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

International Space Station

NASDA

National Space Development Agency of Japan

SSP30312, Revision H
November 22, 1999

Canadian Space Agency   Agence spatiale canadienne

agenzia spaziale italiana
(Italian Space Agency)

National Aeronautics and Space Administration
Space Station Program Office
Johnson Space Center
Houston, Texas

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INTERNATIONAL SPACE STATION ALPHA PROGRAM

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

NOVEMBER 22, 1999

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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NOVEMBER 22, 1999

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For NASA DATE

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For CSA Concurrence DATE

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NASA/ESA

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NASA/NASDA

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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:	______________________	__________	__________
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SPACE STATION PROGRAM OFFICE

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

NOVEMBER 22, 1999

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

LIST OF CHANGES

NOVEMBER 22, 1999

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
SSCN 002439	11-22-99	REVISION H	3.7.1.1, 3.7.1.2, addition of 3.1.3.2 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 applicable documents of the exact issue shown in the current issue of SSP 50257 form a part of this specification to the extent specified herein.

2.1 NASA Documents

DOCUMENT NO.	TITLE
SSP 30423	Space Station Approved Electrical, Electronic, and Electromechanical Parts List
SSP 30513	Space Station Ionizing Radiation Environment Effects Test and Analysis Techniques
Reference paragraphs:	3.9.3, 3.9.3.1

2.2 Military Standards and Specifications

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

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

3.1 EEE Parts Control Plans

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

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

3.2 EEE part selection

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

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

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

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

a. Approved Grade 1 (or equivalent SCDs) nonstandard parts listed in SSP 30423. QCI shall include Group A electrical testing. Remaining QCI requirements: may be reduced for developmental parts at the discretion of the Tier 1 contractor to eliminate duplicative testing; or, shall be at the discretion of the Tier 1 contractor for non-developmental parts, based on engineering judgement, failure histories, and other experience with the part or supplier.

b. Parts procured to a SCD with the technical requirements of the closest Grade 1 specification, including screening, that are procured from sources approved by the Tier 1 contractors. QCI shall include Group A electrical testing. Remaining QCI requirements: may be reduced for developmental parts at the discretion of the Tier 1 contractor to eliminate duplicative testing; or, shall be at the discretion of the Tier 1 contractor for non-developmental parts, based on engineering judgement, failure histories, and other experience with the part or supplier.

c. Grade 2 Standard Parts 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 ISS 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 Supply Center Columbus (DSCC) 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, FM-08 fuses 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 DSCC 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 DSCC 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.

3.13.1 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.

3.13.2 Shelf life

EEE parts that have been in storage for 10 years or more, as indicated by the manufacturers Lot Date Code (LDC), shall be inspected and tested in accordance with requirements approved by the International Space Station Parts Control Board (PCB). The responsible repair or manufacturing activity shall submit a request to the PCB requesting guidance as to the specific inspection and testing required prior to the installation of the parts in International Space Station hardware. Parts that remain in storage shall not be subject to this requirement.

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 report

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

APPENDIX A ABBREVIATIONS, ACRONYMS AND DEFINITIONS (continued)

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

APPENDIX A ABBREVIATIONS, ACRONYMS AND DEFINITIONS (continued)

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)	0.60
	CKS	0.60
	CKR (3)	0.60
	CDR (3)	0.60
Glass	CYR	0.50
Plastic Film	CRH (4)	0.60
	CHS (5)	0.60
Tantalum, Foil	CLR25	0.50
	CLR27	0.50
	CLR35	0.50
	CLR37	0.50
Tantalum, Wet Slug	CLR79	0.60
Tantalum, Solid	CSR (1)	0.50
	CSS (1)	0.50
	CWR (1)	0.50

(1) Parts used in power supply filter applications shall be used only when the effective circuit resistance is greater than 1 ohm/volt and the parts are subjected to surge testing in accordance with MIL-PRF-39003/10.

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

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

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

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

B.3.1.2 Resistors

The derating factors for resistors are tabulated below:

Type	Derating Factor (1)	Parameter	Applicable Notes
Fixed			(2)
Carbon composition (RCR)	0.60	Power	
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)			
1.0%	0.60	Power	
0.1%	0.25	Power	
0.01%	0.25	Power	
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

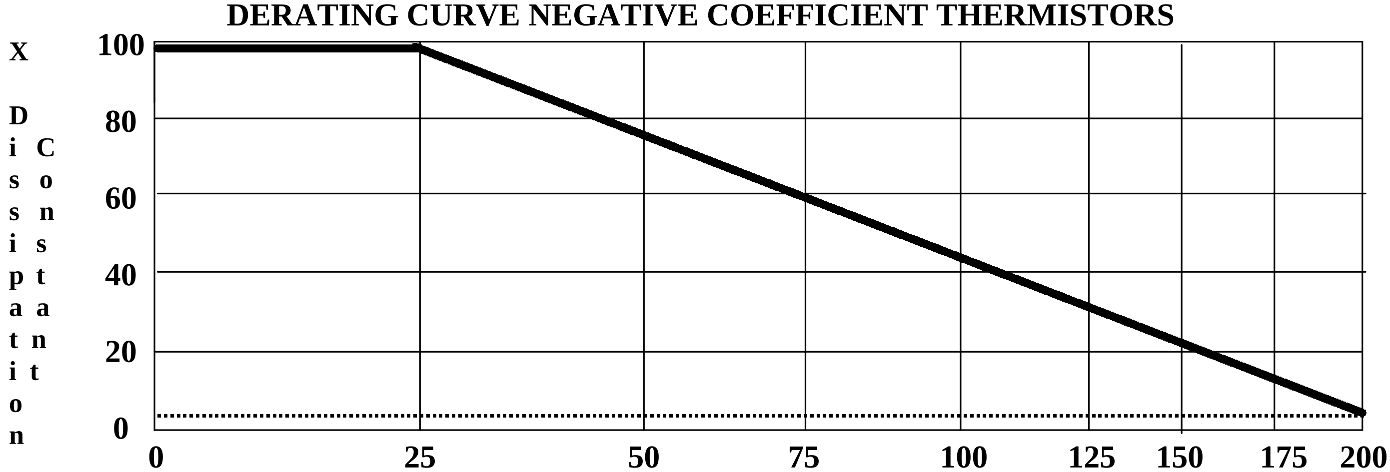
Positive Temperature Coefficient (PTC)

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. ($E_{APP} = 0.8\sqrt{RP}$)

DERATING CURVE NEGATIVE COEFFICIENT THERMISTORS



Case Temperature (°C)

(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	0.90 (7)	0.90 (7)	0.80 (7)	0.80 (7)	0.80 (7)	0.90	0.90
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)	0.90	0.90	0.90	0.90		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) different					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:

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

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:

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

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^{o}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:

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

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.

<table>
<tr><th>Wire Size (AWG)</th><th>Single Wire Current (I_{SW}) (A)</th><th>Remarks</th></tr>
<tr><td>30</td><td>1.3</td><td rowspan="17">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 — $I_{BW} = I_{SW}$ x (29 – N)/28
For N > 15: — I_{BW} = (0.5) x 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. Safety (green) wire ground applications shall meet wire derating requirements as defined in NASA TM 102179 dated June 1991 (Shuttle Payloads requirements).</td></tr>
<tr><td>28</td><td>1.8</td></tr>
<tr><td>26</td><td>2.5</td></tr>
<tr><td>24</td><td>3.3</td></tr>
<tr><td>22</td><td>4.5</td></tr>
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<tr><td>8</td><td>44.0</td></tr>
<tr><td>6</td><td>60.0</td></tr>
<tr><td>4</td><td>81.0</td></tr>
<tr><td>2</td><td>108.0</td></tr>
<tr><td>0</td><td>147.0</td></tr>
<tr><td>00</td><td>169.0</td></tr>
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</table>

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? Yes _____ No _____
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)? Yes _____ No _____

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? Yes _____ No _____
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? Yes _____ No _____

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? Yes _____ No _____
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.) Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____

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? Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____
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? Yes _____ No _____

Explain. ____

____

____

15.4 Stamp Control

15.4.1 (F) Does the vendor maintain a documented stamp control system, including written procedures? Yes _____ No _____

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

		EPOTEK	ABLESTICK	DUPONT
1)	Silver	H20E	36-2	5504
2)	Silver	H31	85-1	
3)	Gold	58-1		
4)	Non-Conductive	H72	41-1	
5)	Non-Conductive	293-X		

- Equipment:

1) Pick and Place ______________________________

2) Eutectic Die Attach ____________________________

3) Ovens ____________________________________

- Reflow Solder Capability? Y/N

1) Vapor Phase 3. Hot Stage

2) Horizontal Furnace 4. Hot Gas

- Is epoxy applied using a screen? Y/N

b. SUBSTRATE ATTACH

- Eutectic: AuSi - AuGe - AuSn - Other
- Epoxy: Preforms Y/N

  Vendor ________________

  Material ________________
- Equipment:

1) Horizontal Furnace, Gas Cover ____________________

2) Hot Stage, Gas Cover __________________________

3) Vapor Phase _______________________________

- Wirebonders QTY
  - Automatic - Hughes TSB2460 __________

    K&S 1472

    Other _____________________

METHOD & QUANTITY

Manual - K&S	US _____ TC _____ TS _____
Westbond	US _____ TC _____ TS _____
Mechel	US _____ TC _____ TS _____
Orthodyne	US _____ TC _____ TS _____
Hughes	US _____ TC _____ TS _____

  - Maximum Wire Size Capability ________________
  - Minimum Wire Size Capability ________________
  - Machine Certification Frequency ________________
  - Operator Certification Frequency ________________
- Welders Parellel Gap - Hughes Unitek

  Opposed Tip - Hughes Unitek
- Bond Pullers Unitek Micropull II W/Printout Y/N

  Unitek Micropull III W/Printout Y/N

  Dage Precima

  Gram Gauge

- Die Shear Dage Precima
  Other ___________________________________

c. INSPECTION

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

d. SEALING

	Epoxy or Moisture Equipment	Solder Monitored	Vacuum Material	Bake
• Parallel Seam Soldering	____________	Y/N	________________	Y/N
• Parallel Seam Welding	____________	Y/N	________________	Y/N
• TIG Welding	____________	Y/N	________________	Y/N
• Laser Welding	____________	Y/N	________________	Y/N
• Solder Sealing	____________	Y/N	________________	Y/N
• Glass Seal	____________	Y/N	________________	Y/N
• Epoxy Seal	____________	Y/N	________________	Y/N
• Horizontal Furnace Reflow	_______________		________________	Y/N

- Vacuum Bake Time and Temperature _________ Hrs @ ______ ^{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? ____

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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.

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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___

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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___

____

____

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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___

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____

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___

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7. Production process procedures that contain the process steps, revisions, and control limits shall be available for use. YES___NO___N/A___

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____

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

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____

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___

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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. ____

____

____

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____

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

TABLE OF CONTENTS

APPENDIX D

ISS PROGRAM APPROVED EXCEPTIONS TO SSP 30312 (continued)

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

EXCEPTION 3

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 1
October 29, 1998	0003	N/C	5A	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Dennis Gard 256-461-5987	EEE Parts

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
US Laboratory	N/A	Pressure Transducer	

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph 3.10	Sentran	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

SSP 30312, paragraph 3.10 requires "EEE parts shall be procured to Tier 1 approved specifications (standard parts specifications or NSPAR and SCD approved) from Tier 1 approved suppliers". Sentran purchased these parts against a disapproved NSPAR. SSP 30312 provides conflicting information with respect to procurement. Paragraph 3.10 requires the specification and NSPAR to be approved and implies prior to procurement. Paragraph 3.3 allows "Procurement and/or use of parts prior to approval shall be at the subcontractor's risk". The subcontractor elected to use an unscreened part when a standard Grade 1 part could have been obtained. The upscreened part is the fourth choice in order of precedence, which the first choice could have been obtained.

RATIONALE: (use continuation pages if required)

The part meets all technical criteria of upscreening in accordance with SSQ 25001. For additional rationale NSPAR SS1-STC-0016 is available.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Ralph Grau	8/2/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 6

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
12 November 1998	0006	N/C	2A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	William Floyd (714) 896-3311 X7-1836	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222045A	1F97563-1 5962-96621Q 1F97563-501 5962-96655Q	Microcircuit, Logic, CMOS	Orbiter
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Paragraph B.3.2.5	Boeing – Huntington Beach	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

Derating requirements imposed by SSP 30312 appendix B call for a 70% derating factor on operating supply for CMOS 4000 series microcircuits. Since thse devices have a maximum voltage of 20 Vcc, properly derated circuits should run at not higher than 14 Vdc. This logic interfaces directly with comparators and operational amplifiers which are connected to ± 15 nominal voltage power supplies which supply a worst case voltage of 15.3 Vdc output. This results in derating of 77% which violates the required criteria.
A program exception is requested to allow up to 79% derating for the CMOS 4000 devices listed above.

