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SUPERSEDING
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MILITARY STANDARD

PARTS, MATERIALS, AND PROCESSES

CONTROL PROGRAM

FOR

SPACE AND LAUNCH VEHICLES



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DEPARTMENT OF THE AIR FORCE
Washington, D.C. 20330

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Parts, Materials, and Processes Control Program
for Space and Launch Vehicles

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FOREWORD

To ensure successful operations of space equipment, attention to every detail is required at every level of assembly throughout development, manufacture, qualification, and testing, starting with the parts, materials, and processes used. For space and launch vehicles, if the parts, materials, and processes have defects or lack the required reliability, success may never be achieved.

Analysis of space mission failures and on orbit anomalies by the USAF Space Division revealed that the nonavailability of reliable space quality electronic piece parts was a serious deterrent to achieving space mission success. In responding to this problem, the Space Division Commander initiated a program with the objective of establishing a "space quality" level of piece parts for space borne missions. In addition, this standard was developed to document the management requirements for parts, materials, and processes for space and launch vehicles.

The objective of this parts, materials, and processes control program standard is to ensure integrated and coordinated management of the selection, application, procurement, control, and standardization of parts, materials, and processes for space and launch vehicles. The requirements presented herein should reduce program costs and should improve the reliability of space and launch vehicles. The requirements in this standard incorporate the Parts Control Program requirements stated in MIL-STD-965, expand those requirements to satisfy space and launch vehicle acquisitions, and extend the requirements to apply to materials and processes. This standard is applicable to all USAF Space Division contracts for new or modified designs of space and launch vehicles.

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SECTION 1

SCOPE

1.1 PURPOSE

This standard establishes the requirements for the preparation, implementation, and operation of a parts, materials, and processes control program for use during the design, development, advanced development, engineering development, production, modification, and test of space and launch vehicles. The implementation of these requirements is intended to:

- a. Assure integrated management of the selection, application, procurement, control, and standardization of parts, materials, and processes (PMP)
- b. Improve the reliability of program PMP to reduce PMP failures at all levels of assembly
- c. Reduce program life cycle cost
- d. Improve procurement of small quantities of parts that meet the system requirements

1.2 APPLICATION

This standard is intended for use in acquisition contracts for space vehicles, upper stage vehicles, payloads, space experiments, and launch vehicles. The standard should be cited in the contract schedule or the statement of work, tailored to the extent that may be applicable. The requirements are intended to be used to coordinate at the program level the selection, application, management, and procurement of PMP throughout the design, development, fabrication, and test phases of an acquisition.

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SECTION 2

REFERENCED DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this standard to the extent specified herein.

SPECIFICATIONS:

MIL-C-123	Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable and General Purpose), High Reliability, General Specification for
MIL-S-19500	Semiconductor Devices, General Specification for
MIL-M-38510	Microcircuits, General Specification for

STANDARDS:

MIL-STD-1547	Electronic Parts, Materials, and Processes Technical Requirements for Space and Launch Vehicles
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HANDBOOKS:

MIL-HDBK-339	Custom Large Scale Integrated Circuit Development and Acquisition for Space Vehicles
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(Copies of specifications, standards, handbooks, drawings, and publications required by contractors in connection with specified acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 ORDER OF PRECEDENCE

In the event of a conflict between the text of this standard and the references cited herein, the text of this standard shall take precedence. Nothing in this standard, however, shall supersede applicable laws and regulations.

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SECTION 3

DEFINITIONS AND ACRONYMS

3.1 DEFINITIONS

3.1.1 Acquisition Activity. The acquisition activity is the Government office or agency acquiring the equipment, system, or subsystem for which this standard is being contractually applied.

3.1.2 Categories of Contractor. The term "contractor" signifies a producer of modules or higher level items of equipment. A contractor that provide items to another contractor can be identified as a "subcontractor". Some system programs have one major contractor identified as a "prime contractor", who is responsible directly to the acquisition activity. Other programs may have two or more major contractors, each responsible directly to the acquisition activity (neither one subordinate to the other), which are called "associate contractors". In the case of programs with associate contractors, the acquisition activity may designate one associate contractor as responsible for managing the program Parts, Materials, and Processes Control Program. In this standard, when the term contractor is used, it applies to the prime, the associate, or the subcontractor, whichever is applicable.

3.1.3 Contracting Officer. A contracting officer is a person with the authority to enter into, administer, or terminate contracts and make related determinations and findings. The term includes authorized representatives of the contracting officer acting within the limits of their authority as delegated by the contracting officer.

3.1.4 Electronic Parts. The term "electronic" is used in a broad sense in this standard and includes electrical, electromagnetic, electromechanical, and electro-optical. These parts are associated with electronic assemblies such as computers, communications equipment, electrical power, guidance, instrumentation, and space vehicles. Electronic parts also include connectors.

3.1.5 JAN Class S Part. A JAN Class S part is an electronic part that is built, tested, qualified, and procured in full accordance with the space quality level requirements as specified in its general and detailed military specification.

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3.1.6 Manufacturing Baseline. The manufacturing baseline is a description, normally in the form of a flow chart, of the sequence of manufacturing operations necessary to produce a specific item, part, or material. The manufacturing baseline includes all associated documentation that is identified or referenced, such as: that pertaining to the procurement and receiving inspection, storage, and inventory control of parts and materials used; the manufacturing processes; the manufacturing facilities, tooling, and test equipment; the in-process manufacturing controls; the operator training and certification; and the inspection and other quality assurance provisions imposed. Each document is identified by title, number, date of issue, applicable revision, and date of revision.

