define incoming inspection criteria?

Yes _____ No _____

Explain. _____

9.4 (F) Is the incoming inspection criteria acceptable for the customer's requirements?

Yes _____ No _____

Explain. _____

9.5 (F) Does the incoming inspection perform periodic or random chemical/physical analysis of purchased raw material?

Yes _____ No _____

Explain. _____

9.6 (F) Is all the equipment used in inspection properly calibrated? Yes _____ No _____

Explain. _____

9.7 (F) Does receiving inspection ensure that material is from an approved supplier?

Yes _____ No _____

Explain. _____

9.8 Are contamination and ESD controlled in this are?

N/A _____

a. (F) Work benches properly grounded? Yes _____ No _____

b. (F) Personnel wearing cotton or conductive smocks? Yes _____ No _____

c. (F) Personnel properly grounded? Yes _____ No _____

d. (F) Personnel discharged before handling parts? Yes _____ No _____

e. (F) ESD generating equipment at work station
(e.g., paper, plastic, tape, etc.)? Yes _____ No _____

f. (F) Storage boxes of the proper material? Yes _____ No _____

g. (F) Grounding straps checked daily and logged? Yes _____ No _____

Explain. _____

9.9 (F) Are reviewed materials isolated and withheld for use until inspection tests are completed or receipt of reports, certification, etc.?

Yes _____ No _____

Explain. _____

9.10 (F) Are inspection history records being maintained? Yes _____ No _____

Explain. _____

9.11 (F) Are items segregated properly (items ready for stock versus rejected items)?

Yes _____ No _____

Explain. _____

9.12 (F) Are accepted and rejected items clearly identified as such? Yes _____ No _____

Explain. _____

9.13 (F) Are limited-life items properly identified as such, and is the correct limitation and shelf life specified?

Explain. _____

9.14 (F) Are items labeled with the correct shelf life? Yes _____ No _____

Explain. _____

9.15 (F) Are waivers of inspection tests or procurement drawings/specifications (or changes to these requirements) approved by the customer? Yes _____ No _____

Explain. _____

9.16 (F) Are inspection test requirements under document control? Yes _____ No _____

Explain. _____

10.0 STORAGE (INVENTORY CONTROL AND TRACEABILITY)

10.1 (O) Are items removed from stock on a first-in first-out basis? Yes _____ No _____

Explain. _____

10.2 (F) Are limited-life items controlled?

Yes _____ No _____

Explain. _____

10.3 (F) Is a log maintained on inventory?

Yes _____ No _____

Explain. _____

10.4 (F) Is stock operating to in-house procedure?

Yes _____ No _____

Explain. _____

10.5 (F) Are all items returned to stock reinspected?

Yes _____ No _____

Explain. _____

10.6 (F) Are items that require special storage properly handled?

Yes _____ No _____

Explain. _____

10.7 (F) Do the stored items show signs of being inspected?

Yes _____ No _____

Explain. _____

10.8 (F) Are the items identified so they are traceable to a specific purchase order and/or test report?

Yes _____ No _____

Explain. _____

10.9 (F) Is there an item recertification program in effect?

Yes _____ No _____

Explain. _____

10.10 (F) Is the storage area restricted to authorized personnel only? Yes _____ No _____

Explain. _____

10.11 (F) Is there any evidence of rejected or nonconforming items in stock?

Yes _____ No _____

Explain. _____

10.12 (F) Are all items issued by signed requisition?

Yes _____ No _____

Explain. _____

11.0 NONCONFORMING MATERIALS

11.1 (F) Does the vendor have a documentation system for identification, segregation, and control of nonconforming items?

Yes _____ No _____

Explain. _____

11.2 (F) Does the nonconforming controls provide a positive closed-loop system to establish that analysis and corrective action has been implemented and/or completed? Yes _____ No _____

Explain. _____

11.3 (F) Are records of nonconformance and corrective action on file and available for review?

Yes _____ No _____

Explain. _____

11.4 Does the vendor's initial review of nonconforming items determine one of the following?

a. (F) Return for completion of operation? Yes _____ No _____

b. (F) Scrap? Yes _____ No _____

c. (F) Return to the supplier? Yes _____ No _____

d. (F) Submit to MRB? Yes _____ No _____

e. (F) Prepare a waiver to customer? Yes _____ No _____

Explain. _____

12.0 PACKAGING/SHIPPING

12.1 (F) Does the vendor have a documented procedure for packing/shipping?

Yes _____ No _____

Explain. _____

12.2 (O) Are the procedures in place for the personnel to use? Yes _____ No _____

Explain. _____

12.3 (F) Is there evidence that all parts being shipped have passed all the inspection and test criteria?
Explain. _____

12.4 (F) Are the parts visually inspected prior to packaging? Yes _____ No _____
Explain. _____

12.5 (F) Is there a system in place to ensure that all proper documentation is submitted with the part(s) when shipped? Yes _____ No _____
Explain. _____

12.6 (F) Are ESD sensitive parts identified?

Yes _____ No _____

Explain. _____

12.7 (F) Is the packing material proper for ESD sensitive parts? Yes _____ No _____
Explain. _____

13.0 ENVIRONMENTAL CONTROLS

13.1 (F) Are the vendor's environmental parameters specified, controlled, and recorded for each critical process step? Yes _____ No _____

Explain. _____

13.2 (F) Are procedures and techniques defined for measuring the relative humidity, temperature, and particle count in accordance with Federal Standard 209, where applicable?

Yes _____ No _____

Explain. _____

13.3 (F) Are procedures defined for corrective action of out-of-tolerance environmental conditions?

Explain. _____

14.0 MANUFACTURING

14.1 Manufacturing Process Flowchart:

14.1.1 (O) Obtain a manufacturing process flowchart and attach it to the end of this checklist.

Comments.

14.1.2 (F) Does the manufacturing process flowchart correctly portray the manufacturing process flow?

Explain. _____

14.1.3 (F) Are procedure numbers referenced on the manufacturing process flowchart?

Yes _____ No _____

Explain. _____

14.2 Fabrication (see Enclosures C3, C4, C5, C6, C7, C8, C9, C10, and C11 for specific part types):

14.2.1 Explain the method for controlling fabrication processes (e.g., traveler, work requisitions, etc.).

14.2.2 (F) Examine facility for good housekeeping practices.

Comments.

14.2.3 (F) Does the vendor ensure that only conforming materials are used to fabricate the part?
Explain.

14.2.4 (F) Are procedures in place to ensure that parts are manufactured and inspected to the applicable drawing specifications? Yes _____ No _____

(F) Are the operators following them? Yes _____ No _____

Explain.

14.2.5 (F) Are the inspection criteria available and at the work station? Yes _____ No _____

Explain.

14.2.6 (F) Are inspection records available which include accept/reject criteria, inspection equipment, drawing numbers (revision), inspection levels, reason for rejection, part number, and part name?

Explain.

14.2.7 (F) Are reject items properly identified and segregated? Yes _____ No _____

Explain.

14.2.8 (F) Is a Material Review Board (MRB) disposition performed during this process?

Yes _____ No _____

Explain. _____

14.2.9 Are there special steps used in manufacturing and are they adequately controlled?

Yes _____ No _____

Explain. _____

14.3 Assembly:

14.3.1 Examine traveler to become more familiar with the process flow.

Comments. _____

14.3.2 (F) Does the traveler identify mandatory inspection points? Yes _____ No _____

Explain. _____

14.3.3 (F) Is the sequence of assembly defined on the traveler acceptable? Yes _____ No _____

Explain. _____

14.3.4 Are contamination and ESD controlled in this area?

N/A _____

- | | | | |
|----|--|-----------|----------|
| a. | (F) Work benches properly grounded? | Yes _____ | No _____ |
| b. | (F) Personnel wearing cotton or conductive smocks? | Yes _____ | No _____ |
| c. | (F) Personnel properly grounded? | Yes _____ | No _____ |
| d. | (F) Personnel discharged before handling parts? | Yes _____ | No _____ |
| e. | (F) ESD generating equipment at work station
(e.g., paper, plastic tape, etc.)? | Yes _____ | No _____ |
| f. | (F) Storage boxes of the proper material? | Yes _____ | No _____ |

g. (F) Grounding straps checked daily and logged?

Yes ____ No ____

Explain. _____

14.3.5 (F) Are all checks in place for inspection prior to the start of the next phase of operation?

Yes ____ No ____

Explain. _____

14.3.6 (F) Are necessary equipment properly calibrated and maintained? Yes ____ No ____

Explain. _____

14.3.7 (O) Is there a procedure for the operator checking out the equipment prior to use (including how often thereafter)?

Yes ____ No ____

Explain. _____

14.3.8 (F) Are rework procedures within the guidelines of the applicable military specification?

Yes ____ No ____

Explain. _____

15.0 PRODUCTION TEST AND EVALUATION**15.1 Test and verification:**

15.1.1 (F) Are the tests to be performed defined on the traveler? Yes ____ No ____

Explain. _____

15.1.2 (F) Do the tests being performed conform to the latest customer drawing/specification?

Yes _____ No _____

Explain. _____

15.1.3 (F) Is the equipment checked prior to usage by the operator to ensure proper operation to an applicable procedure?

Yes _____ No _____

Explain. _____

15.1.4 (F) Are the procedures for performing the test within the area of testing for the operator's use?

Explain. _____

15.1.5 (F) Is there a test procedure for each test to be performed? Yes _____ No _____

Explain. _____

15.1.6 (F) Are the inspection criteria defined?

Yes _____ No _____

Explain. _____

15.1.7 (F) Are the inspection and test records available for review? Yes _____ No _____

Explain. _____

15.1.8 (F) Are the rejected items segregated and identified?

