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

International Space Station

NASDA

National Space
Agency of

Revision G
October 20, 1998

Canadian Space Agency | Agence spatiale canadienne

agenzia spaziale italiana
(Italian Space Agency)

National Aeronautics and Space Administration
Space Station Program Office
Johnson Space Center
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NASA

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NASA/ASI

INTERNATIONAL SPACE STATION ALPHA PROGRAM

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.

NASA/CSA

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For NASA DATE

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For NASDA Concurrence DATE

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

NASA/RSA

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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.

	Signature	ORG	Date
Prepared By:			
Checked By:			
Supervised By (Boeing):			
Supervised By (NASA):			
Approved By (Boeing):			
Approved By (NASA):			
DQA:	/s/ C. Tallman	2-6930	8-6-99

SPACE STATION PROGRAM OFFICE

ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND MECHANICAL PARTS MANAGEMENT AND IMPLEMENTATION PLAN FOR SPACE STATION PROGRAM

OCTOBER 20, 1998

SPACE STATION PROGRAM OFFICE

ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) AND MECHANICAL PARTS MANAGEMENT AND IMPLEMENTATION PLAN FOR SPACE STATION PROGRAM

LIST OF CHANGES

OCTOBER 20, 1998

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

SSCBD	ENTRY DATE	CHANGE	PARAGRAPH
TBD	3-31-95	REVISION F	ALL
SSCN 001685	11-20-98	REVISION G	3.8.1, B.3.5.2 and Appendix D

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APPENDICES

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: Rev. F (March 31, 1995)	Space Station Approved Electrical, Electronic, and Electromechanical Parts List
SSP 30513 Rev. B (June 3, 1994) Reference paragraphs:	Space Station Ionizing Radiation Environment Effects Test and Analysis Techniques 3.9.3, 3.9.3.1

2.2 MILITARY STANDARDS AND SPECIFICATIONS

DOCUMENT NO.	TITLE
MIL-STD-970 Rev. Basic (October 1, 1987) Reference paragraphs:	Standards and Specifications, Order of Preference for the Selection of 3.20.2
MIL-STD-1686: Rev. A (August 8, 1988) Reference paragraphs:	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) 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 upscreened 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 upscreened 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 Tj = +125 degrees centigrade or Tjmax-20 degrees centigrade, whichever is less, where Tjmax 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 subtier contractors' 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 subtier 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

I_{SW}	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

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) CKS CKR (3) CDR (3)	0.60 0.60 0.60 0.60
Glass	CYR	0.50
Plastic Film	CRH (4) CHS (5)	0.60 0.60
Tantalum, Foil	CLR25 CLR27 CLR35 CLR37	0.50 0.50 0.50 0.50
Tantalum, Wet Slug	CLR79	0.60
Tantalum, Solid	CSR (1) CSS (1) CWR (1)	0.50 0.50 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 accomodate 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	
Film, high-stability and metal (RM, RNC, RNN, RNR, RLR)	0.60	Power	(3)
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)

(1) Under no conditions should the applied voltage exceed the values specified. High-density packaging may require further derating if ambient temperatures are increased.

(2) The maximum voltage shall be no more than 80 percent of the MIL-ratings.

(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.

(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:

E = Max applied voltage (dc or rms (in volts)
P = Derated power (in watts)
R = The resistance of the portion of the element actually active in the circuit.

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 0.50 of rated voltage	+85°C
(1) For stud-mounted filters, do not exceed the rated torque specification on the stud nut.		