3.1.7 Material. Material is a metallic or nonmetallic element, alloy, mixture, or compound used in a manufacturing operation which becomes either a temporary or permanent portion of the manufactured item.

3.1.8 Material Lot. A lot for material refers to material produced as a single batch or in a single continuous operation or production cycle and offered for acceptance at any one time.

3.1.9 Military Parts Control Advisory Group (MPCAG). The MPCAG is a Department of Defense organization which provides advice to the military departments and military contractors on the selection of parts in assigned commodity classes, and collects data on nonstandard parts for developing or updating military specifications and standards.

3.1.10 Off-the-shelf Item. An off-the-shelf item is an item which has been developed and produced to military or commercial standards and specifications, is readily available for delivery from an industrial source, and may be acquired without change to satisfy a military requirement.

3.1.11 Part. A part is one piece, or two or more pieces joined together, which are not normally subjected to disassembly without destruction or impairment of its designed use.

3.1.12 Parts, Materials, and Processes Control Board (PMPCB). The PMPCB is a formal organization established by contract to assist the contractor and acquisition activity in managing and controlling the selection, application, procurement, and documentation of parts, materials, and processes used in equipment, systems, or subsystems.

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3.1.13 Parts, Materials, and Processes Selection List (PMPSL). The PMPSL is a list of all parts, materials, and processes which are approved for design in a specific contract.

3.1.14 Process. A process is an operation, treatment, or procedure used during a step in the manufacture of a material, part, or an assembly.

3.1.14 Production Lot (Electronic Parts). A production lot of electronic parts refers to a group of parts of a single part type; defined by a single design and part number; produced in a single production run by means of the same production processes, the same tools and machinery, and the same manufacturing and quality controls; and tested within the same period of time. All parts in the same lot have the same lot date code.

3.1.15 Registered PMP. A registered PMP is a part, material, or process which is registered with the acquisition activity to call attention to special reliability, quality, or other concerns, relating to its procurement or application. Registered PMP includes, but is not limited to, reliability suspect PMP and limited application PMP.

3.1.16 Space Quality PMP Baseline. The Space Quality PMP Baseline defines the parts, materials, and processes which are recommended and approved by the acquisition activity for design selection, application, and procurement for a specific contract. For electronic piece parts this would normally include all space level military qualified products, such as MIL-M-38510 microcircuits, Class S; MIL-S-19500 semiconductors, JAN S; and MIL-C-123A ceramic capacitors. For mechanical parts this would normally include parts meeting the contractual requirements. The Space Quality PMP Baseline should be specified in the solicitation.

3.2 ACRONYMS

- | | | |
|-------|--------------|--|
| 3.2.1 | <u>MPCAG</u> | Military Parts Control Advisory Group
(See 3.1.8) |
| 3.2.2 | <u>PAR</u> | Part (or Material or Process) Approval Request
(Data Item Description, DI-MISC-80071) |
| 3.2.3 | <u>PMP</u> | Parts, Materials, and Processes |
| 3.2.4 | <u>PMPCB</u> | Parts, Materials, and Processes Control Board |
| 3.2.5 | <u>PMPSL</u> | Parts, Materials, and Processes Selection List
(Data Item Description, DI-MISC-80072) |

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SECTION 4

GENERAL REQUIREMENTS

4.1 PARTS, MATERIALS, AND PROCESSES CONTROL PROGRAM PLANNING

The contractor shall establish and conduct a parts, materials, and processes control program in accordance with the requirements of this standard. This parts, materials, and processes control program shall be documented in a plan (Data Item Description, DI-MISC-80526) that addresses how the requirements of this standard are to be met. When the requirements of this standard are imposed on a contractor, it is intended that all of their appropriate subcontractors would also participate in the parts, materials, and processes control program to the extent that they are required in order to meet the objectives of this standard. The plan shall address how the contractor ensures the flow down of the applicable parts, materials, and processes control program requirements to the subcontractors.

4.2 PARTS, MATERIALS, AND PROCESSES CONTROL BOARD (PMPCB)

A Parts, Materials, and Processes Control Board (PMPCB) shall be implemented by the contractor who is identified and tasked by the acquisition activity to plan, manage, and coordinate at the program level, the selection, application, and procurement requirements of all PMP. All contractors shall support the PMPCB and shall implement the findings and decisions of the PMPCB to the extent that the contractors are covered in their contractual effort. The acquisition activity shall have the right of disapproval of PMPCB decisions.

4.3 MANAGEMENT OF PMP SELECTION

The contractor shall manage the selection of PMP in accordance with the criteria specified in this standard. The contractor shall develop a Parts, Materials, and Processes Selection List (PMPSL) (Data Item Description, DI-MISC-80072) to be used by all contractors on the program for their design and manufacture. PMP included in the Space Quality PMP Baseline provided by the acquisition activity shall be considered approved for use if included in the PMPSL. PMP not included in the Space Quality PMP Baseline provided by the acquisition activity which is proposed to be included in the PMPSL shall be submitted to the PMPCB for coordination and subsequent approval by the acquisition activity using the Parts Approval Request (PAR) (Data Item Description, DI-MISC-80071). Deletions or

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other Changes to the PMPSL shall be coordinated through the PMPCB. For electronic parts, when the Space Quality PMP Baseline parts are not available, the applicable requirements of MIL-STD-1547 shall be applied in selecting and procuring parts and materials to meet space quality requirements.