Yes _____ No _____

Explain. _____

SSP 30312 Revision G

October 20, 1998

15.1.9 (O) Are acceptable items so designated? Yes _____ No _____
Explain. _____

15.1.10 (O) How are rework items handled? Yes _____ No _____
Explain. _____

15.1.11 (F) Are rework items re-routed through inspection? Yes _____ No _____
Explain. _____

15.2 Failure Analysis and MRB Disposition:

15.2.1 How is failure analysis used in fabrication, assembly, and testing?

5.2.2 (F) Are nonconforming items segregated and adequately secured in a locked limited access storage area?
Explain. _____

15.2.3 (F) Does an MRB exist? Yes _____ No _____
Explain. _____

15.2.4 (F) Are the members of the MRB officially defined? Yes _____ No _____
Explain. _____

15.2.5 (F) Is there a member of MRB from engineering and quality assurance? Yes ____ No ____

Explain. _____

15.2.6 (F) Are the discrepancies adequately detailed? Yes ____ No ____

Explain. _____

15.2.7 (O) Does the vendor have a form for failure reporting, MRB, etc., and is it in use?

Yes ____ No ____

Explain. _____

15.2.8 (F) Is adequate traceability in place to examine MRB dispositions against a given lot/date code?

Explain. _____

15.2.9 (F) Is scrap material properly disposed of? Yes ____ No ____

Explain. _____

15.2.10 Does the vendor's failure analysis procedures include the following:

a. (F) Identification of the failure or defective item? Yes ____ No ____

b. (F) Handling of the failed or defective items? Yes ____ No ____

c. (F) Analysis of the failure or defective item? Yes ____ No ____

d. (F) Dissemination of the analysis data (including notification to the customer and qualifying activity)? Yes ____ No ____

e. (F) Feedback and requirements for corrective action and evaluation (including the responsible person)? Yes ____ No ____

- f. (F) Provision for identifying unacceptably high return rates and/or critical lot/process related problems based on product failures/defects? Yes ____ No ____
- g. (F) Coordination with failure and defects analysis in identifying production problems trends? Yes ____ No ____
- h. (F) Reporting problem information to the responsible person(s) for appropriate corrective action? Yes ____ No ____

Explain. _____

15.3 Quality Control System:

15.3.1 (F) Are instructions and records for quality maintained and controlled?

Yes ____ No ____

Explain. _____

15.3.2 (F) Are the authority and responsibility of persons in charge of the various production testing and inspection clearly defined? Yes ____ No ____

Explain. _____

15.3.3 (F) Are the quality requirements described in a clear and completely documented instruction?

Explain. _____

15.4 Stamp Control

15.4.1 (F) Does the vendor maintain a documented stamp control system, including written procedures?

Explain. _____

SSP 30312 Revision G

October 20, 1998

15.4.2 (F) Are stamps assigned and traceable to a specific person responsible for its uses (only one person per stamp)? Yes _____ No _____

Explain. _____

15.4.3 (F) Are the fabrication and inspection stamps distinctly different? Yes_____ No_____

Explain. _____

ENCLOSURE 3 CAPACITOR CHECKLIST

Date _____

Manufacturer _____

Location Address _____

City _____ State _____ ZIP _____

CAGE CODE

Type of Capacitor _____

Military Specification _____

Dielectric Thickness _____

Size of the Capacitor _____

Length: _____

Width: _____

Height: _____

Lead Type: _____

Lead Termination: _____

Lead Finish: _____

Case: _____

Encapsulant: _____

Sleeving: _____

Marking Method: _____

TEST CAPABILITIES

Can the Vendor perform the following?

In process Inspection:

1. Nondestructive Internal Examination.

a.	Neutron radiograph	YES _____	NO _____
b.	Ultrasonic	YES _____	NO _____
c.	Other	YES _____	NO _____

Comments.

2. Pre-termination DPA YES NO

Comments.

3. Pre-encapsulation Terminal Strength YES ____ NO ____

Comments. _____

Group A:

1. Thermal Shock YES ____ NO ____

2. Voltage Conditioning YES ____ NO ____

3. Radiographic Inspection YES ____ NO ____

4. Electrical

a. DWV YES ____ NO ____

b. IR @ 25°C YES ____ NO ____

125°C YES ____ NO ____

c. Capacitance YES ____ NO ____

d. DF YES ____ NO ____

e. Impedance YES ____ NO ____

f. ESR YES ____ NO ____

g. DC leakage YES ____ NO ____

i. Surge current YES ____ NO ____

PDA YES ____ NO ____

Measure before YES ____ NO ____

Measure after YES ____ NO ____

5. Visual and Mechanical

a. Material YES ____ NO ____

b. Physical Dimensions YES ____ NO ____

c. Design YES ____ NO ____

d. Construction YES ____ NO ____

e. Marking YES ____ NO ____

f. Workmanship YES ____ NO ____

6. Burn-in YES ____ NO ____

In process. How many hours? _____

Group A. How many hours? _____

7. Seal test YES ____ NO ____

Fine method _____

Gross method _____

8. DPA YES ____ NO ____

Comments. _____

Group B:

- | | | | |
|----|-----------------------|----------|---------|
| 1. | Thermal Shock | YES ____ | NO ____ |
| 2. | Life Test | YES ____ | NO ____ |
| 3. | Humidity Steady State | YES ____ | NO ____ |
| 4. | Voltage Temp Limits | YES ____ | NO ____ |
| 5. | Moisture Resistance | YES ____ | NO ____ |
| 6. | Vibration (Qual) | YES ____ | NO ____ |

Comments. _____

Group C.

- | | | | |
|----|------------------------------|----------|---------|
| 1. | Terminal Strength | YES ____ | NO ____ |
| 2. | Solderability | YES ____ | NO ____ |
| 3. | Resistance to Soldering Heat | YES ____ | NO ____ |
| 4. | Solvent Resistance | YES ____ | NO ____ |

Comments. _____

TRACEABILITY AND MATERIAL CONTROL

Are the following retained ?

- | | | | |
|----|--------------|------------------------------------|------------------|
| 1. | Raw Material | | |
| | a. | Procurement Documents | YES ____ NO ____ |
| | b. | Physical / Chemical Property Data | YES ____ NO ____ |
| | c. | Evaluation / Characterization Data | YES ____ NO ____ |

Comments. _____

2. In-House Prepared Material

- | | | | |
|----|-------------------------------------|----------|---------|
| a. | Fabrication Process Control Data | YES ____ | NO ____ |
| b. | Physical and Chemical Property Data | YES ____ | NO ____ |
| c. | Evaluation / Characterization Data | YES ____ | NO ____ |

Comments. _____

3. Process Control Documents

- | | | | |
|----|--|----------|---------|
| a. | Lot Travelers | YES ____ | NO ____ |
| b. | Material Traceability | YES ____ | NO ____ |
| c. | In process Nondestructive Test Results | | |
| 1) | Acoustic Emission | YES ____ | NO ____ |
| 2) | NRI | YES ____ | NO ____ |
| 3) | X-Ray Film | YES ____ | NO ____ |

Comments. _____

In process and Finished Product Test Samples and Data.

- | | | | |
|----|--------------------|----------|---------|
| a. | In process | | |
| 1) | DPA Samples | YES ____ | NO ____ |
| 2) | Report | YES ____ | NO ____ |
| b. | Group A | | |
| 1) | DPA Samples | YES ____ | NO ____ |
| 2) | Electrical Samples | YES ____ | NO ____ |
| 3) | Test Data | YES ____ | NO ____ |
| c. | Group B | | |
| 1) | Test Samples | YES ____ | NO ____ |
| 2) | Test Data | YES ____ | NO ____ |
| d. | Group C | | |
| 1) | Test Samples | YES ____ | NO ____ |
| 2) | Test Data | YES ____ | NO ____ |

Comments. _____

ENCLOSURE 4 **CONNECTOR CHECKLIST**

Date _____

Manufacturer _____

Location Address _____

City _____ State _____ ZIP _____

Type of Connector:

1. The part design, manufacturing equipment, materials and processing shall be sufficiently documented to assure a reproducible high quality product, and that process and inspection records reflect the results actually achieved.

YES _____ NO _____ N/A _____

Explain: _____

2. The manufacturer's flow chart must be complete, current, accurate, and include both production and QA/QC inspection process flow for each lot.

YES _____ NO _____ N/A _____

Explain: _____

3. Incoming inspection procedures are used to control inspection, storage, handling, and traceability of:

Internal package materials
(wire, adhesives, coatings, etc.)

YES _____ NO _____ N/A _____

External packaging materials
(metals, plating, etc.)

YES _____ NO _____ N/A _____

Explain: _____

4. A lot traveler shall be used for each lot and include lot identification, type of operation, quantity, date of operation and operator identification by stamp or signature, which ever is appropriate, In addition, test

specifications and revisions, processes and revisions, time in and out of processes or tests deemed critical to end results, and disposition of any parts removed from the lot shall be note on the traveler.

YES____ NO____ N/A____

Explain: _____

5. The Qualification inspection in accordance with Table XI of MIL-C-38999H are as follows:

a. Group I (all classes and finishes)

Visual and mechanical examination YES____ NO____ N/A____

Nonmagnetic material (except finish D of series I and II)