RATIONALE: (use continuation pages if required)

HC, HCT and AC series CMOS microcircuits are allowed to operate at a derating 79%. These parts were procured as Standard Military Q level devices and rescreened to V level by Source Control Drawing. The end item effectivity, the APCUI is mounted in the Shuttle Orbiter bay and is accessible for replacement between mission flights. Since the exposure to radiation only occurs during the flight time. Total Dose radiation effects are not a factor. Under the provisions of the SSP 30312, Rev. F, the request for this exception to SSP 30312 requirements for this case will be documented in the NSPAR authorizing use of these non-standard parts.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Ralph Grau	12/23/98	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 7

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 1
5 October 1998	0007	N/C	8A	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	William Floyd (714) 896-3311 X-7-1836	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222069A	M39003/25-256H 2370860-102	Capacitor	IMCA

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph B.3.1.1	Allied Signal Torrance CA	Habitable: Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)

Derating requirements imposed by SSP 30312 appendix B call for a 60% derating factor an operating voltage for non-solid electrolytics (CLR79) and on ceramic (CKS) capacitors. The interface C voltage imposed on the system has maximum steady state voltages of 126 volts. Capacitor C1, a 200V CKS type and C2-C3, 100V CLR parts in series, have a derating of 63% which violates the required criteria. A program exception is requested to allow up to 63% derating factor on the non-soild electrolytics (CLR79) and on ceramic (CKS) capacitors listed above.

RATIONALE: (use continuation pages if required)

The next higher voltage device requires four times the volume to meet the circuit requirements. There is insufficient volume in the IMCA to accommodate this increase in size. Under nominal input voltage conditions, these parts meet the derating requirements. During transient conditions, the maximum ratings of the devices are not violated. Reliability calculations were based on the imposed stress ratios and did not show any negative impact because of the small contribution of these parts in the overall number. The 15% decrease of each part is only 0.0000002% of the total system.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Ralph Grau	4/19/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 8

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 1
11/03/98	0008	N/C		

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
SSSR	Ralph Grau/David Gill	ISS/BOEING

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
			Habitable: Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
International Space Station (ISS) Parts Control Board (PCB) Concurrence in Space-to-Space Station Radio (SSSR) Wire Derating Limit Exceedance for Vacuum Scenario. (Please see attached MEMO #OB5-98-007)

RATIONALE: (use continuation pages if required)

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Ralph Grau	8/20/99	X		

COMMENTS: (use continuation pages if required)
Since the current is limited by 28 volts to the 120-volt d.c./d.c. converter, a toxic event will not happen; therefore, there is not safety hazard.

Based on the data covered in the meeting, the PCB accepts the SSSR deviation to the wire-derating requirement for the vacuum scenario.

Exception 8 (continued)

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
2101 NASA Road 1
Houston, Texas 77058-3696

Reply to Attn of OB5-98-007

DEC 08 1998

TO: Distribution

FROM: OB5/R. A. Grau, Lead EEE Parts Engineering

SUBJECT: International Space Station (ISS) Parts Control Board (PCB) Concurrence In Space-to Space Station Radio (SSSR) Wire Derating Limit Exceedance for Vacuum Scenario

Below are the notes from the meeting held November 3, 1998, to discuss the above subject.

1. Equipment. The SSSR equipment in the U.S. Laboratory uses 26-gauge wire internally.

2. Scenarios.

   a. The laboratory experiences a depressurization event.

   b. The SSSR is used during the repair timeline while an extravehicular activity suited
   crewmember is in the depressurized laboratory to effect laboratory repairs.

   c. The SSSR suffers a failure that creates a “smart-short”.

   d. The SSSR is current limited by d.c./d.c. converter to 5.77 amperes.

3. Issues.

Exception 8 (continued)

a. The Payload Safety Review Panel wire-derating limit 5.3 amperes.
b. The vacuum environment increases the wire operating temperature.

OB-98-007

4. Time Criticality. A resolution is needed to allow shipment of the orbital replaceable unit for installation in the laboratory.

5. Analyses.

   a. Electrical, Electronic, and Electromechanical (EEE) parts. In accordance with the EEE parts analysis, 26-gauge, 200C wire can handle the extra .47 ampere in vacuum; therefore, there is no parts usage issue.

   b. Safety. Since the current is limited by 28 volts to the 120-volt d.c/d.c. converter, a toxic event will not happen; therefore, there is no safety hazard (Even if there was a safety hazard, the module repressurization timeline includes scrubbing of the atmosphere before crew occupancy, therefore, any toxic elements would be scrubbed.)

6. Conclusion. Based on the data covered in the meeting, the PCB accepts the SSSR deviation to the wire-derating requirement for the vacuum scenario.

Original Signed By

Ralph A. Grau

<u>Distribution</u>:

EV/M. A. Chavez
EV/D. D. Lee
NT3/S. M. Schenfeld
NX/R.R. Sheppard
OB5/W. D. Beverly
OB5/P. S. Pilola
OE/G. J. Baumer
OE/N. J. Vassberg
NT52/SAIC/C. A. Corbin
NX22/SAIC/M. A. Defrancis
NX22/SAIC/P. F. Meier
Boeing-Huntington Beach/HO17-D601/D. J. Gill

OB5/RAGrau: 11/30/98: 47660

EXCEPTION 9

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 1
1/28/99	0009	N/C	FM05 & Subsequent	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
BCDU	Roger Parks (818) 586-1914	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
	RER45F10R0R	Wirewound Resistor	ISS

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph 3.8.	QPL MIL-R-39009/2	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

The RER45F10R0R Resistor is used in Super-Fet Snubber CKT for BCDU. The resistor is non-compliant with the de-rating criteria as specified in SSP 30312 paragraph 3.8.

RATIONALE: (use continuation pages if required)

The MTBF on the resistor presents no risk based on the de-rating calculations. The MTBF reduction of 45 days in 0.52% of the 10 year life. PCB accepted the use of the design 'as is" for FM01 through FM04. This exception asks for "use as is" for FM05 and subsequent.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Madhu C. Rao	2/1/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 11

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
16 April 1999 12 August 1999	011	New A	8A/11A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222033A/222032A	5839193-501	SARJ/TRRJ	All
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312 See also SSP 41173	3.14 3.3.1.1.2	LMMS	Habitable: Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)
LMMS did not maintain lot traceability for electrical wire and cable. Negotiations at the time of the issuance of the ISS contract led LMMS to believe that wire/cable were "grandfathered" into the current contract as non-EEE parts. LMMS therefore continued with its normal manufacturing process, treating wire as a sundry without maintaining strict lot traceability.

Per PCB discussions of April 1999 it was determined that lack of wire traceability data would be acceptable as long as each lot of wire was uniform in meeting its functional specification and that LMMS processes were assuring that performance. HB returned an action to LMMS to provide details on the LMMS lot inspection in addition to the in-house control methodology cited below.

RATIONALE: (use continuation pages if required)
LMMS defines and inspects wire in accordance with their internal procedures as "Use Code 1" which is for flight quality applications. The inspection and control routine is as follows:

1) All wire and cable are inspected to meet the requirements of their applicable specification.
2) Source/Receiving Inspection verifies by review of applicable test data and certifications.
3) Only acceptable wire and cable are issued to a segregated flight inventory location with an "A" Stamp identifier.
4) Line inspection verifies part number and the "A" stamp on the wire spool at next assembly.

Some limited traceability is possible by PO receipts and time period received to ascertain possible suppliers and run dates.

Each specific wire type from the LMMS As-designed list was addressed with respect to lot assurance. LMMS letter attached indicates that lot data is required and is reviewed by LMMS M&P and OKed prior to transfer of wire to stock. The specific wire from the LMMS As-designed parts list are as follows:
MIL-W-22759 wire is assured by inspection to paragraph 4.5 of that specification
MIL-C-27500 cable is assured by inspection to paragraph 4.3 of that specification.
J-W-1177 Magnet wire is obsolete as of 10-96 and is replaced by LMMS Material Drawing MD 1069, see Table III therein.
MD 40 covers silver coated Kapton wire, see Table II therein
MD 380 covers tin coated cross-linked Polyalkene/PVF insulated wire with MIL-W-81044 requirements detailed therein.
MD 914 controls MIL-W-81381/19 with exceptions in marking and minimum length only
MD 920 controls wire per MIL-W-81381/17 and /11 with exception of minimum length and marking requirements.

The above controls are felt to sufficient and presenting low risk to the project in terms of future suspect material.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	8/20/99	X		

COMMENTS: (use continuation pages if required)
No specific contract or LMSC part plan text was recorded exempting traceability control other than LMSC's interpretation of the flowdown of NASA-JSC TD 92-00467
Ref. LMMS/P520757, March 8, 1999, MD020

EXCEPTION 12

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
23 September 1999	012	New	3A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
See attached continuation sheet			All
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312 See also SSP 41173	3.14 3.3.1.1.2	L3 and subs	Habitable X Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)

Wire/ cable traceability was not necessarily maintained. Direction to L3 from NASA-JSC removed wire and cable from the list of commodities that were considered EEE parts so internal standard practice was used. Due to cost convergence issues and lack of visibility to that level of detail the ISS decision to replace wire and cable on the EEE list was not imposed. Much of the wire and cable used was procured as far back as 1993 prior to direction by SSP 30312F.

RATIONALE: (use continuation pages if required)

Review by L3 of as-built parts indicates that manufacturer and date code were recorded for much of the hardware including that of their subcontractors. Where the quantities were larger and multiple spools were used there was no room to record multiple date codes so this field was left blank. In all cases the manufacturer CAGE code was recorded.

The assurance process for Mil Spec wire was a review of the C of C and other supplier data as might be provided. Company standard wire and SCD controlled wire were tested by L3 or subcontractors as required by the procurement documentation. The above controls are felt to sufficient and presenting low risk to the project in terms of future suspect material.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Madhu C. Rao	9/24/99	X		

COMMENTS: (use continuation pages if required)

Affected L3 hardware.

LMSC	Motorola	SPAR	MDI	EMS	MPC
VBSP (VIDEO BASE BAND SIGNAL PROCESSOR)	HRM (HIGH RATE MODEM)	SGANT (SPACE TO GROUND ANTENNA)	POWER SUPPLY	POWER	PAN- UN
VSW (VIDEO SWITCH-EXTERNAL)	HRFM (HIGH RATE FRAME MUX)	ACRFG (S-BAND RF GROUP)			
SGTRC (SPACE TO GROUND XMTR-RCVR CONTROL)	XPNDR (TRANSPON-DER)				
TVCIC (TV INTERFACE CONTROLLER CAMERA (VIDEO)	ACBSP (S-BAND SIGNAL PROCESSOR)				

EXCEPTION 15

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 3
17 April 1999	0015	N/C		

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Andrew J. Sellin (818) 586-0197	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
	M39003/10-3015S, M39003/10-3010S, RER65F3010, D015861-0017	Capacitors, Resistors, Inductors	SSU

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Appendix B		Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
Eight components don't meet the derating criteria of SSP30312 Appendix B

RATIONALE: (use continuation pages if required)
See attached sheet for rational and derating summary provided by Loral SSD. Ref P/N M39003/10-3015S reference designator C36 and P/N M39003/10-3010S ref des. C26,C32,C38. Of these four capacitors, three(C36,C32,C38) and one(C32) have applied voltage stress 3 percent and 6 percent respectively above the derating guidelines. In addition, EMI-1(ODD), p/n D015861-0017 ref des EMI15 and EMI-1(EVEN), p/n D015861-0017 ref des EMI15 are EMI inductors which are slightly above the 125 degree centigrade derated limit, at 125.3 and 131.4 degrees respectively. To evaluate the MTTF impact of these small excursion above the derating guidelines, the temperature (of these six parts) were reduced, typically 5 to 6 degrees, to a value which brings the stress within the derating guidelines. The resulting MTTF was then recalculated to determine the penaly incurred from operation above the derating limits for these parts. The result was 229994 verses 229998 hours, or a penalty of 4 hours. This is an overall reduction of .0017 percent of the MTTF.

EMI-1(ODD), resistor p/n RER65F3010 ref des R2 and EMI-1(EVEN), resistor p/n RER65F3010 ref des R2 were evaluated in the Loral analysis based upon work done by K. Whalen,(E-00294, 20 November, 1996). In the K. Whalen analysis, it was decided to assign 10 watts to these parts during isolation, to examine the impact of a given cyclic loading at the ORU output. The Loral analysis concluded that this assumption would lead to a violation of SSP30312 derating criteria. In addition, Loral concluded that if the dissipation was reduced to 4.5 watts, the resistors would meet SSP30312 deraing criteria. Upon re-evaluation by N. Gorchoff(Boeing CP), the normal operational power dissipation for these components is under .5 watts. Based upon this information, these resistors do not exceed the derating criteria of SSP30312.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Davis Gill	Original Signed By Ralph Grau	7/14/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 16

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
April 19, 1999	0016	N/C	6A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	M. Rao/281-244-8180	EEE Parts

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
Mini Pressurized Logistic Module (MPLM)	MLM-EQ-Q1-0096	MPLM Modulation on/off valve specification	MPLM
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Paragraph B.3.2.1	ESA/IP	Habitable: Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)

(1) DC/DC Converter derating not compliant according to SSP 30312, paragraph B 3.1.3. The derating factor for the DC/DC Converter is 0.5 according to paragraph B.3.2.1 of document SSP30312, Rev F. This factor will derate the steady state voltage of 40 Vdc to 20 Vdc. The DC/DC Converter is used at 28 Vdc so this will lead to an insufficient actual derating factor. The input voltage of the DC/DC Converter is specified to be 28 Vdc, this will lead to be a derating factor of 0.7.