4.4 MANAGEMENT OF PMP ENGINEERING REQUIREMENTS

PMP shall be selected to meet the requirements of the system application; however, design preference shall be given to the selection of applicable PMP listed on the Space Quality PMP Baseline until superceded by the approved PMPSL. PMP engineering requirements shall be managed by the PMPCB in accordance with the requirements of this standard.

4.5 MANAGEMENT OF PARTS AND MATERIALS PROCUREMENT

When applicable and appropriate, the contractor shall ensure the use of coordinated procurement to obtain parts and materials for contractor and subcontractor use. Contractors are encouraged to use the JAN Class S Operating Stock to procure parts to the maximum extent possible. Justification by the contractor or subcontractor for the nonuse of parts which are available from the JAN Class S Operating Stock is required by the PMPCB. The selection of suppliers for other parts and materials shall be based on criteria that includes factors to ensure the required quality and reliability can be procured. The contractor shall ensure that source surveillance for all parts and materials is provided to assure the quality of parts and materials. JAN Class S parts do not require contractor source surveillance to meet the requirements of this standard.

4.6 MANAGEMENT OF PARTS, MATERIALS, AND PROCESSES APPLICATION

The contractor shall ensure proper application of all parts, materials, and processes. The contractor shall also ensure that each application of parts is derated to meet system requirements.

4.7 RADIATION HARDNESS ASSURANCE

As necessary, the contractor shall plan for and implement hardness assurance requirements for materials and electronic parts to meet system requirements in accordance with Appendix B.

4.8 COMPLIANCE WITH SYSTEM REQUIREMENTS

The requirements of this standard shall not relieve the contractor of the responsibility for complying with all the equipment, system performance, and reliability requirements as set forth in the applicable specifications and contracts.

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4.9 GOVERNMENT FURNISHED EQUIPMENT

PMP contained in unmodified government furnished equipment used in the end item of the contract shall not be subject to PMP control procedures by the contractor. When required by contract, the "as built" PMP list shall be reviewed to the extent possible by the PMPCB to identify possible problem areas, or areas where substandard parts are being used. Problems as well as substandard parts shall be presented and identified to the acquisition activity.

The contractor shall implement the PMP selection, application, and procurement provisions described herein for PMP to be used for any modification of government furnished equipment intended for use in the end item of the contract.

4.10 OFF-THE-SHELF ITEM (EQUIPMENT)

Parts and materials contained in off-the-shelf equipment used in a space or launch vehicle shall meet the part and material selection, application, procurement, and approval procedures described herein. When off-the-shelf equipment can not be supplied that satisfies these requirements, the equipment shall not be used in a space or launch vehicle without specific approval of the contracting officer.

4.11 CUSTOM LARGE SCALE INTEGRATED CIRCUITS

The guidance provided by MIL-HDBK-339 shall be the basis for the procurement of custom large scale integrated circuits. Each custom large scale integrated circuit planned for system usage shall be selected, developed, analyzed, and tested in accordance with the guidance provided by MIL-HDBK-339. The monitoring, auditing, hardness assurance, and testability guidance of MIL-HDBK-339 shall be followed.

4.12 VERY HIGH SPEED INTEGRATED CIRCUITS

Very high speed integrated circuit technology shall be selected for use where applicable and where its use does not degrade system reliability. The acquisition and technical guidance provided by MIL-HDBK-339 is directly applicable to very high speed integrated circuit devices and should be followed when identifying requirements and uses of this technology for space and launch vehicle systems.

4.13 USAF SPACE DIVISION SPACE PARTS WORKING GROUP

The contractor is encouraged to provide representation to the USAF Space Division Space Parts Working Group meetings.

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These meetings are usually held periodically (approximately annually) at or near the USAF Space Division. The purpose of these meetings is to provide a forum for the exchange of information relating to technical, procurement, application, and status issues of interest involving space programs and especially space quality parts. The primary focus is on general parts issues or items including their selection and procurement.

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SECTION 5

DETAILED REQUIREMENTS

5.1 PARTS, MATERIALS, AND PROCESSES CONTROL PROGRAM PLANNING

5.1.1 Parts, Materials, and Processes Control Program Plan.

The parts, materials, and processes control program shall be documented in a plan (Data Item Description, DI-MISC-80526) prepared by the contractor identified and tasked by the acquisition activity to plan, manage, and coordinate the program level PMPCB. The plan shall be comprehensive and shall describe how the contractors effort is to be organized, managed, and conducted to meet the requirements of this standard. Individual topics or subordinate plans may be prepared as separate documents and incorporated by reference into the overall parts, materials, and processes control program plan. Existing contractor nonproprietary in-house documentation may be used and referenced in the plan when applicable. Contractor documents referenced in the plan shall be made available to program participants upon request. The parts, materials, and processes control program plan shall include the following major topics:

- a. A PMPCB operating procedure, including membership, responsibilities, authority, meeting schedules, PMP review procedures, PMP approval procedures, and plans for updating the operating procedure.
- b. The role and authority of each PMPCB member has in support of PMPCB meetings, in preparing PMP documentation, and in providing timely information on PMP problems to the PMPCB.
- c. Definition of the contents of the PMPSL and procedures for developing, updating, approving, and distributing the PMPSL.
- d. Procedures for identifying "registered PMP."
- e. Initial milestone schedule depicting significant PMP events (e.g., completion dates for PMPSL and other planning documents).
- f. Development and implementation of a shelf life control plan (see Appendix A).
- g. Development and implementation of application and derating documents to meet program derating policy (e.g., MIL-STD-1547 for electronic parts).