YES____ NO____ N/A____

Maintenance aging (except hermetics) YES____ NO____ N/A____

Thermal shock (hermetics only) YES____ NO____ N/A____

Thermal shock (except hermetics) YES____ NO____ N/A____

Air leakage (hermetics only) YES____ NO____ N/A____

Coupling torque YES____ NO____ N/A____

Durability YES____ NO____ N/A____

¹/Altitude immersion (except hermetics) YES____ NO____ N/A____

Insulation resistance at ambient temp YES____ NO____ N/A____

Dielectric withstanding voltage at sea level YES____ NO____ N/A____

Insert retention YES____ NO____ N/A____

Salt spray (corrosion) YES____ NO____ N/A____

Classes and finishes: YES____ NO____ N/A____

Series I an II - Finishes A, D, F, and N YES____ NO____ N/A____

Series III and IV - Classes F and N YES____ NO____ N/A____

Coupling torque YES____ NO____ N/A____

Contact resistance (hermetics only) YES____ NO____ N/A____

Electrical engagement YES____ NO____ N/A____

External bending moment YES____ NO____ N/A____

Coupling pin strength (series I and II) YES____ NO____ N/A____

Visual and mechanical examination YES____ NO____ N/A____

Explain: _____

b.	Group 2 (all classes except hermetics)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Gage location	YES__	NO__	N/A__
	Gage retention	YES__	NO__	N/A__
	Maintenance aging (except hermetics)	YES__	NO__	N/A__
	Contact retention	YES__	NO__	N/A__
	Altitude-low temperature	YES__	NO__	N/A__
	Insulation resistance at ambient temp	YES__	NO__	N/A__
	Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
	Thermal shock (except hermetics)	YES__	NO__	N/A__
	Coupling torque	YES__	NO__	N/A__
	Insulation resistance at elevated temp	YES__	NO__	N/A__
	Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
	¹ /Dielectric withstanding voltage at alt	YES__	NO__	N/A__
	Durability	YES__	NO__	N/A__
	Accessory thread strength	YES__	NO__	N/A__
	¹ /Vibration	YES__	NO__	N/A__
	Shock	YES__	NO__	N/A__
	Shell to shell conductivity (except finish C and class C)			
		YES__	NO__	N/A__
	¹ /Temperature life (series III, classes C, F, K, and W)			
		YES__	NO__	N/A__
	Humidity	YES__	NO__	N/A__
	Insulation resistance at ambient temp	YES__	NO__	N/A__
	Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
	Contact retention	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
c.	Group 3 (hermetic receptacles)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Thermal shock (except hermetics)	YES__	NO__	N/A__
	Air leakage (except hermetics)	YES__	NO__	N/A__
	Insulation resistance at elevated temp	YES__	NO__	N/A__
	Durability	YES__	NO__	N/A__
	Coupling torque	YES__	NO__	N/A__

SSP 30312 Revision G

October 20, 1998

1/Vibration	YES__	NO__	N/A__
Shock	YES__	NO__	N/A__
Insulation resistance at ambient temp	YES__	NO__	N/A__
Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
Humidity	YES__	NO__	N/A__
Insulation resistance at ambient temp	YES__	NO__	N/A__
Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
Contact resistance	YES__	NO__	N/A__
Visual and mechanical examination	YES__	NO__	N/A__

Explain:

d.	Group 4 (shells with spring fingers)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Durability (series I, III, and IV)	YES__	NO__	N/A__
	Shell spring finger forces	YES__	NO__	N/A__
	Shell to shell conductivity (except finish C and class C)	YES__	NO__	N/A__
	EMI shielding (except finish C and class C)	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
e.	Group 5 (dielectric)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Ozone exposure	YES__	NO__	N/A__
	Insulation resistance at ambient temp	YES__	NO__	N/A__
	Dielectric with standing voltage at sea level	YES__	NO__	N/A__
	Fluid immersion Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
	Coupling torque	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
f.	Group 6 (retention system)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Retention system fluid immersion	YES__	NO__	N/A__
	Contact retention	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
g.	Group 7 (retention system)			
	Visual and mechanical examination	YES__	NO__	N/A__

	Pin contact stability	YES__	NO__	N/A__
	Contact walkout	YES__	NO__	N/A__
	1/Installing/removal tool abuse	YES__	NO__	N/A__
	Insert retention	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
h.	Group 8 (hermetic receptacles mated with crimp counter parts)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Contact resistance	YES__	NO__	N/A__
	Contact engagement and separating force	YES__	NO__	N/A__
	Resistance to probe damage	YES__	NO__	N/A__
	Contact engagement and separating force	YES__	NO__	N/A__
	Contact plating and separating force	YES__	NO__	N/A__
	Contact plating thickness (hermetic)	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
Comments. _____				

i.	Group 9 (series I, II- finishes B, C, and E (see note1) and series I, finish N) (series III and IV- classes C, F, K (see note 1), N, Y, and W)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Shock (high impact) (series I, III, and IV only)	YES__	NO__	N/A__
	Dielectric withstanding voltage at sea level	YES__	NO__	N/A__
	Electrolytic erosion (series III and IV)	YES__	NO__	N/A__
	Salt spray (dynamic test) (except classes F and N, and finish N)	YES__	NO__	N/A__
	Coupling torque	YES__	NO__	N/A__
	Coupling pin strength (series I and II)	YES__	NO__	N/A__
	Visual and mechanical examination	YES__	NO__	N/A__
j.	Group 10 (firewall - class K)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Firewall (class K connectors)	YES__	NO__	N/A__
k.	Group 11 (series I, III, and IV)			
	Visual and mechanical examination	YES__	NO__	N/A__
	Ice resistance	YES__	NO__	N/A__
	Dust (fine sand)	YES__	NO__	N/A__

SSP 30312 Revision G

October 20, 1998

Coupling torque	YES___	NO___	N/A___
Visual and mechanical examination	YES___	NO___	N/A___

Comments. _____

6. The qualification and quality conformance procedures in accordance with MIL-C-38999H are specified as follows:

a.	Group A Inspection ^{1/}	YES___	NO___	N/A___
	Visual inspection ^{2/}	YES___	NO___	N/A___
	Critical examination ^{2/ 3/}	YES___	NO___	N/A___
	Insulation resistance at ambient temperature ^{2/ 3/ 4/}	YES___	NO___	N/A___
	Dielectric withstanding voltage at sea level ^{2/ 3/} (except hermetics, style P)	YES___	NO___	N/A___
	Air leakage ^{2/ 3/}	YES___	NO___	N/A___
b.	Group B Inspection ^{1/}	YES___	NO___	N/A___
	Visual and mechanical examination ^{3/}	YES___	NO___	N/A___
	Contact engaging and separating forces ^{2/ 3/} (hermetic sockets only)	YES___	NO___	N/A___
	Contact resistance (hermetics only) AQL of 1.0 ^{5/}	YES___	NO___	N/A___
	Shell spring finger forces ^{3/ 6/} (plugs with spring fingers only)	YES___	NO___	N/A___
c.	Group C Inspection (periodic tests)			
	As specified in MIL-C-38999H, para 4.5.2.1	YES___	NO___	N/A___

Comments. _____

NOTES FOR QUESTION 6

1. Contacts shipped with connectors other than hermetics shall be from lots that have meet the requirements of MIL-C-39029.
2. 100 - percent inspection.
3. The contractor may use in process controls for this requirement.
4. Test between two adjacent contacts and between two peripheral contact and the shell.

5. Select sample connectors in accordance with the AQL shown. Test three contacts in each sample connector.

6. Test five pieces. No failures permitted.

7. Organic materials used in connector:

a.	Does the vendor use materials that pass the outgassing requirements of	ASTM-E-595 for the		
	following:			
	Finishes	YES__	NO__	N/A__
	Inserts	YES__	NO__	N/A__
	Interface Seals	YES__	NO__	N/A__
	Grommets	YES__	NO__	N/A__
	Gaskets	YES__	NO__	N/A__
	Lubricants	YES__	NO__	N/A__
	Sealants	YES__	NO__	N/A__

Comments. _____

1 Qualification only

SSP 30312 Revision G

October 20, 1998

ENCLOSURE 5
ENGINEERING SURVEY HYBRIDS

REVIEWER: _____ EMPLOYEE #: _____ DATE: _____

COMPANY: _____

ADDRESS: _____

CITY/STATE: _____

ZIP: _____

PHONE: () _____

FEDERAL NUMBER: _____

PRESIDENT: _____

EXT. _____

MANUFACTURING MANAGER: _____

EXT. _____

QA, QC MANAGER: _____

EXT. _____

ENGINEERING MANAGER: _____

EXT. _____

PROCESS ENGINEER: _____

EXT. _____

PRODUCTS MANUFACTURED AT THIS LOCATION:

1. _____

4. _____

2. _____

5. _____

3. _____

6. _____

DOCUMENTS RECEIVED:

1. Organization Chart

3. Quality Plan

2. Inspection document

4. Typical Production Traveler

FACILITIES: _____

SQ. FT. _____

ENVIRONMENTAL _____

CLASS _____

1. TOTAL _____

2. TOTAL Hybrid/IC Production _____

a. Substrate Fab _____ Lam Flow Y/N

b. Assembly _____ Lam Flow Y/N

c. Test/Inspection _____ Lam Flow Y/N

3. SURVEYED TO MIL-STD-1772

a. Approved Level S YES _____ NO _____ DATE _____

b. Approved Level B YES _____ NO _____ DATE _____

c. Certified To A/B YES _____ NO _____ DATE _____

EMPLOYEES:

- a. Engineering and Management _____
- b. Production _____
- c. Other, Misc. _____
- d. Total _____

I. SUBSTRATE FABRICATION

a. GENERAL PROCESSING CAPABILITIES

- Thickness Control DEKTAC - BETA Scope Crossection
Other _____
- Notching
- Cutting Laser/Diamond Saw
- Drilling Laser/Diamond Saw
- Plating Gold - Nickel - Copper
Through Hole - Wrap Arounds
- Maximum Substrate Size _____
- BeO Capability? Y/N
- Multilayer Capability: Thickfilm Y/N Thinfilm Y/N
- How Often Are Metal Systems Tested For:
 - 1) Solderability _____
 - 2) Adhesion _____
 - 3) Wire Bondability _____
- Resistor Stabilization: _____ hrs @ _____ C in _____ (gas)
- Typical TCR's _____ ppm/ C
- To What Power Dissipation Level Do You Design? _____ W/IN

b. THICKFILM - MANUFACTURED/PURCHASED (Supplier _____)

- Thickfilm Past Menu

1. Fritted Au	5. Ag	9. Cu	13. _____
2. Fritless Au	6. PdAg	10. Dielectric	14. _____
3. PdAu	7. PtAg	11. Resistors	15. _____
4. PtAu	8. PtPdAu	12. Solder	16. _____
- Paste Suppliers:
 - 1) _____
 - 2) _____
- Is There Traceability Maintained on Pastes? Y/N
- Are Pastes Blended In-House? Y/N
- Printers _____
- Maximum Furnace Belt Width _____ Inches
- Resistor Coating Capability: SiN - SiO - Polyimides

c. THINFILM - MANUFACTURED/PURCHASED (Supplier _____)

- Metal Menu:

1. Au	4. Ni	7. Ta NO	10. _____
2. NiCr	5. Ti	8. Ta O	11. _____
3. Cr	6. W	9. TaO	12. _____

- Is Traceability Maintained on Metals? Y/N

- Sputtering Equipment _____

- Evaporation Equipment _____

d. PHOTOLITHOGRAPHY AND RESISTOR TRIMMING

- Internal:

1) Dry Film Laminates

2) 2. Pattern Plating

3) 3. Etch Back

- Vendor - Supplied? Y/N Vendor _____

- Resistor Trimming

Active Passive Auto Manual

Laser

Abrasive

e. ARTWORK GENERATION

1) Cut And Peel

2) Laser

3) CAD

II. ASSEMBLY

a. COMPONENT ATTACH

- Eutectic: AuSi - AuGe - SN63 - SN96

- Expoxies Used: EPOTEK ABLESTICK DUPONT OTHER

1) Silver	H20E	36-2	5504
-----------	------	------	------

2) Silver	H31	85-1	
-----------	-----	------	--

3) Gold	58-1		
---------	------	--	--

4) Non-Conductive	H72	41-1	
-------------------	-----	------	--

5) Non-Conductive	293-X		
-------------------	-------	--	--

- Equipment:

1) Pick and Place _____

2) Eutectic Die Attach _____

- 3) Ovens _____
- Reflow Solder Capability? Y/N
- 1) Vapor Phase 3. Hot Stage
- 2) Horizontal Furnace 4. Hot Gas
- Is epoxy applied using a screen? Y/N
- b. SUBSTRATE ATTACH
- Eutectic: AuSi - AuGe - AuSn - Other
 - Epoxy: Preforms Y/N
 - Vendor _____
 - Material _____
 - Equipment:
 - 1) Horizontal Furnace, Gas Cover _____
 - 2) Hot Stage, Gas Cover _____
 - 3) Vapor Phase _____
 - Wirebonders QTY
 - Automatic - Hughes TSB2460 _____
 - K&S 1472
 - Other _____
- METHOD & QUANTITY
- | | |
|--------------|-------------------------|
| Manual - K&S | US ____ TC ____ TS ____ |
| Westbond | US ____ TC ____ TS ____ |
| Mechel | US ____ TC ____ TS ____ |
| Orthodyne | US ____ TC ____ TS ____ |
| Hughes | US ____ TC ____ TS ____ |
- Maximum Wire Size Capability _____
 - Minimum Wire Size Capability _____
 - Machine Certification Frequency _____
 - Operator Certification Frequency _____
- Welders
 - Parellel Gap - Hughes Unitek
 - Opposed Tip - Hughes Unitek
 - Bond Pullers
 - Unitek Micropull II W/Printout Y/N
 - Unitek Micropull III W/Printout Y/N
 - Dage Precima
 - Gram Gauge
 - Die Shear
 - Dage Precima
 - Other _____
- c. INSPECTION
- Under Laminar Flow Y/N

- Microscopes: Low Power _____ X To _____ X
High Power _____ X To _____ X
- Document: In-House _____ MIL-STD-883 Y/N
- Microscope: Camera - Polaroid - Wet Process - Polarizing Lens
- History Record Tag/Data Log Y/N

d. SEALING

Epoxy or

Moisture	Solder	Vacuum	
Equipment	Monitored	Material	Bake

- Parallel Seam
Soldering _____ Y/N _____ Y/N
- Parallel Seam
Welding _____ Y/N _____ Y/N
- TIG Welding _____ Y/N _____ Y/N
- Laser Welding _____ Y/N _____ Y/N
- Solder Sealing _____ Y/N _____ Y/N
- Glass Seal _____ Y/N _____ Y/N
- Epoxy Seal _____ Y/N _____ Y/N
- Horizontal
Furnace Reflow _____ Y/N
- Vacuum Bake Time and Temperature _____ Hrs @ _____ °C
- Nitrogen Bake Time and Temperature _____ Hrs @ _____ °C

III. ELECTRICAL TEST

Brand And Models

- Generators _____
- Oscillators _____
- Spectrum Analyzers _____
- Network Analyzers _____
- Oscilloscopes _____
- Sampling Scopes _____
- Attenuators _____
- Automatic Analyzers/
Test Equip. _____
- Polar Scopes _____
- _____
- _____
- _____
- What is the highest frequency you design to? _____
- What is the highest frequency to which you can test? _____

IV. ENVIRONMENTAL SCREENING

SSP 30312 Revision G

October 20, 1998

	In-House Equipment	Process	Outside Supplier
• Stab Bake	_____	_____	_____
• Temp Cycle	_____	_____	_____
• Acceleration	_____	_____	_____
• PIND	_____	_____	_____
• Burn-In	_____	_____	_____
• Leak, Fine	_____	_____	_____
• Leak, Gross	_____	_____	_____
• Vibration	_____	_____	_____
• Mechanical Shock	_____	_____	_____
• Temp Shock	_____	_____	_____
• Salt Spray	_____	_____	_____
• Moisture Resistance	_____	_____	_____
• Thermal Vac	_____	_____	_____
• _____	_____	_____	_____
• _____	_____	_____	_____
• _____	_____	_____	_____

V. FAILURE ANALYSIS

	In-House Equipment	Outside Supplier
• SEM	_____	_____
• X-Ray	_____	_____
• Crossection	_____	_____
• Shear Testing	_____	_____
• Metallurgical Microscopes	_____	_____
• Dark Field Microscopes	_____	_____
• Polarized Microscopes	_____	_____
• Comparator	_____	_____
• Auger	_____	_____
• Microprobe	_____	_____

VI. OTHER CAPABILITIES

• Delidding	Y/N
• Wafer Probe	Y/N
• Wafer Scribe	Y/N

- N2 Part Storage Y/N
- Element Screening Y/N

VII. PARTS PROCUREMENT

- Bonded Stores Y/N
- Vendor Surveys Y/N
- Package/Lead plating inspected properly Y/N

VIII. PARTS HANDLING/CONTROLS

- Tweezers Y/N
- Finger Cots Y/N
- Face Masks Y/N
- Spit Shields on Scopes Y/N
- Vacuum Pickups Y/N

IX. TRAINING

- | | | | |
|---------------------|-----|----------|-----|
| • Formal | Y/N | Informal | Y/N |
| Recall | | Y/N | |
| Documented | Y/N | | |
| Operators Certified | | Y/N | |
| Class Room | Y/N | | |
| On Line | | Y/N | |

ENCLOSURE 6
MICROCIRCUIT CHECKLIST

Date: _____

Surveyor: _____

Manufacturer: _____

1. Incoming inspection procedures are used to control inspection, storage, handling, and traceability of:

Internal package materials (wire, preforms, metals, etc.)

YES _____
NO _____
N/A _____

External package materials (metals, plating, etc.) YES _____

NO _____
N/A _____

2. The manufacturer's wafer fabrication flow chart must be complete, current, accurate, and contain the type of information shown in Figure 1 of MIL-STD-976A

YES _____
NO _____
N/A _____

3. A lot traveler shall be used for each wafer lot and shall include lot identification, type of operation quantity, date of operation, and operator identification by stamp or signature. In addition, test specifications and revisions, processes and revisions, time in and out of processes or tests deemed critical to end results, identification of equipment utilized, and identification and disposition of any parts removed from the lot be noted on the traveler. Records shall be maintained as such.

YES _____
NO _____
N/A _____

4. Each wafer lot acceptance in accordance with Method 5007 of MIL-STD-883 shall be recorded and records maintained as such.

YES _____
NO _____
N/A _____

Wafer thickness (MIL-STD-977, Method 1580)

Metallization thickness (MIL-STD-977, Method 5500)

Thermal stability (MIL-STD-977, Method 2500)

Scanning Electron Microscope (SEM) (MIL-STD-883, Method 2018)

Glassivation thickness (MIL-STD-977, Method 5500)

Gold backing thickness (MIL-STD-977, Method 5500)

YES _____
NO _____
N/A _____

YES _____
NO _____
N/A _____

YES _____
NO _____
N/A _____

YES _____
NO _____
N/A _____

YES _____
NO _____
N/A _____

YES _____
NO _____
N/A _____

SSP 30312 Revision G

October 20, 1998

5. The manufacturer's production flow chart must be complete, current, accurate, and include both production and Quality inspection for each lot.
YES _____ NO _____ N/A _____
6. A lot traveler must be used for each production lot and include lot identification, operations, quantity, date of operation, wafer traceability, operator identification by stamp or signature. In addition, identification and disposition of any parts removed from the lot. Records shall be maintained as such. YES _____
NO _____ N/A _____
7. Production process procedures that contain the process steps, revisions, and control limits shall be available for use. YES _____ NO _____ N/A _____
8. Manufacturing bond pull equipment shall be verified for proper calibration with adequate calibration recall. Results shall be recorded and records maintained as such.
9. Provisions shall be made to allow government mandatory inspection points including as a minimum:
YES _____ NO _____ N/A _____
- | | | | | |
|----|-----------------------------------|-----------|----------|-----------|
| a. | Wafer lot acceptance | YES _____ | NO _____ | N/A _____ |
| b. | Precap internal visual inspection | YES _____ | NO _____ | N/A _____ |
| c. | In-process die shear | YES _____ | NO _____ | N/A _____ |
| d. | In-process bond strength | YES _____ | NO _____ | N/A _____ |
| e. | Burn-in continuity checkout | YES _____ | NO _____ | N/A _____ |
| f. | Radiation tests | YES _____ | NO _____ | N/A _____ |
| g. | Final buy-off | YES _____ | NO _____ | N/A _____ |
10. Does manufacturer use or plan to use positive particle protection?
YES _____ NO _____ N/A _____
- If so, what type? _____
- _____
- _____
11. The manufacturer's flow chart for testing (Groups A, B, C and D per MIL-STD-883, Method 5005) and screening (MIL-STD-883 Method 5004) shall be recorded and records maintained as such.