(2) EMI-filter derating not compliant according to SSP 30312, paragraph B 3.1.3. The derating factor for the EMI filter is 0.5 according to paragraph B.3.2.1 of document SSP30312, Rev F. This factor will derate the steady state voltage of 40 Vdc to 20 Vdc. The EMI filter will be used at 28 Vdc so this will lead to an insufficient derating factor. The input voltage of the filter is specified to be 28 Vdc (32 Vdc max), this will lead to be a derating factor of 0.7 (or 0.8).

EXCEPTION 16 (continued)

RATIONALE: (use continuation pages if required)

DC/DC Converter:

(1) The maximum input voltage of 32 input voltage of 32 Vdc according to paragraph 3.1.3.1 of document MLM-IC-A1-001 will always be within the maximum withstanding voltage of 40 Vdc of the DC/DC Converter.
(2) The type of converter that will be compliant with the mentioned derating factor of 0.5 is a type of converter with a higher input voltage. A converter of this type, however, will be less efficient for what is the power consumption is concerned.
(3) According the derating, the converter is allowed to operate at 20 Volts maximum. The input range of the EMI filter is 16 Vdc to 40 Vdc. The maximum supply voltage of the converter (40 Vdc) leaves therefore a margin of at least 8 Vdc.

EMI Filter:

(1) The maximum input voltage of 32 Vdc according to paragraph 3.1.3.1 of document MLM-IC-A1-001 will always be within the maximum withstanding voltage of 40 Vdc of the EMI filter.
(2) The type of EMI filter that will be compliant with the mentioned derating factor of 0.5 is a type of filter with a higher input voltage. A filter of this type, however, will be less efficient for what is the power consumption and filter abilities are concerned.
(3) According the derating, the EMI filter is allowed to operate at 20 Volts maximum. The input range of the EMI filter is 16 Vdc to 40 Vdc. The maximum supply voltage of the filter (40 Vdc) leaves therefore a margin of at least (40 Vdc rated, 32 Vdc maximum supply voltage) 8 Vdc.

Note MPLM WMV-E box is not considered critical.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	7/1/99	X		

COMMENTS: (use continuation pages if required)

The EMI filter and the DC/DC converter were wrongly considered as EMI filter capacitors and the applied derating rules were para. B.3.1.3 of SSP30312 (derating for discrete EMI filter). But the parts in subject are hybrids and the derating rules of para. B.3.2.7 of SSP30312 have to be applied. Thus input voltage shall not be 50% derated and the raised exception is due to a mistake.

According to SSP30312, as far as hybrids and MCMs are concerned, internal components shall be derated by the manufacturer itself in accordance to the requirements of SSP30312 for the closest similar part type. Additional derating in the application is not required as the parts are procured according to the generic specification MIL-PRF-38534 and are standard parts (not off-the-shelf design). The manufacturer is, thus, listed in QML.

Further information on DC/DC converter:

- Part type MTR2815D according to MIL-PRF-38534 SMD 5962-93072 plus up-screening flow.
- Input voltage range +16-+40 Volt
- Nominal voltage +28V
- Maximum specified output power 30.98W
- Nominal operating condition: V_{in} = 28V, I_{in} = 0.4A, P_{in} = 11.2W
- Worst case operating power: V_{in}= 30V, I_{in} = 0.7A, P_{in} = 19.6 W
- P_{out} is less than P_{in} because the nominal efficiency of the device is about 80% at I_{out}= 1 A.

The part list of the hybrid and the operating condition of each passive and active components are manufacturer proprietary documentation and are not available. Thus, it is not feasible calculate the MTBF of the device in a.m. operating condition.

Two sample of the procured lot successfully performed the steady state life test (1000 hours, 0.75% full load, 125 C).

EXCEPTION 17

<table>
<tr><td>SUBMITTAL DATE</td><td>EXCEPTION NO.</td><td>REV.</td><td>FLIGHT #(s)</td><td rowspan="2">PAGE 1 of 1</td></tr>
<tr><td>29 March 1999</td><td>0017</td><td>N/C</td><td>8A</td></tr>
<tr><td>SYSTEM</td><td colspan="2">ORIGINATOR and PHONE NO.</td><td colspan="2">ORGANIZATION / CONTRACTOR</td></tr>
<tr><td>ISS</td><td colspan="2">Gene Zetka 281-483-0412</td><td colspan="2">EA4/CheCS CPDS GFE Project</td></tr>
<tr><td>END ITEM/CONFIG. ID NO.</td><td>WIRE HARNESS/PART NUMBER(s)</td><td colspan="2">DESCRIPTION</td><td>NEXT ASSEMBLY(s)</td></tr>
<tr><td></td><td>FM08A –125V-1A</td><td colspan="2">Fuse</td><td>Charge Particle Directional Spectrometer</td></tr>
<tr><td>SPECIFICATION NUMBER</td><td>SPEC. PARAGRAPH NO.</td><td colspan="2">MANUFACTURER</td><td>LOCATION</td></tr>
<tr><td>SSP 30312</td><td>Paragraph 3.8.1, “Nonconforming and Noncompliant Parts”</td><td colspan="2">Littlefuse (CAGE Code: 75915)</td><td>Habitable:
Non-Habitable: X</td></tr>
<tr><td colspan="5">ISSUE DESCRIPTION: (use continuation pages if required)
NASA ALERT NNA-045-V, Titled: “High Voltage Reduced Pressure Application Concerns for Electrical Fuses, “ for the above described part, states in part “It has been demonstrated experimentally that upon interruption of the fuse, extremely high current arcs may be generated and sustained IF the following condition exist: High open circuit voltage, and reduced internal pressure within the fuse cavity.” Effectively for a short period of time, the fusing function can be lost due to the environmental conditions and fuse geometry/construction.
The Extravehicular Charged Particle Directional Spectrometer (EV-CPDS) is Class I, Criticality 3 hardware that will be integrated into the Space Station S0 Truss element, scheduled to fly on flight 8A. It presently utilizes FM08 fuses in three individual, flight-unit heater control circuits for 3 spectrometer subassemblies. Following extreme cold soaks, by warning the electronic assemblies prior to application of operational power, the 120 VDC-powered heaters mitigate increased risk of EV-CPDS cold-induced, radiation detector damage. If the FM08 fuses have to be removed, a single heater failure would trip the upstream RPCM power control, removing all heater capability. Flight rules do not allow the reactivation of an RPCM with unexplained EPCE fault, creating the likelihood for premature loss of all 3 subunits within the EV-CPDS flight assembly.</td></tr>
<tr><td colspan="5">RATIONALE: (use continuation pages if required)
FM08 inline fusing allow loss of one (or two) of the backup heaters, thereby leaving intact the remaining heaters functionality, and inherent detector/electronics life benefits. The Government Furnished Equipment Provider has determined:
1. There is no safety issue inherent in the fusing of the heater control circuitry (Attachment A).
2. The EV-CPDS Contractor recommends “Fly As Is,” to maximize flight unit longevity (Attachment B).
3. An independent assessment reinforces the two previous positions (Attachment C).

RECOMMENDATION: Parts Control Board FM08 “hardware use-as-is, “ in accordance with SSP 30312, section 3.18.1.</td></tr>
<tr><td colspan="5"></td></tr>
</table>

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Ralph Grau	5/5/99	X		

EXCEPTION 20

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
05 May 1999	0020	N/C	6A	PAGE1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Ralph Grau 281-244-7660	OB5

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
	FM08A-125V-1A	Fuse	SSRMS, MBS and SPDM system ORUs
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Paragraph 3.18, "Nonconforming and Noncompliant Parts"	Littlefuse (CAGE Code: 75915)	Habitable: ☐ Non-Habitable: ☒

ISSUE DESCRIPTION: (use continuation pages if required)

NASA ALERT NA-045-V (attachment A). Titled: "High Voltage Reduced Pressure Application Concerns for Electrical Fuses," for the above described part, states in part: "It has been demonstrated experimentally that upon interruption on the fuse, extremely high current arcs may be generated and sustained IF the following conditions exist: High open circuit voltage, and reduced internal pressure within the fuse cavity." Effectively, for a short period of time, the fusing function can be lost due to the environmental conditions and fuse geometry/construction.

The SSRMS, MBS and SPDM utilize FM08 fuses in the following ORUs:

* Joint Electronic Unit (JEU),
* Latching End Effector Electronics Unit (LEU),
* SPDM Joint Electronics Unit (SJEU),
* SPDM OTCM Electronics Unit (OEU) and
* SPDM Backup Drive Unit (BDU), CS06 Clamp Card and EPC Card in SPDM Power Switching Unit (PSU).

RATIONALE: (use continuation pages if required)
See attachment B, Effect on SSRMS, MBS and SPDM of Parts Advisory on FM08 type fuses.

RECOMMENDATION: Parts Control Board approve FM08 "hardware use-as-is," in accordance with SSP 30312. section 3.18.1.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Ralph Grau	5/27/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 21

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
04 May 1999	0021	N/C		PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Thomas M. Drury 818.586.7698	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
	D016023-AA01	Microcircuit	BCDU

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
016023	Paragraph 4.8.5.1 (Group D data for QCI)	Harris/Elmo	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
Engineering Model (EM) for flight (FLT) use without Group D Quality Conformance Inspection (QCI) data.

RATIONALE: (use continuation pages if required)
The subject microcircuit (D016023-AA01) has successfully completed the following tests and inspections:

1. Screening electrical tests IAW 016023
2. Group A, B, C, and E inspections IAW MIL-STD-883. Group B testing includes fine and gross leak, lead integrity/fatigue, physical dimensions, temperature cycling, and constant acceleration.
3. Destructive Physical Analysis (DPA) which includes Residual Gas Analysis (RGA), die shear, and bond pull.

Consequently, the only Group D tests that are not repeated during the other test programs described above are moisture resistance, variable frequency vibration, mechanical shock, salt fog, internal water vapor (RGA would reveal a problem in this area), lid torque, and adhesion of lead finish. In light of the verifications noted in #1-#3 above, the absence of test data in these areas is considered low-risk. It is particularly noteworthy that many of the Group D tests are qualitative in nature whereas DPA entails quantitative analysis of many of these same parameters with established pass/fail criteria that assure the integrity of the manufacturing processes involved in making the part.

Thus, although Group D testing would normally be conducted, the use of the subject parts without this testing is considered to be very low risk based on the favorable DPA test results.

In addition, there exist no known GIDEP, NASA, Boeing, or supplier alerts against this product line. RSOP 13.7 describes Rocketdyne's automatic notification and tracking system for such alerts.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	5/14/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 22

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
10 May 1999	0022	N/C	3A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
Space-to-Ground Antenna (SGANT)	Ali Lakhani (714) 896-3311, X71419	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222016A	621-0043-101 (Honeywell NSPAR No. HON-SGS-012D)	Phototransistor	ISS

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph 3.3	EMS Technology	Habitable: Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)

In NSPAR HON-SGS-012D, dated 9/28/95, “yes” in box “a” of section 11 was checked, indicating that the part is qualified, but qualification data (boxes “f” through “I” of Section 11) were not filled in. BEI (a subcontractor of Honeywell, which is a subcontractor of EMS Technology), which uses this part, can not locate QCI (Quality Conformance Inspection) data package.

RATIONALE: (use continuation pages if required)

This part was evaluated as part of Boeing-Huntington Beach Flight 3A SGANT RGA Technical Assessment. The conclusion of the study was that there is no reliability impact. The rest BEI nonstandard parts had QCI data packages, which indicates that Space Station requirements were complied with as a matter of policy, and that the QCI data package in question was simply misplaced. Also, SGANT had passed qualification and acceptance testing.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	5/14/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 24

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
13 May 1999	0024	N/C		PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Thomas M. Drury 818-586-7698	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
RM2466	RM2466-001	Microcircuit	DDCU-I

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	C of C requirement	UTMC	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

Flight (FLT) hardware without Certificate Of Compliance (C of C)

RATIONALE: (use continuation pages if required)

Part RM2466-001, PO PRUTMCo1-R Receiving report 4690143 Lot #OJGS9336 has no vendor C of C nor other data . A quantity of 102 parts was received on 2/15/95. The vendor was contacted and Rocketdyne was informed that a C of C and other data is no longer available. The situation was first noted in January of 1999 which is after the required 5-year data retention period.