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- h. Development and implementation of plans and procedures for manufacturer and subcontractor surveillance and auditing.
- i. Development and implementation of plans and procedures for qualification and qualification updating.
- j. Development and implementation of policies and procedures to ensure that design engineers select PMP described by the Space Quality PMP Baseline to the maximum extent practicable.
- k. Development and implementation of plans and procedures for coordinated procurement, where applicable.
- l. Development and implementation of plans and procedures for conducting destructive physical analysis of parts at incoming inspection, and related review and approval procedures.
- m. Development and implementation of a Defective Parts & Components Control Program.
- n. Development and implementation of methods for the program integration of PMP requirements, reliability requirements, and quality control efforts. Include methods for coordination between the PMPCB, Failure Review Board, Material Review Board, and other applicable boards or groups.
- o. Development of the definition of the authority of the PMPCB as it relates to various groups within the prime, associate, and subcontractor organizations.
- p. Development and implementation of a Radiation Hardness Assurance Program and Plan, if applicable.
- q. Development and implementation of plans and procedures to meet electrostatic discharge protection requirements for PMP.
- r. Development and implementation of plans and procedures for contamination control of critical surfaces of parts and materials during manufacturing, shipping, and handling.

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- s. Implementation of plans and procedures for using the Defense Electronics Supply Center (DESC) JAN Class S Operating Stock Program for the procurement of JAN Class S parts.

5.1.2 Milestone Schedule. A milestone schedule shall be developed showing the interrelationship of program related PMP activities to the program schedule, including completion dates for the PMPSL and other planning documents. This milestone schedule shall be presented to and maintained by the PMPCB to assist in identifying and resolving problems. Milestones at each subcontractor shall be identified. A method shall be developed for closed loop task control and reporting to program management and to the acquisition activity on a regular basis.

5.2 PARTS, MATERIALS, AND PROCESSES CONTROL BOARD (PMPCB)

5.2.1 Membership. The PMPCB membership shall include at least one member from each contractor and each appropriate subcontractor. The acquisition activity shall be represented by an active member on the PMPCB and shall retain the right of disapproval of PMPCB decisions. Each member shall be capable of being supported in technical matters as required. Each member shall have the authority to commit his organization or company to PMPCB decisions which are within the scope of his contract and consistent with the parts, materials, and processes control program plan.

5.2.2 PMPCB Meeting Schedules. PMPCB meetings shall be held as follows:

- a. A post-award PMPCB organizational meeting shall be convened by the contractor designated the program PMPCB manager within 30 days after contract award. The chairman of the PMPCB shall coordinate the date and location of the meeting with the acquisition activity, and inform proposed members and representative of the schedule. This meeting is intended to establish initial working relationships, responsibilities, and procedures for implementation of the PMP control program. This meeting may be held in conjunction with other scheduled contract review meetings.
- b. Subsequent PMPCB meetings shall normally be held monthly, or as suitable to the program activity level.

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- c. Special PMPCB meetings may be called by the PMPCB chairman or the acquisition activity, as required, with adequate notification provided to all the PMPCB members and representatives (7 calendar days minimum notification).

5.2.3 PMPCB Responsibilities.

- a. The PMPCB shall establish PMPCB operating procedures in accordance with this standard.
- b. The PMPCB shall establish and maintain a program PMPSL. Each member shall coordinate the identification and applicable data for candidate PMP proposed for the PMPSL. When required, each member shall request approval of items using a Parts Approval Request (PAR) form with the supporting data, including qualification and evaluation plans. The PMPCB shall recommend approval or disapproval to the acquisition activity for each PAR.
- c. The PMPCB shall ensure selection and use of PMP listed on the Space Quality PMP Baseline to the maximum extent practicable.
- d. The PMPCB shall identify, control, and limit the use of registered PMP. The PMPCB shall also review applicable process controls and special controls to be imposed on any registered PMP used.
- e. The PMPCB shall ensure compliance with the requirements of this standard to the extent they are invoked on contract. The PMPCB shall evaluate and recommend approval or disapproval to the acquisition activity for deviations or waivers on the requirements of this standard.
- f. The PMPCB shall develop a uniform derating policy to meet the system requirements and monitor its use by all contractors and subcontractors on the program. The PMPCB shall evaluate and recommend approval or disapproval to the acquisition activity for any exceptions to this uniform derating policy.
- g. The PMPCB shall develop a standardized destructive physical analysis policy, procedure, and reporting format and recommend their use by

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all contractors and subcontractors on the program. The destructive physical analysis findings and a summary report shall be reviewed by the PMPCB on a regular basis.