-
-
-
12. The screening procedures are to be performed in accordance with MIL-M-38510, Appendix A and MIL-STD-883, Method 5004 as follows:
- | | | | | |
|----|--|--------|-------|--------|
| a. | Wafer Lot acceptance on each lot (5007) | YES___ | NO___ | N/A___ |
| b. | Nondestructive wire pull (2023) | YES___ | NO___ | N/A___ |
| c. | Internal visual (2010) | YES___ | NO___ | N/A___ |
| d. | Stabilization bake (1008, Cond C) | YES___ | NO___ | N/A___ |
| e. | Temperature cycling (1010, Cond C) | YES___ | NO___ | N/A___ |
| f. | Constant acceleration (2001, Cond E) | YES___ | NO___ | N/A___ |
| g. | Visual Inspection | YES___ | NO___ | N/A___ |
| h. | Particle impact noise detection (PIND) (2020) | YES___ | NO___ | N/A___ |
| i. | Serialization | YES___ | NO___ | N/A___ |
| j. | Pre-burn-in electrical test | YES___ | NO___ | N/A___ |
| k. | Burn-in (240 hrs), 125° C minimum | YES___ | NO___ | N/A___ |
| l. | Interim electrical test (post burn-in) (MOS only) | YES___ | NO___ | N/A___ |
| m. | Reverse bias burn-in (MOS only) | YES___ | NO___ | N/A___ |
| n. | Interim electrical test (post burn-in) | YES___ | NO___ | N/A___ |
| o. | Percent defective allowable (PDA) calculation | YES___ | NO___ | N/A___ |
| p. | Final electrical test | | | |
| | 1) Static (25° C) | YES___ | NO___ | N/A___ |
| | 2) Static (min and max rated temperature) | YES___ | NO___ | N/A___ |
| | 3) Dynamic or functional (25° C) | YES___ | NO___ | N/A___ |
| | 4) Dynamic or functional (min and max rated temperature) | YES___ | NO___ | N/A___ |
| | 5) Switching tests (25° C) | YES___ | NO___ | N/A___ |
| q. | Hermetic seal (1014) | | | |
| | 1) Fine | YES___ | NO___ | N/A___ |
| | 2) Gross | YES___ | NO___ | N/A___ |
| r. | Radiographic (2012) | YES___ | NO___ | N/A___ |
| s. | External visual (2009) | YES___ | NO___ | N/A___ |

13. The qualification and quality conformance procedures are to be performed in accordance with MIL-M-38510, Appendix A and MIL-STD-883, Method 5005 are as follows:

a. Group A Electrical Tests		
Subgroup 1	Static 25° C	YES___NO___N/A___
Subgroup 2	Static - maximum temperature	YES___NO___N/A___
Subgroup 3	Static - minimum temperature	YES___NO___N/A___
Subgroup 4	Dynamic 25° C	YES___NO___N/A___
Subgroup 5	Dynamic (max. rated temperature)	YES___NO___N/A___
Subgroup 6	Dynamic (min. rated temperature)	YES___NO___N/A___
Subgroup 7	Functional 25° C	YES___NO___N/A___
Subgroup 8A	Functional (max. rated temperature)	YES___NO___N/A___
Subgroup 8B	Functional (min. rated temperature)	YES___NO___N/A___
Subgroup 9	Switching 25° C	YES___NO___N/A___
Subgroup 10	Switching (max. rated temperature)	YES___NO___N/A___
Subgroup 11	Switching (min. rated temperature)	YES___NO___N/A___
b. Group B Inspection- S Level		
Subgroup 1	a. Physical dimensions (2016)	YES___NO___N/A___
	b. Internal water vapor (1018)	YES___NO___N/A___
Subgroup 2	a. Resistance to solvents(1022)	YES___NO___N/A___
	b. Internal visual (2013)	YES___NO___N/A___
	c. Internal mechanical (2014)	YES___NO___N/A___
	d. Bond strength (2011)	YES___NO___N/A___
	e. Die shear	YES___NO___N/A___
Subgroup 3	Solderability (2003)	YES___NO___N/A___
Subgroup 4	a. Lead integrity (2004)	YES___NO___N/A___
	b. Seal (1014)	1. Fine YES___NO___N/A___
		2. Gross YES___NO___N/A___
	c. Lid torque (2024)	YES___NO___N/A___
Subgroup 5	a. End point electricals (per detail specification)	YES___NO___N/A___
	b. Steady state life (1005)	YES___NO___N/A___
	c. End point electricals (per detail specification)	YES___NO___N/A___
		YES___NO___N/A___
Subgroup 6	a. End point electricals (per detail specification)	YES___NO___N/A___
	b. Temperature cycling (1010)	YES___NO___N/A___
	c. Constant acceleration (2001)	YES___NO___N/A___

	d. Seal (1014)	1. Fine	YES___NO___N/A___
		2. Gross	YES___NO___N/A___
	e. End point electricals		YES___NO___N/A___
Subgroup 7	a. Electrical parameter (Group A)		YES___NO___N/A___
	b. Electrostatic sensitivity (3015)		YES___NO___N/A___
	c. Electrical parameters (Group A)		YES___NO___N/A___
c.	Group D Inspection		
Subgroup 1	Physical dimensions (2016)		YES___NO___N/A___
Subgroup 2	a. Lead integrity (2004)		YES___NO___N/A___
	b. Seal (1014)	1. Fine	YES___NO___N/A___
		2. Gross	YES___NO___N/A___
Subgroup 3	a. Thermal shock (1011)		YES___NO___N/A___
	b. Temperature cycling (1010)		YES___NO___N/A___
	c. Moisture resistance (1004)		YES___NO___N/A___
	d. Seal (1014)	1. Fine	YES___NO___N/A___
		2. Gross	YES___NO___N/A___
	e. Visual examination	YES___NO___N/A___	
	(per visual criteria 1004/1010)		
	f. End point electricals		YES___NO___N/A___
	(per detail specification)		
Subgroup 4	a. Mechanical shock (2002, Cond B)		YES___NO___N/A___
	b. Vibration, variable frequency		YES___NO___N/A___
	(2007, Condition A)		
	c. Constant acceleration		YES___NO___N/A___
	(2001, Condition E, Y1 only)		
	d. Seal (1014)	1. Fine	YES___NO___N/A___
		2. Gross	YES___NO___N/A___
	e. Visual examination (1010)		YES___NO___N/A___
	f. End point electricals		YES___NO___N/A___
	(per detail specification)		
Subgroup 5	a. Salt atmosphere		YES___NO___N/A___
	(1009, Condition A)		
	b. Seal (1014)	1. Fine	YES___NO___N/A___
		2. Gross	YES___NO___N/A___
	c. Visual examination (1009)		YES___NO___N/A___
Subgroup 6	Internal water vapor	YES___NO___N/A___	
	(1018), 5000 ppm at 100° C)		
Subgroup 7	Lead finish adhesion (2025)		YES___NO___N/A___
Subgroup 8	Lid torque (2024)		YES___NO___N/A___

- d. Group E Inspection (radiation hardness)
- Subgroup 1 (Neutron Irradiation)
- a. Qualification (1017) YES___NO___N/A___
- b. QCI YES___NO___N/A___
- Subgroup 2 (Steady State Total Dose)
- a. Qualification (1019) YES___NO___N/A___
- b. QCI YES___NO___N/A___
-
-
-
-
-

ENCLOSURE 7 RELAY CHECKLIST

This checklist is to be used in accordance of test procedures in MIL-R-6106J.

- | | |
|--|-------------------|
| 1. Examination of product. (pp 4.7.1) | Yes___No___N/A___ |
| 2. Pickup Voltage (pp 4.7.2, 4.7.2.1) | Yes___No___N/A___ |
| 3. Dropout Voltage (pp 4.7.2.3) | Yes___No___N/A___ |
| 4. Hold Voltage (pp 4.7.3) | Yes___No___N/A___ |
| 5. Contact Bounce, Operating and Release Time (pp 4.7.4) | Yes___No___N/A___ |
| 6. Insulation Resistance (pp 4.7.5) | Yes___No___N/A___ |
| 7. Dielectric Withstanding Voltage (pp 4.7.6) | Yes___No___N/A___ |
| 8. Contact Voltage Drop or Resistance (pp 4.7.7) | Yes___No___N/A___ |
| 9. High Temperature Pickup Voltage (pp 4.7.2.2) | Yes___No___N/A___ |
| 10. DC Coil Resistance (pp 4.7.8) | Yes___No___N/A___ |
| 11. Maximum Coil Current (pp 4.7.9) | Yes___No___N/A___ |
| 12. Electromagnetic Interference (pp 4.7.10) | Yes___No___N/A___ |
| 13. Strength of Terminals and Mounting Studs (pp 4.7.11) | Yes___No___N/A___ |
| 14. Thermal Shock (pp 4.7.12) | Yes___No___N/A___ |
| 15. Low Temperature Operation (pp 4.7.13) | Yes___No___N/A___ |
| 16. Sand and Dust (pp 4.7.14) | Yes___No___N/A___ |
| 17. Continuous Current (pp 4.7.15) | Yes___No___N/A___ |
| 18. Shock (pp 4.7.16) | Yes___No___N/A___ |
| 19. Vibration (pp 4.7.17) | Yes___No___N/A___ |
| 20. Acoustical Noise (pp 4.7.18) | Yes___No___N/A___ |
| 21. Salt Spray (pp 4.7.19) | Yes___No___N/A___ |
| 22. Mechanical Life (pp4.7.20) | Yes___No___N/A___ |
| 23. Altitude-temperature humidity (pp 4.7.21) | Yes___No___N/A___ |
| 24. Humidity (pp 4.7.22) | Yes___No___N/A___ |
| 25. Ozone (pp 4.7.23) | Yes___No___N/A___ |
| 26. Acceleration (pp 4.7.24) | Yes___No___N/A___ |
| 27. Explosion Proof (pp 4.7.25) | Yes___No___N/A___ |
| 28. Overload DC (pp 4.7.26.1) | Yes___No___N/A___ |