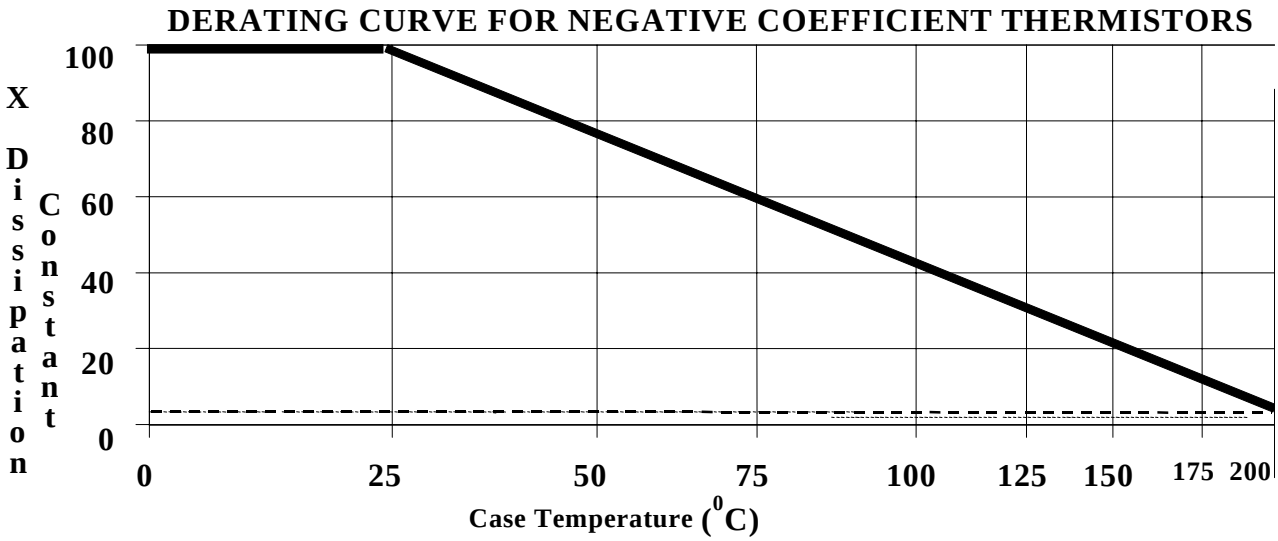
B.3.1.4 THERMISTORS

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°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 ($I_Z$max + $I_Z$nom)
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°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 Tjmax - 20°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)

(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.

(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

(3) MOSFET devices with specified absolute maximum rating for repetitive avalanche energy, E_{AR} (Tj = Tjmax), may be applied using a derating factor of 0.50 for E_{AR} (Tj = Tj 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.

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°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 Vcc 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 Tjmax -20°C, whichever is less, where Tjmax 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 Vcc 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	

(1) a) Derated operating temperature equals ambient temperature plus temperature rise of +10°C (allowance for hot spot). Compute temperature rise as follows:

$$\text{Temperature rise (°C)} = \frac{R-r}{r}\,(T + 234.5) - (T - t)$$

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.

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.

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.

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	

1/ a) Derated operating temperature equals ambient temperature plus temperature rise of $+10^0$C (allowance for hot spot). Compute temperature rise as follows:

Temperature rise (^{0}C) = $\frac{R - r}{r}$ (T + 234.5)

Where R = Winding resistance under load

R = no-load winding resistance at ambient temperature T (^{0}C)

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.

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 $+85^0$C to $+130^0$C, shall be derated as follows: derated operating temperature (^{0}C) equals 0.75 times maximum rated operating temperature (^{0}C). For devices with maximum rated temperatures outside this temperature interval, consult the project parts engineer for temperature derating recommendations.

.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 x T x R x 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 % select 0.9.

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

Relay derating factor is T x R x L = 0.85 x 0.9 x 0.8 = 0.612. The derated contact load is 0.612 x 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:

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

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	1. Current ratings are based on wires at +70^{0}C in a hard vacuum. (10-6 to 10-9 torr) 2. When wires are bundled, the maximum design current for each individual wire shall be derated according to: For N < 15 For N > 15: $I_{BW} = I_{SW} \times (29 - N)/28$ $I_{BW} = (0.5) \times I_{SW}$ Where: N = number of wires I_{BW} = current, bundled wire I_{SW} = current, single 3. Deratings listed are for insulated wire rated for +200^{0}C. A. For 150^{0}C wire, use 80% of value shown in table. B. For 135^{0}C wire, use 70% of value shown in table. C. For 105^{0}C wire, use 50% of value shown in table. 4. Dielectric withstanding voltage rating requied: at least two times the highest application voltage. 5. 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. 6. Circuit protective devices shall not allow sustained current exceeding 130% of derated single wire current. 7. 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^{O}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

ENCLOSURES

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, vacuumed 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)?