- h. The PMPCB shall review the results of receiving inspection, destructive physical analyses, failure analyses, Material Review Board actions, and problems including those identified in the field. The PMPCB shall notify the acquisition activity with recommended corrective actions.
- i. The PMPCB shall ensure the timely initiation of procurement of long lead procurement items.
- j. The PMPCB shall identify to the acquisition activity those changes required in part specifications necessary to meet the equipment, system, or subsystem requirements.
- k. The PMPCB shall review the selection (if used) of custom large scale integrated circuits in accordance with the guidance from MIL-HDBK-339.
- l. The PMPCB shall ensure the proper control of all processes approved for space and launch vehicle use. This includes ensuring the proper selection, application, and use of each process as well as the control of associated items which do not become part of the manufactured item.
- m. The PMPCB shall review plans by program contractors or subcontractors to procure JAN Class S parts from sources other than the JAN Class S Operating Stock Program when they are available from the Operating Stock Program.

5.2.4 Responsibilities of the Program PMPCB

Contractor. The contractor designated by the acquisition activity as responsible for the PMP Control Program shall:

- a. Provide the PMPCB Chairman, conduct PMPCB meetings, prepare and distribute meeting minutes (Data Item Description, DI-A-7089), and manage the PMPCB.
- b. Prepare PMPCB meeting agenda (Data Item Description, DI-A-7088), distribute meeting notices and agenda a minimum of 21 calendar days prior to the PMPCB meeting (7 calendar days prior for special PMPCB meetings).

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5.3 MANAGEMENT OF PMP SELECTION

The contractor shall use the following PMP review and approval procedures for parts to be selected and listed on the PMPSL:

- a. After contract award, those items which the contractors and subcontractors propose to use shall be definitized in the format of a PMPSL and submitted to the PMPCB for review and approval, and to the acquisition activity for their approval. PMP not defined by the Space Quality PMP Baseline in the solicitation, and proposed for inclusion on the PMPSL shall require submission of an approval request (PAR) with supporting data. When this list is approved by the acquisition activity, it becomes the approved PMPSL and shall be used by all contractors and subcontractors on the program when selecting PMP for program use. The PMPSL shall not be formally issued until it has been approved by the acquisition activity.
- b. Each contractor shall update the PMPSL through the PMPCB as required to support their design efforts. All PMP proposed for use, but not approved or listed on the PMPSL, shall be clearly identified at all design reviews and information shall be presented to justify their selection and use.
- c. Following approval of any additions to or deletions of PMP to the PMPSL, all changes to the PMPSL shall be made available to all contractors on the program in a timely manner.

5.3.1 Parts, Materials, and Processes Selection List (PMPSL).

The PMPSL (Data Item Description, DI-MISC-80072) shall be organized into three separate sections:

Section I for approved parts,
Section II for approved materials, and
Section III for approved processes.

Each PMP listing in each section of the PMPSL shall contain, as a minimum, the following information:

- a. PMP index number (including revision)
- b. Generic part number (manufacturer's designation)
- c. Military specification number, slash sheet number, and dash number, as applicable

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- d. Contractor PMP identification number
- e. Noun description
- f. Approved, proposed, and selected sources
- g. Status (such as: on-order or in-house)
- h. Qualification status
- i. Identification of any application limitations
- j. Identification as "registered PMP" if so designated
- k. Reference file number for the PMP application data

Each item listed in the PMPSL and identified as "limited application PMP" or as "registered PMP" shall also list information on applicable restrictions and reasons.

5.3.2 PMPSL Records. Records of the program PMPSL shall be organized into three separate sections similar to the PMPSL: Section I for parts, Section II for materials, and Section III for processes. Records shall be kept for the life of the program. The records shall include as a minimum the following:

- a. The PMPSL.
- b. Approved PMPSL data, including registration or critical listing, if applicable.
- c. Proposed PMP. This is the PMP for which approval action is pending. The records for the proposed PMP should be organized similar to the listing of the PMPSL (see 5.3.1).
- d. Addition and deletion actions.
- e. Disapproved PMP. This is the PMP that has been disapproved for program use. Each item listed as "Disapproved PMP" shall also list information on applicable reasons for disapproval and the date of disapproval.

5.3.3 Part (Material or Process) Approval Request (PAR).
A PAR (Data Item Description, DI-MISC-80071) shall be submitted to the PMPCB for all PMP not defined by the Space Quality PMP Baseline and proposed for listing on the PMPSL.

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Supplemental data required with this request includes as a minimum the following:

- a. Justification for the proposed applications.
- b. Reliability history, test data, other program usage and history, and any failure analysis reports, relevant GIDEP Alerts, and other relevant Alerts.
- c. Availability including approved, proposed, and selected sources.
- d. General performance and application data.
- e. Description of how the technical requirements are met; including qualification.
- f. Any criteria which meet the requirements to register the PMP (see 5.4.2).
- g. Process methods and data and required quality control provisions, if applicable.

5.3.4 As-designed Parts and Materials List. As the program progresses, the PMPCB shall be responsible for the development and maintenance of an as-designed parts and materials list which shall indicate the final parts and materials selected, quantities used, next assembly location, and end item location. Parts and materials approved or qualified for program use, but not actually used, shall not be included on this as-designed list.

5.4 MANAGEMENT OF PMP ENGINEERING REQUIREMENTS

5.4.1 System Designs. The PMP shall be selected to meet the requirements of the system application; however, design preference shall be given to the selection of applicable PMP described by the Space Quality PMP Baseline. The contractor shall limit the number of different PMP used by selecting PMP for new design from the existing PMPSL approved by the acquisition activity. PMP not described by the Space Quality PMP Baseline shall meet the requirements of the contract. Electronic parts shall meet the requirements of MIL-STD-1547.