SSP 30312 Revision G**October 20, 1998**

- | | |
|--|-------------------|
| 29. Overload AC (pp 4.7.26.1) | Yes___No___N/A___ |
| 30. Rupture (pp 4.7.26.2) | Yes___No___N/A___ |
| 31. Circuit Breaker Compatibility (pp 4.7.26.3) | Yes___No___N/A___ |
| 32. Inductive Load, DC (pp 4.7.26.4.1) | Yes___No___N/A___ |
| 33. Motor Load (pp 4.7.26.4.2) | Yes___No___N/A___ |
| 34. Resistive Load, DC (pp 4.7.26.4.3) | Yes___No___N/A___ |
| 35. Lamp Load (pp 4.7.26.4.4) | Yes___No___N/A___ |
| 36. Inductive Load, AC (pp 4.7.26.4.5) | Yes___No___N/A___ |
| 37. Resistive Load, AC (pp 4.7.26.4.7) | Yes___No___N/A___ |
| 38. Motor Load, AC (pp 4.7.26.4.6) | Yes___No___N/A___ |
| 39. Load transfer, Single or Polyphase (pp 4.7.26.5) | Yes___No___N/A___ |
| 40. Intermediate Current (pp 4.7.26.6) | Yes___No___N/A___ |
| 41. Low Level (pp 4.7.26.7) | Yes___No___N/A___ |
| 42. Mixed Loads (pp 4.7.28.8) | Yes___No___N/A___ |
| 43. High/Low Load Transfer (pp 4.7.26.9) | Yes___No___N/A___ |
| 44. Vibration Scan (pp 4.7.27) | Yes___No___N/A___ |
| 45. Seal (pp 4.7.28) | Yes___No___N/A___ |
| 46. Mechanical Interlock (pp 4.7.29) | Yes___No___N/A___ |
| 47. Resistance to Solvents (pp 4.7.31) | Yes___No___N/A___ |
| 48. Insertion and Withdrawal Force (pp 4.7.33) | Yes___No___N/A___ |

ENCLOSURE 8
SEMICONDUCTOR CHECKLIST

Date: _____

Surveyor: _____

Manufacturer: _____

1. Incoming inspection procedures are used to control inspection, storage, handling, and traceability of:

Internal package materials (wire, preforms, metals, etc.) YES___NO___N/A___

External package materials (metals, plating, etc.) YES___NO___N/A___

2. The manufacturer's wafer fabrication flow chart must be complete, current, accurate, and provide the actual process flow. YES___NO___N/A___

3. A lot traveler shall be used for each wafer lot and shall include lot identification, type of operation quantity, date of operation, and operator identification by stamp or signature. In addition, test specifications and revisions, processes and revisions, time in and out of processes or tests deemed critical to end results, identification of equipment utilized, and identification and disposition of any parts removed from the lot be noted on the traveler. Records shall be maintained as such. YES___NO___N/A___

4. Each wafer lot acceptance in accordance with Method 5001 of MIL-STD-750 shall be recorded and records maintained as such. YES___NO___N/A___

Wafer thickness (MIL-STD-977, Method 1580) YES___NO___N/A___

Metallization thickness (MIL-STD-977, Method 5500) YES___NO___N/A___

Scanning Electron Microscope (SEM) (MIL-STD-750, Method 2077) YES___NO___N/A___

Glassivation thickness (MIL-STD-977, Method 5500) YES___NO___N/A___

Gold backing thickness (MIL-STD-977, Method 5500) YES___NO___N/A___

-
-
-
5. The manufacturer's production flow chart must be complete, current, accurate, and include both production and Quality inspection for each lot. YES___NO___N/A___
6. A lot traveler must be used for each production lot and include lot identification, operations, quantity, date of operation, wafer traceability, operator identification by stamp or signature. In addition, identification and disposition of any parts removed from the lot. Records shall be maintained as such. YES___NO___N/A___
-
-
-
7. Production process procedures that contain the process steps, revisions, and control limits shall be available for use. YES___NO___N/A___
-
-
-
8. Manufacturing bond pull equipment shall be verified for proper calibration with adequate calibration recall. Results shall be recorded and records maintained as such. YES___NO___N/A___
-
-
-
9. Provisions shall be made to allow government mandatory inspection points including as a minimum:
YES___NO___N/A___
- a. Wafer lot acceptance
 - b. Precap internal visual inspection
 - c. In-process die shear
 - d. In-process bond strength

- e. Burn-in continuity checkout
- f. Radiation tests
- g. Final buy-off

10. The manufacturer's flow chart for testing (Groups A, B, C and D of MIL-S-19500) and screening (Table II of MIL-S-19500) shall be recorded and records maintained as such.

YES___NO___N/A___

11. The screening procedures in accordance with Table II of MIL-S-19500 and test methods of MIL-STD-750 are as follows:

- a. High temp life Lot Tolerance Percent Defective (LTPD) (Stabilization Bake)
 - YES___NO___N/A___
 - *Does the manufacturer have capability of 200° C? YES___NO___
- b. Thermal shock (Temperature Cycling)
 - YES___NO___N/A___
 - *Does the manufacturer have capability of 200° C? YES___NO___
- c. Constant acceleration
 - YES___NO___N/A___
- d. Particle impact noise detection (PIND)
 - YES___NO___N/A___
- e. Instability shock test
 - YES___NO___N/A___
- f. Hermetic seal
 - 1. Fine YES___NO___N/A___
 - 2. Gross YES___NO___N/A___
- g. Serialization
 - YES___NO___N/A___
- h. Interim electrical test
 - YES___NO___N/A___
- i. High Temperature Reverse Bias (HTRB) (48 hrs), 150°C minimum
 - YES___NO___N/A___
- j. Interim electrical test and delta parameters
 - YES___NO___N/A___
- k. Power burn-in
 - YES___NO___N/A___
- l. Final electrical test (for deltas and PDA)
 - YES___NO___N/A___
- m. Hermetic seal
 - 1. Fine YES___NO___N/A___
 - 2. Gross YES___NO___N/A___

- | | | |
|----|-----------------|-------------------|
| n. | Radiographic | YES___NO___N/A___ |
| o. | External visual | YES___NO___N/A___ |
-
-
-

12. The qualification and quality conformance procedures in accordance with MIL-S-19500 Groups A, B, C, and D for the product assurance level in accordance with the test methods of MIL-STD-750 are specified as follows:

- | | | |
|----|---|-------------------|
| a. | Group A Inspection | |
| | Subgroup 1 Visuals and mechanical MIL-STD-750, Method 2071 | YES___NO___N/A___ |
| | Subgroup 2 DC (static) test 25° C | YES___NO___N/A___ |
| | Subgroup 3 DC (static) tests at max and min operating temperature | YES___NO___N/A___ |
| | Subgroup 4 25° C dynamic | YES___NO___N/A___ |
| | Subgroup 5 Safe operating area (power transistors only) | YES___NO___N/A___ |
| | Subgroup 6 Surge current (diodes and rectifiers only) | YES___NO___N/A___ |
| | Subgroup 7 Select dynamic tests | YES___NO___N/A___ |
| b. | Group B Inspection- JANS Devices | |
| | Subgroup 1 Physical Dimensions (2066) | YES___NO___N/A___ |
| | Subgroup 2 a. Solderability (2026) | YES___NO___N/A___ |
| | b. Resistance to solvents(1022) | YES___NO___N/A___ |
| | Subgroup 3 a. Thermal shock (1051) | YES___NO___N/A___ |
| | b. Hermetic Seal (1071) | |
| | 1. Fine | YES___NO___N/A___ |
| | 2. Gross | YES___NO___N/A___ |
| | c. Electrical measurements (as specified) | YES___NO___N/A___ |
| | d. Decap internal visual (2075) | YES___NO___N/A___ |
| | e. SEM (when specified) (2077) | YES___NO___N/A___ |
| | f. Bond strength (2037) (wire and clip bonded devices only) | YES___NO___N/A___ |
| | g. Die shear (2017) (excluding axial lead devices) | YES___NO___N/A___ |
| | Subgroup 4 a. Intermittent operation life (1037) | YES___NO___N/A___ |
| | b. Electrical measurements (per detail specification) | |

		YES__NO__N/A__
Subgroup 5	a. Accelerated steady state operation life (1027)	YES__NO__N/A__
	b. Electrical measurements	YES__NO__N/A__
	c. Bond Strength (2037) (Al-Au die interconnects only)	YES__NO__N/A__
Subgroup 6	Thermal resistance (3131)	YES__NO__N/A__
c.	Group C Inspection (All quality levels)	
Subgroup 1	Physical dimensions (2066)	YES__NO__N/A__
Subgroup 2	a. Thermal shock (1056)	YES__NO__N/A__
	b. Terminal strength (2036)	YES__NO__N/A__
	c. Hermetic seal (1071)	YES__NO__N/A__
	d. Moisture resistance (1021)	YES__NO__N/A__
	e. External visual exam (2071)	YES__NO__N/A__
	f. Electrical measurements (per detail specification)	YES__NO__N/A__
Subgroup 3	a. Shock (2016)	YES__NO__N/A__
	b. Vibration, variable freq (2056)	YES__NO__N/A__
	c. Constant acceleration (2006)	YES__NO__N/A__
	d. Electrical measurements (per detail specification)	YES__NO__N/A__
Subgroup 4	Salt atmosphere (1041)	YES__NO__N/A__
Subgroup 5	Barometric pressure (1001)	YES__NO__N/A__
Subgroup 6	a. Steady state operation life	YES__NO__N/A__
	b. Intermittent operation life	YES__NO__N/A__
	c. Blocking life	YES__NO__N/A__
	d. Electrical measurements (per detail specification)	YES__NO__N/A__
d.	Group D Inspection	
Subgroup 1	a. Neutron irradiation (1017)	YES__NO__N/A__
	b. End point electrical parameters (per detail specification)	

SSP 30312 Revision G

October 20, 1998

		YES__NO__N/A__
Subgroup 2	a. Steady state dose (1019)	YES__NO__N/A__
	b. End point electrical parameters (per detail specification)	
		YES__NO__N/A__

ENCLOSURE 9
MAGNETICS CHECKLIST

Manufacturer _____

Location Address _____

City _____ State _____ ZIP _____

Type of magnetics _____

Military Specification (MIL-STD-981)

MIL-T-27 _____

MIL-F-15305 _____

MIL-T-21038 _____

MIL-C-83446 _____

1. Wire:

Is the wire in accordance with J-W-1177? YES___ NO___

Is the wire less than two years old? YES___ NO___

If the wire is older than two years has it been evaluated? YES___ NO___

Is there a procedure to perform evaluation? YES___ NO___

Is each spool of wire prior to use subjected to the following tests?