In January 1994, a shipment of 70 pieces of the same P/N lot, and date code was received with C of C plus the following data items (UTMC PO R00SIJ90561358): Group A, B, and D attributes; wafer lot acceptance report; radiograph examination summary; CSI summary sheets; SEM photos; test data in electronic media format; ESD data; lot traveler; and 100% lot screening summary. The C of C, which remains on record at Rocketdyne with other aforementioned data items, is dated 12/28/93.

Thus, when comparing the two shipments, only the 100% screening data is lacking relative to the subject 102-piece shipment, because both shipments are of the same P/N, lot, and date code.

In addition, there exist no known GIDEP, NASA, Boeing, or supplier alerts against this product line. RSOP 13.7 describes Rocketdyne's automatic notification and tracking system for such alerts.

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By David Gill	Original Signed By Ralph Grau	5/14/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 25

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
May 14, 1999	0025	N/C		PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Dennis Gard – 256-461-5987	EEE Parts/Boeing-Huntsville

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
683-20181-1 and 683-20181-2	3521H-408-502 and 3051H-1-502	Potentiometer	Tanks, Water Storage
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Paragraph 3.5 (EEE Parts Qualification)	Bourns	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
Qualification of the potentiometers is by similarity to previously qualified hardware. All potentiometer qualification has been performed at the system level, not the component level.
RATIONALE: (use continuation pages if required)

Similar standard potentiometer does not exist. Therefore, the use of the subject potentiometers is alternatives to meet the liquid-level sensing requirement imposed by Boeing specification 683-20181.

Qualification of the potentiometer is by similarity to previously qualified hardware. All potentiometer qualification has been performed at the system level, not the component level. The Pump and Flow Control System (PFCS) uses a similar potentiometer (3541H-479-502) to the water storage tank, 7 gallon (P/N 46767) in a similar liquid-level sensor. Qualification of the PFCS was performed to the qualification test procedure QTP 88280. Qualification included random vibration, thermal cycling, and cyclic life testing.

The Storage, Potable and Waste Water Space Shuttle Tanks use a similar potentiometer (Bourns P/N 3501H-1-502) to the water storage tank, 7 gallon (P/N 46767) in a similar liquid-level sensor. Qualification of the Storage, Potable and Waste Water Space Shuttle Tank was performed to the qualification test procedure QTP 69480. Qualification included random vibration, cyclic life testing, as well as functional testing.

Freon and Water Tanks supplied to United Technologies, Hamilton Standard for the Spacelab Program. These tanks used the same 5-turn (3521H-408-502) potentiometer that is used in the Storage Water Tank, 7 gallon. Hamilton Standard performed all qualification testing at the system level.

EXCEPTION 25 (continued)

Comparison of 7 gallon tank (P/N 46767) and Space Shuttle Water Storage Tank

	Water Storage Tank, 7 gallon	Shuttle Water Storage Tank
Input Voltage	Not Specified	5 VDC
Output Voltage	0-5 VDC	0-5 VDC
Supplied Current	1.0 mA	Not Specified
Temperature		
Operating	60 to 113 ^{0}F	40 to 120 ^{0}F
Non-operating	280 ^{0}F Sterilization	250 ^{0}F Sterilization
Cycles	20 full stroke 500 partial stroke	3000 full stroke

Each Space Shuttle incorporates 5 (five), 20 gallon waste/water tanks with one sensor per tank. A total of 35 flight tanks have been supplied to the Space Shuttle Program. The combined service life is shown to be 685.05 days.

RATIONALE Continued

Testing of the PFCS to date, includes a continuous endurance test of bellows and sensor operation amounting to approximately 350, 000 cycles over a continuous period from 08/09/96 to 10/29/96. The accumulated constant operational test time was 81 days.
In addition to testing at the assembly level the potentiometers are subjected to the following testing at Bourns:

Group 'A' testing (Sample Size:100%)

Total Resistance, Output smoothness, Minimum voltage, Erratic TR and Visual.

Group 'B' Testing (Sample Size:14%)

Mechanical angle, Electrical angle, Dielectric strength, Insulation resistance and Torque.

Burn-in (Sample Size:100%)

Load Test(Sample Size:100%)

17 lbs. lateral force and 10 lbs. axial force applied at wiper

Based on the information above, use of the potentiometers (P/N 3521H-408-502 and 3051H-1-502) are considered to be very low risk.

In addition, there exist no known GIDEP, NASA, Boeing, or supplier alerts against this product line.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	5/14/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 26

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
9 April 1999	0026	N/C	4A – 12A.1	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Eric Gietl (281) 336 - 5231	Electrical Power Team

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
LERC 6900.600	54059M90A001 54059M90A011 54059M90A002 54059M90A012 54059M90A003 54059M90A021 54059M90A004 54059M90A022	Manually actuated electrical switch (GFE)	ITS Z1 and ITS S0
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Paragraph B.3.4.4 (B.3.4.3), "Switches"	NASA Glenn Research Center	Habitable: Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)

The Circuit Isolation Device (CID) is a mechanical switch used for manually dead-facing circuits to avoid mating and de-mating hot connectors. It is used as a temporary deadfacing device during the assembly of the space station. The manufacturer (Glenn Research Center) has space qualified the CID for 60A continuous current carry and 2A break current at an operational voltage of 173v.

The CID will be used to open a circuit after the load current has been reduced to less than or equal to 2 amps. There are no intentions or needs to operate the CID above the designed limit, however, in the event that a load greater than 60A is inadvertently applied or a "soft fault" occurs, the 60A rating will be exceeded. The maximum steady state current the CID could be subjected to is 100A.

Once the power system is in its final configuration, the CIDs will be removed from the system. Additionally, opening and closing (with less than 2 amps load) is only required when power cables are reconfigured. CIDs are only expected to be cycled one or two times during their intended usage.

An operational constraint has been provided to MOD (repeated in comments section below) on how to proceed if currents in excess of 60A are put through the CID.

RATIONALE: (use continuation pages if required)

1) The switch inside of the CID is a military grade part (see attached NSPAR). The military version is rated for 60A-break current with no specification for the level of continuous carry current. Current carry ratings are determined by the temperature rise of the contacts when being opened at 60A load current. The industrial version of the switch is rated to carry 75A continuous current and break 60A.

2) Power system telemetry current sensors will be able to determine if the current through any CID exceeds the 60A rating and will be used to verify the current is less than 2A before opening any CID.

3) If the CID is subjected to steady state currents greater than 60A, the entire power channel can be shut down to avoid de-mating hot connectors. (As baseline prior to CID implementation.) Since the CID is a mechanical device, it is also possible that a crew member could open the switch after such an overcurrent. If the crewperson is able to open the switch, dead-facing is guaranteed by the nature of the design. (If the handle turns, the switch opens.)

RECOMMENDATION: Parts Control Board approve Circuit Isolation Device "hardware use-as-is," in accordance with SSP 30312, paragraph 3.18.

EXCEPTION 26 (continued)

DISPOSITION					
BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Dave Beverly	6/11/99	X		

COMMENTS: (use continuation pages if required)

1) A Nonstandard Part Approval Request for the CID has been submitted. The NSPAR number is CID-001. A copy is attached.

2) A test was conducted at the Glenn Research Center to determine the effects of applying a 125A load in a vacuum chamber. During these tests, the CID successfully carried the current and was able to dead-faced when the load was reduced to 2A. The torque required to open the CID was found to be acceptable. Test report #0084-01-15, “Switch Derating Test” includes the results of these tests.

3) Operational Constraint: In the event the CID is subjected to a steady state current in the range of 60A - 100A and then reduced to its rupture level of 2A, the CID may be difficult/impossible to open. Based on test results it is suggested that an EVA crewperson attempt to open the CID. If however, the torque required to open the CID is excessive, the flight control team should be prepared to power down the channel to satisfy the deadfacing requirements for connector mate/demate. In addition, if the CID cannot be opened, it should be removed from the system when the channel is powered down.

EXCEPTION 27

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
May 14, 1999	0027[TBC3]	N/C		PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Thomas M. Drury 818-586-7698	EEE Parts/Boeing-Huntsville

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
	3541H-479-502	Potentiometer	SV809903 Accumulator Assy.

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph 3.5 (EEE Parts Qualification)	Bourns	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
Qualification of the potentiometers is by system and subsystem qualification, not at the component level.

RATIONALE: (use continuation pages if required)

Similar standard potentiometer does not exist. Therefore, the subject potentiometers were deployed by United Technologies, Hamilton Standard, as a mean to meet the liquid-level sensing requirement imposed by Boeing specification RE2814. RE2814 was used as a basis to develop the Hamilton Standard Specification SVHS13094, to which the accumulator assembly was designed, manufactured, and qualified. Testing of the full-up accumulator assembly includes temperature cycling, random vibration, burn-in, and life cycle testing – all of which would typically be included in a part (potentiometer) level qualification test program. QTP 88280 depicts the qualification test procedure that was used to qualify the accumulator.

Because the accumulator is a subassembly of the Pump and Flow Control Assembly (PFCS) orbital Replacement Unit (ORU), qualification of the potentiometer was also accomplished at system level. Qualification test results of the PFCS are documented in the PFCS Delta Qualification Test Report, SVHSER19573. PFCS qualification testing included random vibration, thermal cycling, and cyclic life testing.

In addition to the accumulator, the Space Lab application uses the same potentiometer (3541H-479-502) in the water storage tank, 7 gallon (P/N 46767) liquid-level sensor.

Comparison of PFCS 7 gallon tank (P/N 46767) and Accumulator

	Water Storage Tank, 7 gallon	Shuttle Water Storage Tank
Input Voltage	Not Specified	7.5 VDC
Output Voltage	0-5 VDC	1.075 – 6.425 VDC
Supplied Current	1.0 mA	Not Specified
Operating Temperature	60 to 113 0F	-67 to 120 0F
Non-operating	280 0F Sterilization	-85 to 120 0F
Cycles(full stroke)	20	400
Cycles (partial stroke)	500	350, 400

EXCEPTION 27 (continued)

Testing of the PFCS to date, includes a continuous endurance test of bellows and sensor operation amounting to approximately 350, 000 cycles over a continuous period from 08/09/96 to 10/29/96. The accumulated constant operational test time was 81 days.

Potentiometer Procurement Information

The part is procured by Sensor Flexonics, who is the subcontractor of United Technologies Hamilton Standard responsible for the accumulator. The potentiometer is procured to Sensor Flexonics drawing 88514 which requires the following tests:

RATIONALE Continued

1) Test to the requirements of MIL-R-12934
2) Screen all potentiometers as follows:

a) Temperature-Resistance IAW MIL-STD-202, Method 107, Test Condition B
b) Burn In: Operate at 100% of rated power dissipation (1.5 W) 1.5 hours on, 0.5 hours off at 250C. The resistance shall remain within the specified limits and shall change by no more than ±6%.
c) Load test: After screening for resistance temperature and burn-in, each unit shall be subjected to a load test to determine the acceptability of the bond joint of the forward and rear end caps. The forward end cap shall be subjected to a lateral force 17 lbs. The rear end chap shall be subjected to a (axial) force of 10 lbs.

In addition. There exist no known GIDEP, NASA Boeing, or supplier alerts against this product line. RSOP 13.7 describes Rocketdyne's automatic notification and tracking system for such alerts.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	6/28/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 28

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 1
7 September 1999	028	A	5A	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222429A	950S9018 PEHG 967S8023 PEHG-J HP3290 thru HP3293 PEHB/ PEHG FEU 987S7043, NCP	Payload Ethernet Hub Gateway/ Payload Ethernet Hub Bridge/NCP	All
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	3.4, 3.6	BF Goodrich	Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
The following parts are procured as commercial part.
FL1020 Ethernet 10baseT transformer/ Filter, Valor Electronics, San Diego Calif. This supplier is not an approved source.
Item is procured to supplier drawing FL1020.

RATIONALE: (use continuation pages if required)
Supplier would not accept SCD for quantities being procured. Supplier is commercially oriented and did not feel that a survey to military requirements would be productive. BF Goodrich was reluctant to develop a new source as 1) the parts were a standard component in IEEE 802.3 systems and it was anticipated that attempts to create a new design would compromise system operation. This condition was reported to the PCB in 1996 and approved. This item is resubmitted for formal documentation.
Parts are 100% screened with 5 thermal cycles and 3 temperature electrical test. No failures of the screened devices have been reported and only one unscreened device in the qualification ORU has been reported. Parts received and passed DPA. Qualification on a representative sample consisting of exposure to solder heat, extended thermal shock, life and functional test is being performed by BF Goodrich to assure life integrity. Formal qualification tests completed 8-31-99 with all samples passing. See comments below.

These ORU's are Criticality 3, Grade 2 application.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Ralph Grau	9/10/99	X		

EXCEPTION 28 (continued)

COMMENTS: (use continuation pages if required)
Qualification tests completed. All sample quantities indicated passed post test inspections. Tests per MIL-STD-202 unless otherwise indicated. Internal reference at BF Goodrich is Tracer #994090.