5.4.2 Registered PMP. The PMPCB shall identify to the acquisition activity any proposed use of registered PMP. Registered PMP are PMP which meet any of the following criteria:

- a. Requires special handling, transportation, storage, or test precautions.

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- b. Unsatisfactory performance on current program or historical data showing unsatisfactory performance on other programs, including relevant GIDEP Alerts, industry problem alert bulletins, and other relevant industry problem notices or alerts.
- c. PMP with any limitations that warrants additional controls.
- d. Parts or materials difficult to manufacture or processes difficult to control.
- e. The part or material is stressed in the application in excess of recommended derating criteria.
- f. The PMP involves any deviation from the manufacturing baseline procedure affecting system performance.
- g. Limited application PMP.
- h. The part, material, or process is identified as a reliability suspect PMP
- i. State-of-the-art manufacturing or technology with insufficient reliability history
- j. PMP which represents a single point of failure for the system

Additional controls shall be applied to registered PMP to ensure their suitability for system use.

5.4.3 Reuse of Parts and Materials. Parts and materials which have been installed in an assembly, and are then removed from the assembly for any reason, shall not be used again in any item of flight or space hardware.

5.4.4 PMP Qualification.

5.4.4.1 General. All PMP, including any processes developed to accomplish rework or retrofit, shall be qualified for program use. Only qualified PMP shall be used on flight hardware. For each nonqualified PMP, the contractor(s), through the PMPCB, shall prepare a qualification plan and procedure. For electronic parts, the qualification plans and procedures shall be based on the requirements of MIL-STD-1547. The qualification plan shall identify all conditions and testing

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necessary to meet the program and mission reliability and qualification requirements. These plans and procedures shall be reviewed and approved by the PMPCB prior to acquisition activity approval. A summary report of qualification test results shall be submitted to the PMPCB. The PMPCB shall maintain an up-to-date listing of the qualification status of all program PMP. Test methods used for qualification of PMP shall be in accordance with applicable specifications and shall include test methods for any additional tests necessary to fully qualify the part for its intended use in the system.

Qualification of PMP may be expedited by the following:

- a. Initial selection of PMP using applicable military specified PMP previously qualified for use on space and launch vehicle programs.
- b. Proof testing of all parts and materials to the program requirement levels.
- c. Vendor audits and certification.
- d. Satisfactory completion of tests on engineering models that use the PMP

5.4.4.2 Qualification by Extension. Parts, materials, or processes may be qualified by extension when either of the following criteria are met:

- a. The part, material, or process was successfully used in a prior but recent space application in which the application environment conditions of use and test were at least as severe as those required of the candidate PMP for qualification.
- b. The part or material is of identical construction or contains constituents identical in composition and near identical in significant properties as the previously qualified part or material. The part or material is manufactured by the same manufacturing facility to the same manufacturing baseline as the previously qualified part or material, and the utilization of the part or material does not result in critical stresses or mechanical strain (such as due to a temperature or thermal mismatch) greater than the previously qualified part or material.

Qualification by extension shall be based on a review of supporting data by the PMPCB and approval by the acquisition activity.

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5.4.5 Incoming Inspection Requirements. Each contractor shall perform, or be responsible for performing, applicable incoming testing and inspections to parts and materials to ensure that they meet the requirements of the procurement specifications. Parts or materials not meeting lot acceptance criteria shall not be used on qualification or flight hardware. Unless previously accomplished and accepted by contractor field personnel, incoming testing and inspections shall be accomplished upon receipt of the parts or materials.

5.4.5.1 Incoming Inspection of Electronic Parts. As a minimum, incoming inspection of electronic parts shall consist of the following:

- a. One hundred percent external inspection at 10X magnification (minimum) for such things as permanent and legible marking, body finish, lead finish, insulation, lead straightness, excessive material misalignment dimensions, and any visual or mechanical defect.
- b. A destructive physical analysis on a lot sample basis in accordance with procedures approved by the PMPCB. The minimum sample size shall be a quantity of five (5) per each lot date code. With PMPCB approval, the contractor may use an independent destructive physical analysis previously performed on the same production lot date code as evidence for the quality of the lot, in lieu of performing another destructive physical analysis. An example of this is shown by not requiring another destructive physical analysis for parts procured from the Defense Electronics Supply Center (DESC) JAN Class S Operating Stock Program.
- c. For PMP not defined by the Space Quality PMP Baseline:
 - 1). One hundred percent electrical testing at 25 ± 5 degrees Centigrade to detail specification requirements.
 - 2). Electrical testing at specified temperature extremes on a lot sample basis.
- d. Data accompanying all parts shall be reviewed to determine acceptability of received parts and where possible to provide a lot-by-lot trend analysis.

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5.4.5.2 Incoming Inspection of Materials. As a minimum, incoming inspection of materials shall consist of the following:

- a. Analysis of significant physical properties of randomly selected samples of "as received" material.
- b. Sample analysis of significant physical properties of processed material (where appropriate).
- c. Review of all data accompanying the lot to ensure that the material meets all specified requirements.