Dielectric test? YES___ NO___

Visual and dimensional examination? YES___ NO___

Bare wire size checked by DC resistance? YES___ NO___

Is the wire stored in a protective dust free container? YES___ NO___

Comments. _____

2. Insulation:

Is the layer insulation prior to use subjected to the following tests?

Dielectric test? YES___ NO___

Tensile strength? YES___ NO___

Volume resistivity YES___ NO___

Flexibility YES___ NO___

Comments. _____

3. Solder and Flux:

Is the solder in accordance with QQ-S-571

YES___ NO___

Solder type SN10___ SN60___ SN62___ SN63___

Is the flux in accordance with MIL-F-14256

YES___ NO___

Flux Type R___ RA___ RMA___

Does the soldering conform to NHB 5300.4(3A)?

YES___ NO___

Comments. _____

4. Coil winding:

Bobbin

Is there a procedure?

YES___ NO___

How is the tension of the wire being held uniform for wire AWG 18 or smaller?

Is the wire tension checked prior to use

YES___ NO___

Is there a log?

YES___ NO___

Toroidal

Is there a procedure?

YES___ NO___

How is the tension of the wire being held uniform for wire AWG 18 or smaller?

SSP 30312 Revision G

October 20, 1998

Is the wire tension checked prior to use YES____ NO____

Are the shuttles and sliders inspected prior to use? YES____ NO____

Is the tape changed on the shuttle prior to each use? YES____ NO____

Is there a log? YES____ NO____

Comments. _____

Are lint free gloves used in assemble? YES____ NO____

Is the impregnation and potting equipment adequate? YES____ NO____

Are the impregnation and potting procedures adequate? YES____ NO____

Is the impregnation and potting area free of extraneous material and debris?

YES____ NO____

Comments. _____

ENCLOSURE 10

MISCELLANEOUS CHECKLIST

Manufacturer _____

Location Address _____

City _____ State _____ ZIP _____

CAGE CODE _____

Part Type _____

Military Specification _____

Construction Description _____

Lead Type _____

Lead Termination _____

Lead Finish _____

Case _____

Encapsulant _____

Marking Method _____

TEST CAPABILITIES

Can the Vendor perform the following?

In process Inspection:

1. Nondestructive Internal Examination.

a.	Visual 30X	YES _____	NO _____
b.	X-Ray	YES _____	NO _____
c.	Other	YES _____	NO _____

Comments. _____

2. DPA YES _____ NO _____

Comments. _____

SSP 30312 Revision G**October 20, 1998**

3. Terminal Strength YES_____ NO _____

Comments.

4. PIND YES____ NO____

Comments. _____

Group A:

1. Thermal Shock YES____ NO____

2. Electrical

a. Dielectric Withstanding Voltage (DWV) YES____ NO____

b. DWV Barometric Pressure YES____ NO____

c. Insulation Resistance 25°C YES____ NO____

125°C YES____ NO____

d. Burn-in YES____ NO____

e. Other YES____ NO____

3) _____ YES____ NO____

4) _____ YES____ NO____

5) _____ YES____ NO____

6) _____ YES____ NO____

3. Visual and Mechanical

a. Material YES____ NO____

b. Physical Dimensions YES____ NO____

c. Design YES____ NO____

d. Construction YES____ NO____

e. Seal: Gross Leak YES____ NO____

Fine Leak YES____ NO____

f. Marking YES____ NO____

g. Workmanship YES____ NO____

Group B:

1. Terminal Strength YES____ NO____

2. Solderability YES____ NO____

3. Resistance to Soldering Heat YES____ NO____

4. Solvent Resistance YES____ NO____

SSP 30312 Revision G**October 20, 1998**

Group C:

- | | | |
|----|-----------------------|--------------|
| 1. | Thermal Shock | YES___ NO___ |
| 2. | Life Test | YES___ NO___ |
| 3. | Humidity Steady State | YES___ NO___ |
| 4. | Voltage Temp Limits | YES___ NO___ |
| 5. | Moisture Resistance | YES___ NO___ |
| 6. | Vibration: Sine Wave | YES___ NO___ |
| | Random | YES___ NO___ |
| 7. | Shock | YES___ NO___ |
| 8. | Salt Atmosphere | YES___ NO___ |

Comments. _____

TRACEABILITY AND MATERIAL CONTROL

Are the following retained ?

- | | | |
|----|---------------------------------------|--------------|
| 1. | Raw Material | |
| | a. Procurement Documents | YES___ NO___ |
| | b. Physical / Chemical Property Data | YES___ NO___ |
| | c. Evaluation / Characterization Data | YES___ NO___ |

Comments. _____

2. In-House Prepared Material

- | | | |
|----|-------------------------------------|--------------|
| a. | Fabrication Process Control Data | YES___ NO___ |
| b. | Physical and Chemical Property Data | YES___ NO___ |
| c. | Evaluation / Characterization Data | YES___ NO___ |

Comments. _____

SSP 30312 Revision G

October 20, 1998

3. Process Control Documents

- | | | |
|----|-----------------------|-------------------|
| a. | Lot Travelers | YES_____ NO _____ |
| b. | Material Traceability | YES_____ NO _____ |

Comments. _____

ENCLOSURE 11
CABLE AND WIRE CHECKLIST

Manufacturer _____

Location Address _____

City _____ State _____ ZIP _____

Cage Code _____

Military Specification _____

Type of Cable _____

Unshielded, Unjacketed YES _____ NO _____ N/A _____

Unshielded, Jacketed YES _____ NO _____ N/A _____

Shielded, Unjacketed YES _____ NO _____ N/A _____

Shielded, Jacketed YES _____ NO _____ N/A _____

Type of Wire _____

Military Specification _____

Is the wire annealed copper YES _____ NO _____ N/A _____

Is the wire high strength copper alloy YES _____ NO _____ N/A _____

Other: _____

Shield material

Copper YES _____ NO _____ N/A _____

High strength copper alloy YES _____ NO _____ N/A _____

Stainless steel YES _____ NO _____ N/A _____

Other: _____

Shield finish

Tin YES _____ NO _____ N/A _____

Nickel YES _____ NO _____ N/A _____

Nickel clad YES _____ NO _____ N/A _____

Silver YES _____ NO _____ N/A _____

Other: _____

SSP 30312 Revision G

October 20, 1998

Wire finish

Solder YES _____ NO _____ N/A _____

Nickel YES _____ NO _____ N/A _____

Silver YES _____ NO _____ N/A _____

None YES _____ NO _____ N/A _____

Other: _____

Insulation/Jacket

Is the insulation/jacket used for Space Station inert to Atomic Oxygen?

YES _____ NO _____ N/A _____

If No explain: _____

Comments. _____

PVC YES _____ NO _____ N/A _____

TFE YES _____ NO _____ N/A _____

ETFE YES _____ NO _____ N/A _____

Polyimide YES _____ NO _____ N/A _____

Other: _____

Is concentricity controlled to 70% minimum? YES _____ NO _____ N/A _____

Comments. _____

What is the wire Insulation thickness? _____

Testing: Are the following test and measurements preformed?

Shield coverage	YES _____	NO _____	N/A _____
Braid angle	YES _____	NO _____	N/A _____
Insulation/jacket wall thickness	YES _____	NO _____	N/A _____
Insulation/jacket removability	YES _____	NO _____	N/A _____
Crosslink proof test	YES _____	NO _____	N/A _____
Outgassing	YES _____	NO _____	N/A _____
Wire/cable diameter	YES _____	NO _____	N/A _____
Low temperature (Cold Bend)	YES _____	NO _____	N/A _____
Age stability	YES _____	NO _____	N/A _____
Weight	YES _____	NO _____	N/A _____

Comments. _____

Insulation/Jacket Tensile strength	YES _____	NO _____	N/A _____
Insulation/Jacket Elongation	YES _____	NO _____	N/A _____
Wire Tensile strength	YES _____	NO _____	N/A _____
Wire Elongation	YES _____	NO _____	N/A _____
Finished wire diameter	YES _____	NO _____	N/A _____
Insertion loss	YES _____	NO _____	N/A _____
Wrap back test	YES _____	NO _____	N/A _____
Blocking	YES _____	NO _____	N/A _____
Flammability	YES _____	NO _____	N/A _____
Impulse dielectric	YES _____	NO _____	N/A _____
Insulation humidity resistance	YES _____	NO _____	N/A _____
Insulation shrinkage	YES _____	NO _____	N/A _____
Insulation wicking	YES _____	NO _____	N/A _____
Concentricity	YES _____	NO _____	N/A _____

SSP 30312 Revision G**October 20, 1998**

Thermal shock	YES ____	NO ____	N/A ____
Thermal cycling	YES ____	NO ____	N/A ____
Fluid immersion	YES ____	NO ____	N/A ____
Life	YES ____	NO ____	N/A ____
Impedance	YES ____	NO ____	N/A ____
Wrinkling	YES ____	NO ____	N/A ____
Conductor adhesion	YES ____	NO ____	N/A ____
Attenuation	YES ____	NO ____	N/A ____
Conductor resistance	YES ____	NO ____	N/A ____
Arc tracking	YES ____	NO ____	N/A ____
Insulation shrinkage	YES ____	NO ____	N/A ____
Capacitance	YES ____	NO ____	N/A ____
Maximum continuous working voltage	YES ____	NO ____	N/A ____
Current rating	YES ____	NO ____	N/A ____
Insulation Resistance	YES ____	NO ____	N/A ____
Marking	YES ____	NO ____	N/A ____
Workmanship	YES ____	NO ____	N/A ____