1) Pre qual electrical test- 24 samples per 6061-EP0146 with std 10BaseT test fixture
2) Resistance to soldering heat- 10 samples
3) Resistance to solvents- 4 samples
4) Solderability- 15 samples
5) X-ray analysis- 28 samples
6) 10 cycles thermal shock, -55C to +85C- 24 samples monitored for intermittance.
7) Humidity test 240 hours @ 90% RH- 24 samples
8) Burn-in, 240 hours @ 70C operation using functional test fixture of step 1- 24 samples
9) Post qual electrical test same as step 1- 24 samples.
10) 4 samples returned to stock, 24 samples exposed to environments placed in bonded stores.

Data on file @ Boeing Huntington Beach- Ref NSPAR GDS-0006

EXCEPTION 29

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
16 June 1999	0029	new	5A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222429A	950S9018 PEHG 967S8023 PEHG-J HP3290 thru HP3293 PEHB/ PEHG FEU	Payload Ethernet Hub Gateway/ Payload Ethernet Hub Bridge/NCP	All
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	3.4, 3.5.2	BF Goodrich	Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
The following parts are procured as commercial equivalent with Supplier MIL-STD-883B equivalent screening. Parts are
1) A1280A-CQ172B, Actel Corp.; FPGA
2) DP83932BVFB-MPC, National Semi; Ethernet Receiver Interface Controller
3) DP83950BVQB-MPC, National Semi; Ethernet Systems Oriented Network Interface Controller

RATIONALE: (use continuation pages if required)
Suppliers would not accept SCD for quantities being procured. Items 2) and 3) above were reported to the PCB in 1996 and accepted at that time. This exception is written to formally document this condition. National data sheets are written to address an avionics grade part as a COTS equivalent, and includes MIL-STD-883, level B screening and 5005 QCI periodic inspection. The data sheets were provided as part of the initial PCB submittal. National has not been cooperative in providing QCI data. All of the parts above have been used extensively in PEHG, PEHG derivatives, and other ethernet hub/ bridge products. No failures have been experienced with these devices during qualification or acceptance test at the ORU level. QCI data on lot has been received for 1280A lots and PIND is performed on all A1280's (not required on plastic National parts). DPA is performed on all 3 types above and have demonstrated good quality.
These ORU's are Criticality 3, Grade 2 applications.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	6/28/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 30

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE of
11 June 1999	0030	N/C	5A.1	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Janie Miernik 256 461-3670	Boeing HSV

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
683K28A	ME451-0009-1003	fuse 3 A	Fluid Systems Servicer

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	paragraph 3.18 "Non-conforming and non-compliant parts"	Bussmann (cage code 71400	Habitable: ☒ Non-Habitable: ☐

ISSUE DESCRIPTION: (use continuation pages if required)

One of the DPA fuses had flux residue on wire element. This condition is not screened for during manufacturing process or the acceptance test procedure, but is rejectable by MSFC-SPEC-1198, para 10.2.1.f. when seen during internal visual inspection of DPA.

RATIONALE: (use continuation pages if required)

See attachmented for rationale for the disposition "use-as-is, limited use", for this lot No. 71400L804E07. This fuse is used only in the FSS on ISS. Fuses from the suspect lot will be stored on the FSS for spares. The FSS is expected to see only about 50 hours of operation in ten years on ISS because it is support equipment and not nominally operated. The FSS is manually operated, only IVA, and the fuses are readily accessable. The disposition "Use-as-is Limited Use", will require that member of this lot be specially designated for use only in the FSS application.

RECOMMENDATION: Parts Control Board approve ME451-0009-1003 hardware "Use-as-is Limited Use", in accordance with SSP 30312, section 3.18.1.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Ralph Grau	6/28/99			

COMMENTS: (use continuation pages if required)

EXCEPTION 30 (continued)

Attachment

- Use of two fuses in the FSS design has been baselined since the beginning as being a simple and less expensive design solution.
- Two previously qualified fuses (shuttle) were selected.
- In DPA, 1 of 5 fuses had residual flux on the wire inside the sealed fuse.
- This is a rejectable condition due to the potential of wire corrosion and premature fuse burn-out.
- Flux is RMA type, 25% solids, with an R0L1 activity level
- R0L1 fluxes generally exhibit no measurable corrosion when subjected to the industry standard 7 day, extended temperature & humidity test
- The active ingredient of the RMA flux used is abietic acid; this is amildly acidic substance. Corrosion potential is low; but would increase at elevated temperatures. The FSS will experience very few, less than 50, hours of elevated temperatures in it's lifetime.
- The fuse is filled with an extremely dry (baked out) ground gypsum material, and hermetically sealed, resulting in a non-corrosive environment.
- The failure mode of a weakened fuse element is to open, resulting in a fail-safe condition
- The FSS is a portable item of IVA Orbital Support Equipment (OSE); no nominal operation. It has 50 hours expected use in 10 years; it is stowed unpowered the rest of the time.
- The FSS is not operated in a vacuum.

Fuse replacement is an easy procedure, and like all FSS operations it is manual. The FSS has a "spare fuse box" right on the unit which will hold 4 spare fuses.

EXCEPTION 32

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 3
7/23/99	0032[TBC4]	-		

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS		EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
See IDCR list attached	See IDCR list attached	Connector	See IDCR list attached
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSQ21636	Par. 3.4.3.2	ITT CANNON	Habitable: Non-Habitable: x

ISSUE DESCRIPTION: (use continuation pages if required)

EMI springs may have a bend radius that is too tight causing excessive stress concentrations when exposed to the specified qualification vibration levels. See SCAN 019A. Parts are acceptable for this application, even though they are not fully qualified to part-level specification as required by SSP 30312, paragraph 3.5.1.

RATIONALE: (use continuation pages if required)

Engineering reviewed vibration test data supplied by ITT Cannon for connectors installed with the non-conforming EMI springs:

1. The test data indicates the springs perform up to a stress level of 25.3 g rms.
2. The Z1 and P6 qualification stress level is 13.1g rms as specified in RC1800* and RJ00122* for components with a mass less than 25 lbs. housed within ORU's.
3. An "Exception to SSP30312" is justified since the test data provided by the ITT Cannon indicates the connector performance level of 25.3g rms is well above the Space Station qualification stress level of 13.1g rms.

*Space Station Specifications

RC1800 ..... General Specification, Procured Items (Boeing North American)
RJ00122 .... General Specification, Designed Items

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By Madhu C. Rao	7/27/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 32 (continued)

Element	Cable Box Assy.	Cable Box No.	Cable Box S/N	Location	Connector P/N
IDCR 1224715					
P4-IEA	R077666-11	CB1	8837186	Harvard	NRP6E1A1107SD
S4-IEA	R077666-11	CB1	8837187	Harvard	NRP6E1A1107SD
P4-IEA	R078510-11	CB4	8834914	Harvard	NRP6E1A1107SD
S4-IEA	R078510-11	CB4	8834915	Harvard	NRP6E1A1107SD
P6-IEA	R071752-31	CB5	8821796	KSC	NRP6E1A1107SD
S6-IEA	R071752-31	CB5	8821797	Harvard	NRP6E1A1107SD
P6-IEA	R071753-31	CB6	8821799	KSC	NRP6E1A1107SD
S6-IEA	R071753-31	CB6	8821800	Harvard	NRP6E1A1107SD
P6-LS-FLT	R071814-11	W05	8830811	KSC	NRP6E1A1107SD
Z1	R076331-1	W38	8722698	KSC	NRP6E1A1107SD
IDCR 1224716					
P4-IEA	R077666-11	CB1	8837186	Harvard	NRP6E1A1108SB
P4-IEA	R078510-11	CB4	883494	Harvard	NRP6E1A1108SB
P6-IEA	R071752-31	CB5	8821796	KSC	NRP6E1A1108SB
P6-IEA	R071753-31	CB6	8821799	KSC	NRP6E1A1108SB
S4-IEA	R077666-11	CB1	8837187	Harvard	NRP6E1A1108SB
S4-IEA	R078510-11	CB4	8834915	Harvard	NRP6E1A1108SB
S6-IEA	R071752-31	CB5	8821797	Harvard	NRP6E1A1108SB
S6-IEA	R071753-31	CB6	8821800	Harvard	NRP6E1A1108SB
IDCR 1224719					
P4-IEA	R077666-11	CB1	8837186	Harvard	NRP6E1A116SA
P4-IEA	R078510-11	CB4	8834914	Harvard	NRP6E1A116SA
P6-IEA	R071752-31	CB5	8821796	KSC	NRP6E1A116SA
P6-IEA	R071753-31	CB6	8821799	KSC	NRP6E1A116SA
S4-IEA	R077666-11	CB1	8837187	Harvard	NRP6E1A116SA
S4-IEA	R078510-11	CB4	8834915	Harvard	NRP6E1A116SA
S6-IEA	R071752-31	CB5	8821797	Harvard	NRP6E1A116SA
S6-IEA	R071753-31	CB6	8821800	Harvard	NRP6E1A116SA
IDCR 1224720					
P4-IEA	R077666-11	CB1	8837186	Harvard	NRP6E1A116SC
P4-IEA	R078510-11	CB4	8834914	Harvard	NRP6E1A116SC
P6-IEA	R071752-31	CB5	8821796	KSC	NRP6E1A116SC
P6-IEA	R071753-31	CB6	8821799	KSC	NRP6E1A116SC
S4-IEA	R077666-11	CB1	8837187	Harvard	NRP6E1A116SC
S4-IEA	R078510-11	CB4	8834915	Harvard	NRP6E1A116SC
S6-IEA	R071752-31	CB5	8821797	Harvard	NRP6E1A116SC
S6-IEA	R071753-31	CB6	8821800	Harvard	NRP6E1A116SC

EXCEPTION 32 (continued)

Element	Cable Assy.	Cable No.	Cable S/N.	Location	Connector P/N
IDCR 1224722					
P6-LS-FLT	R078523-11	W19	8830799	KSC	NRP6E1A124SA
IDCR 1224714					
P6-LS-FLT	R073812-11	W03	8830803	KSC	NRP6E1A1107SB
Z1	R076315-1	W18	8822679	KSC	NRP6E1A1107SB
Z1	R076361-1	W201	8827100	KSC	NRP6E1A1107SB
IDCR 1224717					
Z1	R076309-11	W11	8829360	KSC	NRP6E1A115SA
Z1	R076314-1	W17	8822672	KSC	NRP6E1A115SA
IDCR 1224718					
P6-LS-FLT	R073813-11	W04	88330804	KSC	NRP6E1A115SC
Z1	R077170-1	W07	8827216	KSC	NRP6E1A115SC
IDCR 1224721					
Z1	R071802-1	Wave Guide	N/A		NRP6E1A117SC
IDCR 1224708					
Z1	R076313-1	W15	8822671	KSC	NRP6E1A103SD

EXCEPTION 33

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
26 July 1999	0033	new	3A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach Allied Signal/ Teterboro NJ

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
222007A	5157511-4 Generic FM08-4-125	Fuse	5080097-1 Control Moment Gyro
SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	3.8.1	Allied Signal Teterboro, NJ.	Z1 Truss

ISSUE DESCRIPTION:
Fuse overstress condition-- Fuse rated for 4.0 amp @ 32 Vdc and 125 Vac. Application is in a 120 Vdc (maximum voltage internal to the CMG) circuit in vacuum. NASA Alert NA-045-V indicates under conditions of high voltage DC voltage and vacuum that FM08 style fuses may arc and continue conducting under specific conditions. Loss of fusing function would allow secondary failures to propagate to CMG Electronic Assembly "H" bridge transistors and CMG motor assembly. Repair on-orbit might require that the CMG end item level be replaced rather than just the Electronic Assembly level.

RATIONALE:
There are no safety issues as rotor overspeed protection is still in place and there is no fire potential (vacuum environment). The RPCM is self protected at 12.5 Adc. This fact may protect the CMG motor assembly as the Internal resistance will not allow current to exceed 20 A and 38 mS until the RPCM reacts. If failure should occur 3 of 4 CMG's provide adequate ISS system function until repair.

Effective correction for fuse overstress may require CMG recall, redesign, rework and requalification of CMG at high cost and schedule impact. Detail design and experiment have not been conducted to establish either new detail requirements or whether or not the current design may work.

Recommendation for use as is based on low failure probability (internal current sense circuitry MTBF is 3167 years), potential high cost and schedule impact, and no critical safety issues. The fuse function works during ground testing.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	8/6/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 35

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
25 August 1999	0035	N/C		PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Seak Lee 818-586-3960	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
	F015804-0A01	Microcircuit	DDCU
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
015804	Paragraph 4.8.3 & 4.8.5 (Screening & QCI)	Harris	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)
Read and Record data for Screening and QCI are missing from archive.