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. _____
_____
_____

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. _____

_____

_____

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. _____

_____

_____

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. _____

_____

_____

NASA

ACTION REQUEST NO. _____

SPACE STATION EEE PARTS PROGRAM

NAME AND ADDRESS OF MANUFACTURER	NAME, ADDRESS, AND EXTENSION OF SURVEY TEAM (POINT OF CONTACT)

SUBJECT: _____

REFERENCE DOCUMENT: _____

CONDITION REQUIRING INVESTIGATION/ACTION (INCLUDE PART/TOOL/DOCUMENT AND REVISION LEVEL):

REQUESTED ACTION (SPECIFIC EXPLANATION):

REQUIRED DATE	APPROVING MANAGER	DATE	ASSIGNED TO	MAIL DROP	EXTENSION	DATE

REPLY (REQUIRES DETAILS OF WHAT, WHEN, WHO, AND HOW. ATTACH OBJECTIVE EVIDENCE WHENEVER FEASIBLE):

PREPARED BY (INCLUDE EXTENSION)	APPROVING MANUFACTURER MANAGER	DATE

ACCEPT/REJECT	NOTE/ACTION	APPROVING MANAGER	DATE

CLOSURE DATE

ENCLOSURE 2 - STANDARD SURVEY ACTION REQUEST FORM

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
     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___

	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___

	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

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

Equipment	Moisture Monitored	Solder Material	Vacuum 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 @ _____ ^{0}C
- Nitrogen Bake Time and Temperature _____ Hrs @ _____ ^{0}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

	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)
   YES_____ NO_____ N/A _____
   Metallization thickness (MIL-STD-977, Method 5500)
   YES_____ NO_____ N/A _____
   Thermal stability (MIL-STD-977, Method 2500)
   YES_____ NO_____ N/A _____
   Scanning Electron Microscope (SEM) (MIL-STD-883, Method 2018)
   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.

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___
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 (per visual criteria 1004/1010)		YES___NO___N/A___
	f. End point electricals (per detail specification)		YES___NO___N/A___
Subgroup 4	a. Mechanical shock (2002, Cond B)		YES___NO___N/A___
	b. Vibration, variable frequency (2007, Condition A)		YES___NO___N/A___
	c. Constant acceleration (2001, Condition E, Y1 only)		YES___NO___N/A___
	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 (per detail specification)		YES___NO___N/A___
Subgroup 5	a. Salt atmosphere (1009, Condition A)		YES___NO___N/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 (1018), 5000 ppm at 100° C)		YES___NO___N/A___
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___

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)	

		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?

_____

_____

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. _____

_____

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____

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. _____

_____

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: _____

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. _____

_____

_____

Insolation/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 _____

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

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EXCEPTION 1

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
5 October 1998	0001	N/C	2A	**PAGE 1 of** 1

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 were 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° C - 50°C = 150° C

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

130 amps X .64 vacuum derating X .84 two wire bundle derating = 70 amps

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

65 amps / (.64 vacuum derating X .84 two wire bundle derating) = 120 amps

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

50° C ambient + 130°C temperature rise = 180° 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)	
5 October 1998	0002	N/C	2A	**PAGE 1 of** 1

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; W2302/1F94836	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)

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
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.

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 2-6930-TMO-9812, dated September 8, 1998, The memo contains the engineering analysis with supporting calculations.
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).

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 were 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° C/.64 = 55 ° C

Maximum ambient temperature + thermal rise in wire at maximum current < solder melt temp; 100° C + 55° C = 155° 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