Comments. _____

APPENDIX D

ISS PROGRAM APPROVED EXCEPTIONS TO SSP 30312

APPENDIX D
ISS PROGRAM APPROVED EXCEPTIONS TO SSP 30312

TABLE OF CONTENTS

PARAGRAPH	PAGE
EXCEPTION 1	D - 3
EXCEPTION 2	D – 6

EXCEPTION 1

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT # #(s)	PAGE 1 of 1	
5 October 1998	0001	N/C	2A		
SYSTEM	ORIGINATOR and PHONE NO.		ORGANIZATION / CONTRACTOR		
Node 1	Izzy S. Leybovich (714) 896-4694		EEE Parts/Boeing-Huntington Beach		
CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT Assembly (s)		
222160A	W54/R076396; W56/R076397; W0911/1F89777-1; W0912/1F89779-1; W0107/1F89877-1;	Wire Harnesses	ISS		
SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION		
SSP 30312	Paragraph 3.8.1	Boeing-Huntington Beach	Habitable: X Non-Habitable:		
ISSUE DESCRIPTION: (use continuation pages if required) The Electrical Power System (EPS) team has identified the case (in the memo A3-J090-RH-M-9800659, dated 4 May 1998) when the DDCU-HP could source 65 amps through 8 gauge power wire. The SSP 30312 derated single wire current for 8 gauge wire is 44 amps and the maximum allowable circuit breaker trip point is 57.2 amps (130% of 44 amps). A program exception is requested to allow 65 amps on a 8 gauge wire in the wire harnesses listed above.					
RATIONALE: (use continuation pages if required) Under the provisions of the SSP 30312, Rev. F, the request for an exception to SSP 30312 requirements for this case was analyzed by the PCB engineer Mr. Thomas M. Orton - see the enclosed memo dated June 5 1998, addressing EPS Action Item #4 (153-3 and 154-1). The memo contains the engineering analysis with supporting calculations.					
DISPOSITION					
BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
(Original signed by David Gill)	(Original signed by Ralph Grau)	10/5/98	X		
COMMENTS: (use continuation pages if required) Document this exception in SSP 30312					

EXCEPTION 1 (Continued)

MEMO APPROVED

June 5, 1998

Subject: Request for Parts Control Board (PCB) Approval of Stress Analysis**Reference:** EPS Action Item #: 4 (153-3 & 154-1), submitted by Dee Dupass (818-586-3596)

Background: The Electrical Power System (EPS) team has identified a case where it could be possible for the DDCU-HP could source 65 amps through 8 gage power wire. The SSP30312 limits for 8 gage wire is 44 amps and a maximum circuit breaker trip point of 57.2 amps. Therefore, the EPS team want the PCB to allow 65 amps on 8 gage wire in the following wire harnesses:

Boeing, Canoga Park	
Harness Nomenclature/Identifier	Harness Part Number
W54	R076396
W56	R076397
Boeing, Huntington Beach	
Harness Nomenclature/Identifier	Harness Part Number
W0911	1F89777-1
W0912	1F89779-1
W0107	1F89877-1
W0108	1F89879-1

Approval Requirements: The PCB wants the following assurances from the EPS team as conditions for granting the approval.

1. The current will never exceed 65 amps.
2. The fault condition that allows the DDCU-HP to source up to 65 amps will be detected and corrected within 48 hours.

Analysis: The PCB analysis took a different track than the EPS team analysis but reached the same conclusion, the 8 gage wire can handle 65 amps for a limited (in days) amount of time.

The PCB analysis used the following assumptions:

1. The maximum ambient temperature of the un-powered 8 gage wire was 50° C in vacuum.
2. The maximum thermal rise in the 8 gage wire is 150° C.
3. To raise the 50° C ambient 8 gage wire to 200° C requires 130 amps of current in free air at sea level. (Boeing Design Manual, BDM-7032, Rev. C, Figure 3-2)
4. The 8 gage wire is rated to 200° C.

EXCEPTION 1 (continued)

5. The maximum bundle size is 2 wires. Per MIL-W-5088 the bundle derating for two wire with 100% current is 0.84.
6. The derating for a vacuum environment is 0.64 that of sea level.

Calculations:

wire temperature rating - maximum ambient temperature = maximum thermal rise
 $200^{\circ}\text{C} - 50^{\circ}\text{C} = 150^{\circ}\text{C}$

Maximum allowed current in a two wire bundle of 8 gage wire in vacuum is:

$130\text{ amps} \times .64\text{ vacuum derating} \times .84\text{ two wire bundle derating} = 70\text{ amps}$

If the maximum current is 65 amps, the maximum temperature of the 8 gage wire will be:

$65\text{ amps} / (.64\text{ vacuum derating} \times .84\text{ two wire bundle derating}) = 120\text{ amps}$

Per the BDM-7032 temperature plot chart 120 amps will raise wire temperature 130°C

$50^{\circ}\text{C ambient} + 130^{\circ}\text{C temperature rise} = 180^{\circ}\text{C maximum wire temperature.}$

Conclusions: Approval be granted provided the approval requirements above are met. The EPS Team analysis data and PCB analysis data shall be captured in formally documented design data and is maintained to reflect as-designed configurations.

Prepared By /s/ Thomas M. Orton
 Thomas M. Orton PCB Engineer
 281-336-4535

Approved By: /s/ Patrick A. Swartzell
 Patrick A. Swartzell PCB Chairman

EXCEPTION 2

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT # (s)	PAGE 1 of 1	
5 October 1998	0002	N/C	2A		
SYSTEM	ORIGINATOR and PHONE NO.		ORGANIZATION / CONTRACTOR		
PMA-1 and PMA-2	Izzy S. Leybovich (714) 896-4694		EEE Parts/Boeing-Huntington Beach		
END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)		
222340A and 222300A	W0309/1F94743; W0310/1F92903 and 1F94745; W0311/1F92905; W0313/1F94751; W2301/1F94834; W2307/1F94836	Wire Harnesses	ISS		
SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION		
SSP 30312	Paragraph 3.8.1	Boeing-Huntington Beach	Habitable: X Non-Habitable:		
ISSUE DESCRIPTION: (use continuation pages if required)					
<p>The Electrical Power System (EPS) team has identified the case (in the memo A3-J090-TAB-M-9801239, dated 1 October 1998) where the maximum sustained current in some of the wires through connector of the GFE Russian-supplied APAS could exceed the SSP 30312 limits. The Russian-designed circuit protection will allow a "smart short" maximum sustained current of 7.5 and 8.5 amps on 22 gauge and 8.5 amps on 20 gauge wire, before the circuit protection devices would shut the current off. The SSP 30312 limits for current protection are 5.85 amps for 22 gauge wire and 8.45 amps for 20 gauge wire</p> <p>A program exception is requested to allow up to 8.5 amps on both 22 and 20 gauge wires in the wire harnesses listed above.</p>					
RATIONALE: (use continuation pages if required)					
<p>Under the provisions of the SSP 30312, Rev. F, the request for an exception to SSP 30312 requirements for this case was analyzed by the PCB engineer Mr. Thomas M. Orton - see the enclosed memo 2-6930-TMO-9812, dated September 8, 1998, The memo contains the engineering analysis with supporting calculations.</p> <p>Note: In the memo 2-6930-TMO-9812, the quoted highest current value of 8.8 amps in 20 gauge wire is a typo. The highest possible current in 20 gauge wire is 8.5 amps (as calculated in the memo A3-J090-TAB-M-9801239).</p>					
DISPOSITION					
BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
(Original signed by David Gill)	(Original signed by Ralph Grau)	10/5/98	X		
COMMENTS: (use continuation pages if required)					
Document this exception in SSP 30312					

EXCEPTION 2 (continued)

2-6930-TMO-9812

September 8, 1998

Subject: Request for Parts Control Board (PCB) Approval of Circuit Protection of APAS Wiring In Excess of SSP30312 Limits

Reference:

Background: The Electrical Power System (EPS) team has identified a case where the maximum sustained current in some of the wires through the APAS connector could exceed SSP30312 limits. The wires are protected by a Russian designed fuse box that would allow a “smart short” maximum sustained current of 7.5 and 8.5 amps on 22 gage wire and 8.8 amps on 20 gage wire before the fuse would blow. The SSP30312 limit for circuit protection is 5.9 amps on 22 gage wire and 8.5 amps on 20 gage wire. Therefore, the EPS team requests the PCB to allow up to 8.5 amps on 22 gage wire and 8.8 amps on 20 gage wire in the following wire harnesses:

Boeing, Huntington Beach	
Harness Nomenclature/Identifier	Harness Part Number
W0309	1F94743
W0310	1F92903
W0310	1F94745
W0311	1F92905
W0313	1F94751
W2301	1F94834
W2302	1F94836

Approval Requirements: The PCB wants the following assurances from the EPS team as conditions for granting the approval.

1. The current will never exceed 8.5 amps on 22 gage wire and 8.8 amps on 20 gage wire.
2. The maximum ambient temperature of the APAS wire harness will not exceed 100° C.

Analysis: The PCB analysis used the following assumptions:

1. The maximum ambient temperature of the wire harness is 100° C in vacuum.
2. The maximum thermal rise in the 22 gage wire in vacuum with 8.5 amps is 55° C.
3. The 20 and 22 gage APAS wire is rated to 200° C.
4. The solder melt temperature in the APAS connector is at least 180° C (60 - 40 tin lead solder).
5. Only ¼ of the wires in the harness carry power and only 2 of those would be faulted to maximum sustained current at one time.
6. The derating for a vacuum environment is 0.64 times the sea level rating.

EXCEPTION 2 (continued)

MEMO CONTINUED

Calculations:

Temperature rise of 22 gage wire with 8.5 amps (worst case condition) in free air is approximately 35° C per Boeing Design Manual (BDM) - 7032. Temperature rise of 22 gage wire with 8.5 amps in vacuum is $35^{\circ} \text{C} / .64 = 55^{\circ} \text{C}$

Maximum ambient temperature + thermal rise in wire at maximum current < solder melt temp; $100^{\circ} \text{C} + 55^{\circ} \text{C} = 155^{\circ} \text{C}$ or 25° C less that solder melt point and 45° C less that wire insulation maximum temperature.

Conclusions: Approval be granted provided the approval requirements above are met. The EPS Team analysis data and PCB analysis data shall be captured in formally documented design data and is maintained to reflect as-designed configurations.

Prepared By: /s/ Thomas M. Orton
Thomas M. Orton PCB Engineer
281-336-4535

Concurrence: /s/ W. David Beverly
W. David Beverly, NASA EEE Parts, JSC