RATIONALE: (use continuation pages if required)
Although Read and Record data for Screening and QCI are missing from archive, There is evidence that Loral had received, reviewed and approved the data package. In addition, there is a complete DPA report for that lot, and a D level parts with a latter data code has also been procured with all proper data attached. The risk of not having the actual data is mitigated by the fact that the subject P/N is produced by a Qualified Manufacturer's Line (QML) manufacturer

The lack of Read and Record data became known to Rocketdyne after the required 5-year data retention period for the manufacturer.
In addition, there exist no known GIDEP, NASA, Boeing, or supplier alerts against this manufacturer since 1990. RSOP 13.7 describes Rocketdyne's automatic notification and tracking system for such alerts.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Ralph Grau	9/10/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 36

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
14 September 1999	0036	N/C	5A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
High Rate Modem(HRM)- (Part of Communication And Tracking Hardware)	Ali Lakhani(714) 896-3311, x1419	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	NEXT ASSEMBLY(s)	PART NUMBER	DESCRIPTION
222017A	ISS	24-P24311NXXX Date Code 9324A	Coil, Fixed, Radio Frequency, Molded, Microminiature

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph 3.5	American Precision Industries, Delevan Division	Habitable: Non-Habitable: X

ISSUE DESCRIPTION: (use continuation pages if required)

This part is used by Motorola (Subcontractor to L3 Communication) in the High Rate Modem (HRM), which is part of the Communication and Tracking Hardware. Motorola can not locate the QCI (Quality Conformance Inspection) data package.

A program exception is requested to allow use of this part.

RATIONALE: (use continuation pages if required)

This part was approved via NSPAR SS2-5-1-MMMO-0059D. During Motorola's EEE parts verification audit , QCI data packages were made available for all other nonstandard parts, which indicates that the Space Station requirements were complied with as a matter of policy and that the QCI data package in question was simply misplaced. The date code on these parts is 9324A which exceeds the required 5-year data retention period for the manufacturer.

The part is manufactured to an approved MIL-C-39010 line by QML supplier. In addition there is o known GIDEP, NASA, Boeing alerts or SCANS against this part.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Madhu C. Rao	9/17/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 38

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE of
	0038		6A	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
C&T/IVS	Mike Delmas (256)461-2884	

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
683-51020-001	NA	Video Tape Recorder	MSS Rack

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	3.2.3.1	Boeing-Hsv	Habitable: ☒ Non-Habitable: ☐

ISSUE DESCRIPTION: (use continuation pages if required)

The following grade 2 parts are used within the VTR. Per the referenced requirements, positive particle control provisions for these parts are required. In addition, the requirement and assurance methods are required to be documented in a procurement drawing (SCD).

The VTR is an approved application for grade 2 parts. However, the following parts were procured as standard parts (I.e. The parts were not procured to an SCD.), and were not subject to positive conductive control provisions (PIND).

Part Number	Nomenclature	Used On	
5962-9309001HXX	+/- 15 Volt DC-DC Converter	Interface Control Card	
JANTXV2N2222A	Transistor, NPN, Switching	Interface Control Card	
JANTXV4N49	Opto Electronic Coupler	Interface Control Card	
M38510/13503BPX	Op-Amp	Interface Control Card	
M38510/65202BCX	Quad 2-Input XOR	Interface Control Card	Note 1
M38510/65305BEX	CMOS, Dual J-K Flip Flop	Interface Control Card	
M38510/65701BCX	CMOS, Hex Inverter	Interface Control Card	Note 1
M38510/10706BYX	Voltage Regulator, 5 Volt	Power Supply Card	

Note 1) This part will be replaced in upgrading the -1 Circuit Card Assembly to a -3 Assembly. This part will stay on the PL because the -1 assembly has already been manufactured. The upgrade is planned to occur in October 1999.

RATIONALE: (use continuation pages if required)

The VTR is composed of three major electronic assemblies. The TEAC V-80AB-F off-the-shelf (OTF) video recorder, the Power Supply Circuit Card Assembly, and the Interface Control Circuit card Assembly. The Power Supply and Interface Control circuit card assemblies were subjected to power on vibration and thermal cycle tests. In addition, the grade 2 components received lot sample PIND tests. The pedigree of the parts identified above surpasses the pedigree of the parts used within the TEAC OTF recorder. Attached is a partial listing of the parts used within the TEAC OTS recorder.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Ralph Grau	10/20/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 39

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	

	0039		6A,UF2,	PAGE of

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
MSS	Henry L. Williams	CSA/T&AM

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
See next page	See next [page	See next page	See next page

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP-30312	B.3.5.2		Habitable: ☐ Non-Habitable: ☐

ISSUE DESCRIPTION: (use continuation pages if required)

20 AWG wire is used in a circuits that are protected upstream by a 25 AMP short circuit fault protection device, and also protected downstream by a protective device within the single connected load. In question is the acceptance of this design for adequate protection of the 20 AWG cable, and whether any ‘smart’ or ‘soft’ short circuit failures before the downstream protective device are credible. Max rating for a 20 AWG wire is 6.5 AMP per SSP 30312, Rev.F, B 3.5.2 wire and cable derating criteria.

RATIONALE: (use continuation pages if required)

(1) In the ACU, JEU, LEU, VDU, and VSC, a solid state overload protection circuit, a built-in design feature, will permit a maximum input current of 150 percent of each respective unit’s nominal current.

(2) Should there be a short circuit in components upstream of the protection in (1) above (i.e. in EMI filters, heaters, thermostats, or input connectors), RPCA will limit the available current to a maximum of 30A and will clear the fault in 38 msec. The 20 AWG wire will not be damaged since it takes approximately 5 seconds for the wire temperature to rise from 75 to 200 degrees C (wire rated temperature) at this level of current. If a smart short were to occur, the wire insulation would exceed the 200^{0}C maximum temperature rating.

(3) Numerous types of controls used in the manufacture, inspection, and test (e.g. “MEGGAR”, “HIPOT”) of cable harnesses make the risk of any cable harness failure extremely low. In particular, soft shorts (“smart” shorts) within the cable harness are non-credible failures.

The Safety organization did not agree with the Parts Control Board approval of this exception. The Safety Organization has presented this issue to the ISS Safety Review panel for review and acceptance.

Attachments: 20 AWG wire Analysis, VSC protection circuit, FMEA

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curt Tallman	Original Signed By Ralph Grau	10/15/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 39 (continued)

Drawing numbers to fill in Exception Report heading

	End Item/ Config. ID No	Wire Harness/ Part Number	Description	Next Assembly
Definitions	1	2	3	4
VSC (Note 1)	51618-1007	51618-1007	Cable Harness Assembly	51618-1007
ACU	51612-1001-1	51612-3011	SSRMS Boom Cable Harness Assembly	51612-3001-1 51612-3009-1 51612-3110-1
JEU	51612-1001-1	51612-2505	SSRMS Joint Harness Assembly	51612-2030-1 (Pitch/Roll) 51612-2030-3 (Yaw)
LEU	51612-1001-1	51612-4017	SSRMS LEE Cable Harness Assembly	51612-4000-1
VDU (on LEE)	51612-1001-1	51612-4017	SSRMS LEE Cable Harness Assembly	51612-4000-1
VDU ORU (on Boom)	51612-1001-1	51612-3011	SSRMS Boom Cable Harness Assembly	51612-3003-1 51612-3009-1 51612-3110-1

Definitions used:

1 Part number/drawing for delivered End Item/System
2 Source Control Drawing that contains info about wire gauge, cable lengths, etc
3 Title of SCD in column 2
4 Next assembly drawing for SCD in column 2

Note 1: All information pertaining to VSC cable harness, assembly, end item, etc are on a

EXCEPTION 40

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)
10/29/99	0040	-	4A

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Paul Lockwood 818-586-7155	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
BCDU / RE1807-03	Mil-C-39003/10-xxxx (see attached list on Pages 2 & 3)	Capacitor	See attached list

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Appendix B, para B 3.1.1, note (1)	KEMET	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

Forty-one (41) solid tantalum capacitors are used in BCDU power supply applications. SSP30312 Appendix B, paragraph B 3.1.1, note (1), requires Parts Control Board approval of this type of application.

Seven (7) of these capacitors are located in five (5) circuits that do not provide the 1 ohm/volt minimum effective series resistance required by SSP30312. These capacitors are listed at the top of Table I, herein.

RATIONALE: (use continuation pages if required)

The use of solid tantalum capacitors in circuits with less than 1 ohm/volt series resistance has been investigated by KEMET, the capacitor manufacturer, along with ISS Design Engineering, Reliability Engineering, and EEE Parts Engineering.

The ISS team findings are summarized in memo 3UV600-RA-97-003 Rev A (copy attached). They find sufficient margin in KEMET's surge current testing results to endorse applications where 0.1 ohm/volt effective series resistance (ESR) exists. They surmise that the 1 ohm/volt requirement originated early in tantalum capacitor manufacture, and is too conservative for today's parts. KEMET has improved their manufacturing processes, surge current testing, scintillation testing, and life testing to effectively allow a 0.1 ohm/volt rating for current surges. ISS Reliability Engineering found that in the five worst cases in BCDU, the MTBF would only change 1.4 hours @<3 ohms/volt ESR.

Specific details may be found in attached documents:

...9/15/97 PCB AIT Memo: PCB Response for CSS Tantalum Caps Usage (attached page 4)
...7/30/97 ISS EEE Parts & Reliability Memo: Justification for using CSS solid tantalum capacitors in power supply application (attached page 5)
...6/3/97 Templeman memo 3UV600-RA-97-003 Rev A: BCDU Solid Tantalum Capacitor Usage Recommendation (attached pages 6-11)
...KEMET Engineering Bulletin, Effects of High Current Transients on Solid Tantalum Capacitors (attached pages 12-15)

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER
Original Signed By Curtis Tallman	Original Signed By David Beverly	11/23/99	X	

EXCEPTION 40 (continued)

PART NUMBER	VALUE	ASSEMBLY	QTY	MODULE	REF	CIRCUIT TYPE	CALC SURGE CURRENT	EFF SERIES OHM/VOLT	COMMENTS
M39003/10-2044S	6.8uF, 10%, 35V	E041989-01	1	RBI	C4	Pos. FET Gate Drive	9.2A	0.11	High Surge Current, 1.3 Ohm limiting resistor, 0.65 Ohm/V
M39003/10-2086S	4.7uF, 10%, 50V	E040465-01	1	FI	C55	Pos. Gate Drive for SuperFET, 12V	5.76A	0.175	High Surge Current, 0.3 Ohm limiting resistor, 0.2 Ohm/V
M39003/10-2086S	4.7uF, 10%, 50V	E040465-01	1	FI	C6, C7, C8	Neg. Gate Drive for SuperFET, 1.5V	5A	0.2	100 mH choke limits inrush current to 90 mA for first 1.5 ms
M39003/10-2086S	4.7uF, 10%, 50V	E041989-01	1	RBI	C13	LM117 Output, 5V	1.8A	0.56	Input to LM117 is 12VF. Limiting inductor is only 104 uH. LM117 Current limit is 1.8A, which gives 0.56Ohm/V
M39003/10-2044S	6.8uF, 10%, 35V	E041989-01	1	RBI	C6	Neg. FET Gate Drive	3.1A	0.65	dV/dT=4000, added 10% for part tolerance
M39003/10-3090S	10uF, 10%, 50V	E041429-01	3	DC/DC	C55	Discharge thru FET & 10 Ohms	0.728A	1.37	Real Series Resistor, 7.28V could be discharged to Gnd, max discharge current is 7.28/10=0.728A
M39003/10-2049S	47uF, 10%, 35V	E041697-01	2	DC/DC	C6, C7, C8	-15V Output Filter	0.43A	2.33	dV/dT=8300, added 10% for part tolerance
M39003/10-2049S	4.7uF, 10%, 35V	E041947-01	1	FI	C2	-15V Input Filter	0.429A	2.33	dV/dT=2500, Added 10% for part tolerance
M39003/10-2049S	47uF, 10%, 35V	E041505-01	1	RBI	C2	-15V Input Filter	0.429A	2.33	dV/dT=2500, Added 10% for part tolerance
M39003/10-3090S	10uF, 10%, 50V	E041709-02	1	DC/DC	C20	HK2 Filter on 15V Bias	0.293A max	3.4	51.1 Ohm series R
M39003/10-2121S	15uF, 10%, 75V	E041697-01	1	DC/DC	C10, C11	30V Output Filter	0.22A	4.55	dV/dT=13.3K, added 10% for part tolerance
M39003/10-2049S	4.7uF, 10%, 35V	E041947-01	1	FI	C1	15V Input Filter	0.206A	4.8	dV/dT=8300, added 10% for part tolerance
M39003/10-2049S	47uF, 10%, 35V	E041505-01	1	RBI	C1	15V Input Filter	0.206A	4.8	dV/dT=8300, added 10% for part tolerance
M39003/10-2049S	47uF, 10%, 35V	E041697-01	3	DC/DC	C2, C3, C4	15V Output Filter	0.206A	4.84	dV/dT=4000, added 10% for part tolerance
M39003/10-2049S	4.7uF, 10%, 35V	E041947-01	1	FI	C3	5V Input Filter	0.129A	7.7	High Surge Currrent, 2.08 Ohm limiting resistor (0.3 + 1.78 in SuperFET Gate); 0.175 Ohm/V
M39003/10-2049S	47uF, 10%, 35V	E041505-01	1	RBI	C3	5V Input Filter	0.129A	7.7	dV/dT=4000, added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E040465-01	1	FI	C11	12V FI Filter	0.112A	8.9	dV/dT=4000, added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E042007-01	1	FI	C2	-15V Input Filter	43mA	23	dV/dT=2500, Added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E041515-02	1	HTRSW	C9	-15V Input Filter	43mA	23	I=Cd/dT, dV=5V, dT=3 ms
M39003/10-2086S	4.7uF, 10%, 50V	E041985-01	1	RBI	C2	-15V Input Filter	43mA	23	dV/dT=8300, added 10% for part tolerance
M39003/10-3111S	2.2uF, 10%, 75V	E040406-02	1	DC/DC	C8	30V Output Filter	32mA	31	dV/dT=4000, added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E042007-01	1	FI	C1	15V Input Filter	21mA	48	dV/dT=8300, added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 10V	E041515-02	1	HTRSW	C6	15V Input Filter	21mA	48	dV/dT=8300, added 10% for part tolerance