5.4.6 Configuration Control. The contractor shall plan for and assess the physical characteristics of all parts and materials for the purpose of identifying any changes in the materials used, construction, or configuration of the parts or materials. As a minimum for parts, the contractor shall use manufacturer data and initial destructive physical analysis findings to baseline the physical characteristics of the parts, and then to compare subsequent destructive physical analysis findings to that initial baseline.

5.4.7 Failure Analysis. Failure analysis shall be performed on part and material failures experienced during receiving inspection, production, and testing. 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. A standardized trouble and failure reporting system and summary report format shall be established by the PMPCB and used by all contractors in the program. Corrective action shall be determined and implemented for each failure. All failures, and the results of failure analysis, shall be reported to the PMPCB and to the acquisition activity. Failed parts and failure analysis reports shall be retrievable for the duration of the contract, and shall be available to the acquisition activity for independent examination. Failures attributed to processes shall be recorded and analyzed to identify cause of failure and need for corrective action. All such data and the corrective actions taken shall be submitted to the PMPCB for review. Failure of parts procured from the DESC JAN Class S Operating Stock Program require immediate notification to DESC, the PMPCB, and the acquisition activity.

5.4.8 Traceability and Lot Control. The contractor shall be capable of tracing each part and each material batch procured for system use to its manufacturer, lot identification (lot date code or batch designation), and serial numbers (where a serial number exists). Similarly, given a lot date code, the

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contractor shall be capable of determining the unique piece of equipment by serial number (and dash number) at the lowest assembly level in which the part is installed.

5.4.9 Shelf-life Control. The contractor shall develop a shelf-life control plan to identify the inspections and tests required to ensure shelf life for each part type. Parts or materials shall be installed into equipment within four years following receiving inspection or within four years following rescreening or retesting in accordance with a PMPCB approved plan. Guidance for the preparation of the shelf-life control plan is presented in Appendix A. The shelf-life control plan shall be documented and referenced in the parts, materials, and processes control program plan.

5.4.10 Preservation and Packaging. Preservation, packaging, and packing shall be in accordance with both the item and the system requirements. All parts which are subject to degradation by electrostatic discharge, and which are to be packed in bags or wraps manufactured from static-generating materials, shall first be individually wrapped in proper anti-static material. The anti-static packaging material shall be intimate to the item. An approved label shall be affixed to each unit package clearly advising that the contents can be destroyed by static electricity and should be handled only by personnel instructed in the necessary precautions.

5.4.11 Handling and Storage. Handling and storage procedures shall be instituted to prevent part and material degradation. These procedures shall apply until the parts and materials lose their individuality when assembled into modules, boards, or higher indentured items. The handling and storage procedures shall be retained through inspection, kitting, and assembly and shall be identified on "build to" documentation. The following criteria shall be used as a minimum for establishing handling and storage procedures for parts and materials:

- a. Control of environment, such as temperature, humidity, contamination, and pressure.
- b. Measures and facilities to segregate and protect parts and materials routed to different locations such as, to the materials review crib, or to a laboratory for inspection, or returned to the manufacturer from unaccepted shipments.
- c. Easily identifiable containers to identify space quality parts shall be used.

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- d. Control measures to limit personnel access to parts and materials during receiving inspection and storage.
- e. Facilities for interim storage of parts and materials.
- f. Provisions for protective cushioning, as required, on storage area shelves, and in storage and transportation containers.
- g. Protective features of transportation equipment design to make sure that packages are not accidentally dropped or dislodged in transit.
- h. Nondegradable cushioning of bench surfaces on which parts and materials are handled during operations such as test, assembly, inspection, and organizing kits.
- i. Required use of gloves, finger cots, tweezers, or other means when handling parts to protect the parts from contact by bare hands.
- j. Provisions for protection of parts susceptible to damage by electrostatic discharge.

5.4.12 Defective Parts and Components Control Program.

The PMPCB shall review and evaluate Government Industry Data Exchange Program Alerts (GIDEP ALERTS), industry problem alert bulletins, and other available information relating to defective PMP to ensure that defective PMP are not selected for the design or procured for use, or used in system equipment. PMP indicated as defective in any GIDEP ALERT, industry problem alert bulletins, industry problem notices or alerts, or other sources of problem information shall not be approved for use or listed on the PMPSL unless the indicated defects or failures have been corrected or identified, and approved preventions implemented to eliminate the cause of the defects or failures in the parts to be used in the flight hardware.

5.5 MANAGEMENT OF PARTS AND MATERIAL PROCUREMENT

All parts and materials shall be procured directly from the manufacturer or procured from an authorized distributor. Parts and materials procured from an authorized distributor shall be traceable to the manufacturer and a written certification by lot date code of specification compliance, shall be furnished by the manufacturer with each procurement. Contractors are encouraged to use the JAN Class S Operating Stock Program to procure parts to the maximum extent possible.

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5.5.1 Electronic Parts Procurement Order of Precedence.

The contractor shall procure JAN Class S parts as the first order of precedence. For parts not on an applicable space quality military qualified products list (QPL), the contractor is encouraged to place orders with manufacturers willing to pursue qualification during the processing of the order so that the delivered product can be space qualified. When JAN Class S parts and other space qualified military standard parts and materials are not obtainable, the contractor shall procure parts and materials in accordance with the technical requirements of the system and of the contract. For any PMP not specifically covered by contractual requirements, the contractor, with PMPCB approval, shall select and apply specification and test requirements appropriate to the specific part or material type, design, and manufacturing process. Space quality test procedures and requirements shall be used.