EXCEPTION 40 (continued)

Part Number	VALUE	ASSEMBLY	QTY	MODULE	REF	CIRCUIT TYPE	CALC SURGE CURRENT	EFF SERIES OHM/VOLT	COMMENTS
M39003/10-2086S	4.7uF, 10%, 50V	E041985-01	1	RBI	C1	15V Input Filter	21mA	48	dV/dT=4000, added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E041532-01	1	BILAT	C17	Card Input Filter, 15V	18.8mA	53.2	dV/dT=4000
M39003/10-2086S	4.7uF, 10%, 50V	E042007-01	1	FI	C3	5V Input Filter	13mA	77	I=CdV/dT, dV=5V, dT=3ms
M39003/10-2086S	4.7uF, 10%, 50V	E041985-01	1	RBI	C3	5V Input Filter	13mA	77	dV/dT=2500, Added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E041429-01	1	BILAT	C2	LM117 OUTPUT, 5V	7.8mA	128	I=CdV/dT, dV=5V, dT=3ms
M39003/10-2086S	4.7uF, 10%, 50V	E041796-01	1	BILAT	C1	LM117 Output, 5V	7.8mA	128	I=CdV/dT, dV=5V, dT=3ms
M39003/10-2086S	4.7uF, 10%, 50V	E042007-01	1	FI	C21	LM117 Output 5V	7.8mA	128	I=CdV/dT, dV=5V, dT=3ms
M39003/10-3010S	4.7uF, 10%, 50V	E040465-01	1	FI	C14	LM117 Output, 5V, 12V FI is input	7.8mA	128	dV/dT=4000, added 10% for part tolerance
M39003/10-2086S	4.7uF, 10%, 50V	E041515-02	1	HTRSW	C10	LM109 Output, 5V	7.8mA	128	High Surge Current, 1.3 Ohm limiting resistor, 0.11 Ohm/V
M39003/10-3018S	220uF, 10%, 10V	E041704-01	4	DC/DC	C2-C5	5V Output Filter	1ma max	1000	dV/dT=294

EXCEPTION 42

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)
	042		3A

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
	Seak Lee 818-586-3960	Boeing Rocketdyne

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
3R070135		PCU EMI Filter	

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP30312	4	Boeing	Habitable: ☒ Non Habitable: ☒

ISSUE DESCRIPTION: (use continuation pages if required)
The following components fail the derating critera on the PCU EMI Filter:

Ref DES	Part Number	Description	Parameter	Actual Stress	Rated Value	Stress Ratio	SSP30312 limit
C1	RM2485	Capacitor	V	130	200	0.65	0.6

RATIONALE: (use continuation pages if required)
C1 does not meet derating by 10 volts. However, the parts was tested by the manufacturer at 500 volts, which is 2.5 times the rating of 200 volts. There is no problem even operating C1 at 140V, which puts the stress level at 70%, but still leaves a 30% margin. The next higher rated capacitor would be too large to fit in the space allocated for C1. A voltage stress of 65 % will not effect the life of the part. It will have some effect on the failure rate calculation because the voltage stress level is part of the equation, but the difference is very minimal.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER
Original Signed By Curtis Tallman	Original Signed By David Beverly	12/9/99	X	

COMMENTS: (use continuation pages if required)

EXCEPTION 43

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE1 of 1
	043		3A	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
	Seak Lee 818-586-3960	Boeing Rocketdyne

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
3R076426		PEU PS #2	

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP30312	4	Boeing	Habitable: ☒ Non-Habitable: ☒

ISSUE DESCRIPTION: (use continuation pages if required)
The following components fail the derating critera on the PCU EMI Filter:

Ref DES	Part Number	Description	Parameter	Actual Stress	Rated Value	Stress Ratio	SSP30312 limit
L3	RM3625	Inductor	V	850	1683	0.505	0.5

RATIONALE: (use continuation pages if required)

L3 does not meet derating by 17 volts out of 1683 volts or 1%. L3 is only excerised during ignition of the Zenon gas for 100 μsec, and this only happen once every two years. During testing of the PEU the pulse was 800 volts maximum, which meets the derating requirements. Magnetics components are typically designed to operate at their using voltage plus a margin of 10%. Therefore, a voltage derating of 50% provides a safe margin. The voltage derating is to ensure that the insulation breakdown rating has margin. This rating depends on the materials used in construction, which includes the insulating material. The maximum operating temperature is the most critical derating, not the voltage or current, L3 is rated for 130 degree C, and is operated at 93 degree C in the ORU, which gives it a 72% derating, and the requirement for SSP30312 is 75%. Operating L3 at 800-900V with a voltage rating of 1683V is not a problem. It will not effect life of the part or reliability.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	12/9/99	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 44

SUBMITTAL DATE	EXCEPTION NO.	REV.
7 December 1999	044	New
SYSTEM	**ORIGINATOR and PHONE NO.**	**ORGANIZATION / CONTRACTOR**
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach
END ITEM/CONFIG. ID NO.	**WIRE HARNESS/PART NUMBER(s)**	**DESCRIPTION**
222070A	P/N C16C0001-1 End Item= 1F03046-1	CETA Luminaire
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**
SSP 30312	3.5.1	Boeing St. Louis

ISSUE DESCRIPTION: (use continuation pages if required)
Qualification not completed on right angle high voltage connector. This exception is to allow use of assembly level qualification and acceptance vibration to be used in lieu of completion of this qualification testing.

• History- Dynamic tests were ordered by PO. Testing was halted prior to commencement of dynamic test, random vibration and shock. Due to personnel changes at supplier the test deficiency was overlooked, misreported as complete and not discovered until Boeing review at completion of block 11 data on the NSPAR.

Part level qualification test for the dynamic environments was restarted. Tests conducted per the drawing at an outside lab resulted in 1 failure of 5 units. Dielectric breakdown was found resulting from a cracked dielectric boss in the connector.

• During assembly at St. Louis is was discovered that over torqued connections were found to be subject to dielectric breakdown resulting from cracking in the same location as the failure noted above. The failure mechanism was found to be related due to the fact that o-ring squeeze out resulted in a side load of the boss resulting in direct cracking or cracking due to assembly side load. Corrective action by Boeing was to return the parts to the supplier for retesting and to restrict the assembly torque to approximately 1 inch-pound. No failures have been noted in any high voltage connector since implementation of the noted controls. No cracked parts have been found to pass dielectric breakdown.

• Only one other random failure has been observed in this part. One part did fail after 2 minutes and 50 seconds at 10K volts DC. The cracking noted was not in the same location or type as observed above but resulted from dielectric heating as a result of the arc. This connector had not been subjected to any environments. No failures have been experienced in the other 5 high voltage connector styles manufactured by the supplier Reynolds Industries using this same technology and used in the CETA and Video Luminaires.

RATIONALE: (use continuation pages if required)
• Parts tested at the supplier were tested to the MIL spec without review of the ISS environments. Parts were subjected to 41.7 Grms random vibration and 300 G shock test. It is not known which environment caused the failure. Parts were torqued to as much as 3 inch-pounds and cable ties were at 8 inches (per MIL-STD-1344)

Assembly level qualification was conducted at 8.6 Grms random vibration input to the box. No shock requirement. The actual levels to the 4 connectors installed ranged from 19 grms to 25.2 grms depending on axis. Cable ties were at 2 inches.

A total of 28 connectors have been accepted at 6.1 grms for flight acceptance tests using the controlled torque settings cited above.

Due to the fragility of the lamps the CETA Luminaires will be launched in the shuttle lockers where maximum expected vibration levels are expected to be 2.5 grms.

Due to the test experience above it was determined that completion of a revised vibration test more closely simulating the ISS environment was not in the best interests of the program. Little is to be gained by conducting small sample tests at the supplier at this late date as the parts have passed at the levels of interest with suitable margin.

(Continued next sheet)

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE
Original Signed By Curtis Tallman	Original Signed By David Beverly	1/21/00	X

COMMENTS: (use continuation pages if required)

EXCEPTION 44 (continued)

Rationale: Continued.

• The one dielectric failure has no bearing on the mechanical cracking failure mode noted during assembly as the failure mode has been viewed as a primary dielectric failure. Visual appearance is much different and cracking is not in the high mechanical stress area as the other failures. This again is the only failure noted for over 100 parts using this design/ dielectric system. (Exclusive of parts determined to be due to over torque.) Failure occurred at 10 KVdc at a simulated altitude of 70 Kfeet near the 3 minute point specified for this test. Actual application sees 6 KV for 1 uS at less than a 1% duty cycle in a vacuum. These conditions provide more enough margin and derating from the test condition/ rating imposed.

• As to why the connector did not meet the mil spec requirements imposed, the reasons after review to the picture below and discussions with the supplier indicate that 1) the right angle configuration restrains the lateral movement of the dielectric. No failure has been noted in the straight configuration connectors, 2) The o-ring volume allows squeeze out to side load the boss on the receptacle end which in turn drives contact with the plug end dielectric to provide a fulcrum for the bending force to be applied. Removal of the o-ring allows torque settings down to full metal to metal contact without damage to the dielectric. 3) the diallyl phthalate dielectric while having excellent dielectric properties is very brittle and has little impact resistance. Supplier indicates that if the problem had been found in 1996 that design changes would have been feasible. At this stage however the handling/ installation procedures incorporated by Boeing St. Louis must be continued to provide adequate functionality as redesign rework at this point would adversely affect program cost and schedule.

EXCEPTION 45

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
10 January 2000	0045	N/C	8A	**PAGE 1 of** 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
Electrical Power System (EPS)	Jerry Arnett(714) 896-3311, x7-0235	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY (s)
222200A	W4011/1F75130-1 W4012/1F75132-1 W4014/1F75136-1 W4015/1F75138-1 W4019/1F75144-1	Wire Harnesses	ISS

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Paragraph B.3.5.2	Boeing-HB	Habitable: Non-Habitable: **X**

ISSUE DESCRIPTION: (use continuation pages if required)

The Electrical Power System (EPS) team has identified the case (in the memo A3-J093-RTS-M-9900659, dated 10 September 1999) where MBSUs could source 64 amps through 4 gauge power wire. The SSP 30312 derated wire bundle values for 4 gauge wire range from 40.50 amps to 60.75 amps dependant on the maximum wires in a harness. This would be for the no fault condition.

During a fault condition, an analysis (A3-J093-RTS-M-9901434) showed that the following items exceed the SSP 30312 130% requirements: RPCM-S0-1A, RPCM S0-2B, RPCM S0-3A, RPCM S0-4B, MBSU 4A 4B Heater, SPDA S0 OPNL Heater, TUS-1 IMCA-2, TUS-1 VSC 1, TUS VSC Heater, SSMDM S0-1, GPS Ant Assy-1 Heater-1.

A program exception is requested to allow these overcurrent conditions to exist since all these conditions meet the requirements of NSTS 18798-A.

RATIONALE: (use continuation pages if required)

The request for an exception to SSP 30312 requirements for this case is justified because this meets the NSTS 18798-A wire rating requirements.

Recommendation: Parts Control Board approve the use of these wire harnesses in accordance with SSP 30312, Section 3.18.1

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	2/4/00	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 46

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
1/18/00	0046	-	4A	**PAGE 1 of 1**

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Paul Lockwood 818-586-7155	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
PFCS / R073433-11	F015442-0A02	Microcircuit, Linear, low noise precision inst amp	SV809963 SCI Sig Cond & SV823074 HCU Sig Cond PCBs
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Appendix B, para B.3.2.6, supply voltage	Analog Devices	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

In twelve (12) locations on the PFCS SCI Signal Conditioning and Heater Control Unit Signal Conditioning circuit boards, the worst-case maximum power supply voltage is 15.75v (15volts±5%) SSP30312 requires derating to 80% of the manufacturer-specified 18v supply voltage, or 14.4v.

RATIONALE: (use continuation pages if required)

Hamilton Standard submitted the following rationale for the use of these parts:

"These integrated circuit instrumentation amplifiers provide the signal conditioning for the PFCS temperature and pressure sensors. They are being used instead of standard operational amplifiers in an effort to save weight and volume. No industry available instrumentation amplifiers have voltage supply ratings greater than 18vdc. AMP01 (015442) devices were selected to maintain EEE part commonality with other space station hardware suppliers.

"(SSP30312) derates differential amplifier supply voltage to 80% of the maximum rating. This would allow no more than ±14.4vdc for the AMP01 (015442) devices. To reduce PFCS weight and volume, one DC/DC converter provides power to both the LDI (BFE hardware) and signal conditioning circuitry. The LDI requires ±15vdc, therefore, the AMP01 instrumentation amplifiers are also supplied with ±15vdc.

"A supply voltage of ±15vdc is the operating condition recommended by the component manufacturer. Including supply voltage tolerance (±5%, worst case over life), this is only 87.5% of the component's maximum rated value. A design change to fully meet the requirements of (SSP30312) would require adding additional circuitry to the SCI signal conditioning board."

Worst case thermal operating conditions are not an issue. Application analysis reveals a worst-case temperature of 64°C, against a rating of 125°C.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	1/21/00	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 47

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
1/18/00	0047	-	4A	PAGE 1 of 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Paul Lockwood 818-586-7155	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
PFCS / R073433-11	D015875-0A01	Microcircuit: linear variable differential transformer signal conditioner (AD598)	SV809963 SCI Signal Conditioning PCB

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	Appendix B, para B.3.2.6, supply voltage	Analog Devices	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

In tw0 (2) locations on the PFCS SCI Signal Conditioning circuit board, the worst-case maximum power supply voltage is 15.75v (15volts±5%) SSP30312 requires derating to 80% of the manufacturer-specified 18v supply voltage, or 14.4v.

RATIONALE: (use continuation pages if required)

Hamilton Standard submitted the following rationale for the use of these parts:

"This integrated circuit provides both excitation and signal conditioning for the PFCS VPI and delta-pressure sensors. It is being used instead of discrete components and operational amplifiers in an effort to save weight and volume.

"(SSP30312) derates differential amplifier supply voltage to 80% of the maximum rating. This would allow no more than ±14.4vdc for the AD598 (015875) devices. To reduce PFCS weight and volume, one DC/DC converter provides power to both the LDI (BFE hardware) and signal conditioning circuitry. The LDI requires ±15vdc, therefore, the AD598 (015875) integrated circuit is also supplied with ±15vdc.

"A supply voltage of ±15vdc is the operating condition recommended by the component manufacturer. Including supply voltage tolerance (±5%, worst case over life), this is only 87.5% of the component's maximum rated value. A design change to fully meet the requirements of (SSP30312) would require adding additional circuitry to the SCI signal conditioning board."

Worst case thermal operating conditions are <u>not</u> an issue. Application analysis reveals an actual temperature of 63.3°C, against a rating of 125°C.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	1/21/00	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 48

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
1/24/00	0048	-	4A	**PAGE 1 of** 2

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Paul Lockwood 818-586-7155	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
SSU / E039875-03	M39003/10-XXXX (See page 2)	Capacitor, Fixed, Electrolytic, Tantalum, ER	See Page 2
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Appendix B, para B 3.1.1, note (1)	Kemet	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

Thirty-six (36) solid tantalum capacitors are used in SSU power supply applications. SSP30312, Appendix B, paragraph B 3.1.1, note (1), requires Parts Control Board approval for this type of application.

RATIONALE: (use continuation pages if required)

The attached table shows the capacitor part numbers and circuit application details.

Circuit voltages meet the 50% derating factor required by SSP 30312.

In all cases, there is a minimum effective series resistance of 5 ohms per volt or more. This exceeds the 1 ohm per volt minimum imposed by SSP30312.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	1/28/00	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 48 (continued)

PART NUMBER	VALUE	ASSEMBLY	QTY	MODULE	REF	CIRCUIT TYPE	CALC SURGE CURRENT	EFF SERIES OHM/VOLT	COMMENTS
M39003/10-2119S	10.0 uF, 10%, 75v	E040103-01, 02	2	Ramp Gen.	C1, C101	+30V Filter Cap	0.2	5	
M39003/10-2119S	10.0 uF, 10%, 75v	E040050-01	3	PVCE 1	C52 - C54	+30V Filter Cap	0.06	16.7	
M39003/10-2119S	10.0 uF, 10%, 75v	E040085-01 to -10	2	8-String	C1, C101	+30V Filter Cap	0.06	16.7	
M39003/10-2049S	47uF, 10%, 35v	E040103-01, 02	2	Ramp Gen.	C6	+15V Filter Cap	0.94	19.86	
M39003/10-2049S	47uF, 10%, 35v	E040103-01, 02	2	Ramp Gen.	C2	+15V Filter Cap	0.05	19.86	
M39003/10-3090S	10.0 uF, 10%, 50v	E040050-01	3	PVCE 1	C55- C57	+15V Filter Cap	0.03	33.3	
M39003/10-3090S	10.0 uF, 10%, 50v	E040050-01	3	PVCE 1	C65- C67	-15V Filter Cap	0.03	33.3	
M39003/10-2119S	10.0 Uf, 10%, 75v	E040085-01 to -10	2	8-String	C2, C102	+15V Filter Cap	0.03	33.3	
M39003/10-3090S	10.0 uF, 10%, 50v	E040050-01	3	PVCE 1	C62- C64	+5V Filter Cap	0.01	100	
M39003/10-2049S	10.0 uF, 10%, 35v	E040034-02	1	Current Monitor	C14	+15V Filter Cap	0.007	139	dV/dt = .652 V/msec
M39003/10-2049S	10.0 uF, 10%, 35v	E040034-02	1	Current Monitor	C16	-15V Filter Cap	0.007	139	dV/dt = .652 V/msec
M39003/10-2044S	6.8uF, 10%, 35v	E040034-02	6	Current Monitor	C5, C7, C21, C24, C35, C38	+15V Filter Cap	0.005	204	dV/dt = .652 V/msec
M39003/10-2044S	6.8uF, 10%, 35v	E040034-02	3	Current Monitor	C10, C26, C40	-15V Filter Cap	0.005	204	dV/dt = .652 V/msec
M39003/10-3015S	10.0 uF, 10%, 10v	E040034-02	3	Current Monitor	C6, C22, C36	+5V Filter Cap	0.003	419	dV/dt = .217 V/msec

EXCEPTION 49

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	
1/24/00	0049	-	4A	**PAGE 1 of** 1

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	Paul Lockwood 818-586-7155	EEE Parts/Boeing-Canoga Park

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
SSU / E039875-03	RER65F3030R	Resistor, Wirewound, Power, Chassis mt	E119791-01 E119793-01
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	Appendix B, para B.3.1.2	Dale Electronics	Habitable: X Non-Habitable:

ISSUE DESCRIPTION: (use continuation pages if required)

Eighty-two (82) RER65F3030R wirewound power resistors are used in SSU applications that experience a transient condition beyond their power rating. Allowable derated power dissipation is 6 watts, maximum. In these cases, 6.329 watts is applied.

RATIONALE: (use continuation pages if required)

General Circuit Description:

These resistors are part of EMI filter circuitry used for filtering the 82 SSU input power strings. Each array string input to the SSU contains a low pass LC type EMI filter, which blocks any conducted emissions from passing to the solar array through the cables running from the SSU to the array. The inductor and capacitor in the EMI filter circuit are low-loss components, so, if the network were stimulated at the correct frequency, the circuit could oscillate. This oscillation would constitute a large EMI type interference signal. A series RC network (using this RER65 resistor) is added across the C element, which effectively damps out any possible oscillation of the LC circuit. During *normal operation*, there is no EMI type perturbation of the string and no LC oscillation; in other words, power dissipated by the 301 ohm resistor is 0.0 watts.

Exception Rationale:

Two *low probability* conditions must be present simultaneously to cause loading of the resistor: (1) the frequency spectrum of the AC current load must be from 200Hz to 1.0KHz with an amplitude greater than 2.0 amperes peak-to-peak, and (2) the DC load current must not vary by more than 2.0 amperes. If this AC current load is applied to the primary bus, engineering has estimated that the worst case average power dissipated by the resistor will be 6.329 watts. (Again, if both conditions are not present, there will be no power dissipated in any EMI resistor.)

This scenario is actually a transient type incident and will not affect the long-term reliability of the resistors. An engineering estimate of the duty cycle of this transient is 0.21%, or one event per month. The events will not (confidence level 99%) stress the same resistor for any period of time, so there are no long-term degradation effects.

The component temperature, during the transient was calculated to be 81.5°C. The maximum applied voltage (200V) is only 60% of the derated maximum. These parameters are well within the component derating criteria.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	1/28/00	X		

COMMENTS: (use continuation pages if required)

EXCEPTION 51

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)
19 January 2000	051	New	4A 8A

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
218002A	1F95896-1 (2 pieces)	Capture Latch, MSS-Common Attach Sys	1F95894-1
222066E	1F95819-1 (2 pieces)	Capture Latch, MTS Attach Sys	1F95819-1

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	LOCATION
SSP 30312	3.7	Boeing	Vacuum

ISSUE DESCRIPTION: (use continuation pages if required)

During DPA inspection 2 parts found to be non-hermetically sealed. There was evidence of leakage through the epoxy seal around the wire lead exits. Some of parts from 2 lots were installed on management risk prior to completion of DPA. Failure analysis indicates that seal damage occurred after seal test during handling and potting operation. Modules with potting and wire installed can not be leak checked after that point in production. Supplier concurs with analysis.

While past DPA's were successful and while suspected to be lot related there is not enough data to preclude other leak failures during prior production. For this reason the first order of priority will be to examine the risks associated with "use as is" assuming only an epoxy seal as this approach allows all parts produced to be used without further action.

RATIONALE: (use continuation pages if required)

A test routine presented to the PCB on 1-13-00 was conducted. The tests and inspections indicated that the epoxy seal alone provided sufficient protection even with extensive atmospheric leakage into the part. Details of all the test and investigation including design/ material analysis are contained in a memo report, Evaluation of Atmospheric Leakage Effects in Thermostat Hybrid Module, dated 2-9-00. The results of this report indicate that the parts are usable with moisture condensation derived from earthside storage and subsequent low temperature/ vacuum operation without indication of developing any failure mechanisms from this operation.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER
Original Signed By Curtis Tallman	Original Signed By David Beverly	2/15/00	X	

COMMENTS: (use continuation pages if required)

EXCEPTION 52

SUBMITTAL DATE	EXCEPTION NO.	REV.	FLIGHT #(s)	PAGE 1 of 1
10 February 2000	052	new	August 2004	

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
ISS	W. Dykes (714)896-3311 7-0062	EEE Parts/Boeing-Huntington Beach

END ITEM/CONFIG. ID NO.	WIRE HARNESS/PART NUMBER(s)	DESCRIPTION	NEXT ASSEMBLY(s)
SSMDS	320100-1	NCP Solid State Mass Storage Device for NASDA	All
SPECIFICATION NUMBER	**SPEC. PARAGRAPH NO.**	**MANUFACTURER**	**LOCATION**
SSP 30312	3.7	SEAKR Engineering	Habitable:

DESCRIPTION
Step coverage for Grade 2 parts do not meet SSQ25000 requirements. Parts purchased to Class H processing with no SEM required. There are no contractual means for rejection.
Supplier is Interpoint which is ISS qualified. DPA performed by Hi Rel.

RATIONALE: (use continuation pages if required)
Parts were evaluated for current density by reviewing the current rating vs applied current which has been shown to be substantually less than the fraction of observed step coverage reduction. Data supplied by Interpoint.
U2, TSC4429 FET driver, Rating = 6 Amp, Applied current= .33 A, =6%, Observed step coverage = 37%
Q1, 2N3501 transistor, Rating= 300 mA, Applied current= 30 mA, =10%, Observed step coverage= 44%
Q6, IR HexFET, thinning applies to gate metallization only, current applied is negligible, Observed step coverage= 21%*
* note that this the normal range for IR die which is 20-30%, IR considers this as normal from past discussions.

This data exceeds conditions approved in earlier PCB reviews.
Submission of this data agrees with earlier PCB established policy that all step coverage issues be addressed on a case by case basis. It is recommended that 1) future reporting of this data not be by formal exception but by other means or 2) delegate this disposition to the design centers.

DISPOSITION

BOEING PCB CHAIR	NASA PCB CHAIR	DATE	APPROVE	DEFER	REJECT
Original Signed By Curtis Tallman	Original Signed By David Beverly	2/15/00	X		

COMMENTS: (use continuation pages if required)