5.5.2 Coordinated Procurement. The contractor shall use coordinated procurement practices wherever possible. This includes the use of common specifications, common management responsibilities, common purchase agreements, common monitoring, and common quality assurance responsibilities by several contractors. A contractor may develop a master purchase agreement, where applicable, which allows individual contractors to initiate their own procurements within the scope and framework of the master purchase agreement.

5.5.3 Electronic Parts Manufacturer Surveillance (Monitoring). The contractor shall arrange for the surveillance of all nonJAN Class S procurements of electronic parts at the manufacturer. For all nonJAN Class S electronic parts the contractor shall participate in precap visual inspections and shall monitor the screening and quality conformance tests performed by the part manufacturer. The contractor shall be responsible for authorizing shipment of the electronic parts from the manufacturer.

5.5.4 Manufacturing Baseline. All nonJAN Class S parts and all materials shall be procured to a manufacturing baseline for the parts or materials which has been approved by the contractor.

5.5.5 JAN Class S Operating Stock Program A JAN Class S Operating Stock has been initiated by the Defense Logistics Agency to allow contractors to procure JAN Class S parts that are readily available from stock. This reduces procurement lead times, and allows small quantity ordering. In support of this program, the contractor shall:

- a. Forecast requirements for using stock listed parts.

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- b. Submit requisitions for stock listed parts through the contracting officer.
- c. Obtain approval from the PMPCB for plans to buy Stock listed JAN Class S parts from sources other than the Defense Electronics Supply Center (DESC), when they are available at DESC.

5.6 MANAGEMENT OF PARTS AND MATERIALS APPLICATION

5.6.1 Derating. A uniform derating policy to meet the system requirements shall be established by the PMPCB and used by all contractors in the program. Exceptions to this derating policy shall require the approval of the PMPCB. The derating policy shall address degradation sensitive parameters and maximum rated variations expected over the program mission life. The policy shall also include derating due to radiation effects.

5.6.2 PMP Application Data. Each contractor shall develop, and have on file, application data for each item on the PMPSL that they are using or are proposing to use. The PMP application data shall be consistent with program requirements and shall be readily available to all circuit and equipment design engineers. The application data shall, as a minimum, contain the following:

- a. Configuration drawing
- b. Recommended mounting procedure.
- c. Recommended derating
- d. Common failure modes
- e. Estimated failure rate
- f. Environmental capability (e.g., shock or vibration limitations or outgassing)
- g. Expected degradation due to radiation and aging.
- h. Identification of registered items and reasons for being registered

The contractor shall identify all critical areas in each component and subsystem. A stress analysis shall be performed for each part or material employed in each critical application. These analyses shall relate the stress of parts or materials to circuits, module, components, and subsystem performance as they are influenced by parametric variations,

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environmental effects, radiation effects, and input and output limits. These analyses shall consider all derating factors identified in the approved derating criteria to determine the worst-case part stress. These analyses shall be available for PMPCB and acquisition activity review.

5.7 RADIATION HARDNESS

When required, the contractor, through the PMPCB, shall develop and conduct a hardness assurance program in accordance with Appendix B for all hardness critical parts and material to meet the hardness assurance requirements of the system. The hardness assurance program plan shall address all phases of the flight hardware program including the design, test, and production. The hardness assurance program shall ensure:

- a. Radiation environments for piece parts and materials are specified.
- b. Hardness assurance requirements and appropriate test methods are identified and included in the respective procurement specifications.
- c. Hardness assurance representatives support the PMPCB

The hardness assurance program plan shall be documented and referenced in the Parts, Materials, and Processes Control Program Plan. The hardness assurance program plan shall be provided to the PMPCB for review and to the acquisition activity for approval prior to the Preliminary Design Review.

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SECTION 6

NOTES

The contents of this section are noncompliant and are intended for guidance and information only.

6.1 INTENDED USE

This standard should be cited in the contract schedule, or the statement of work, to specify the requirements for the parts, materials, and processes management and control program for applicable equipment. The standard is intended for use in all USAF Space Division acquisition contracts for new or modified designs of space vehicles, upper stage vehicles, payloads, launch vehicles, and for their subtier equipments. Note that this standard is not an appropriate reference in any specification since it is a management standard and does not contain technical requirements for the parts, materials, and processes to be used in the equipment. Of course, all requirements for data delivery must be listed in the Contract Data Requirements List of the acquisition contract.

The requirements in the text of this standard expand the applicable Parts Control Program requirements as stated in MIL-STD-965 in order to satisfy space and launch vehicle acquisition requirements. This standard also extends the requirements for part controls to also apply to materials and processes. For the convenience of everyone using this standard, and also using either MIL-STD-965 or MIL-STD-1547, the definition of key terms that are common are the same in this standard as in those documents.

Contracts for ground equipment (e.g., control segments and user segments of space systems) could apply MIL-STD-965 for those segments unless it is determined that a tailored application of this standard would be more appropriate for the reliability or standardization objectives of the program. Note that many space and launch vehicle acquisition contracts include both space and ground equipment, so if both MIL-STD-965 and this standard are referenced, care should be taken to ensure that the applicability of each document is clear.

There may be acquisition contracts for other types of equipment requiring high reliability where the special parts, materials, and processes control requirements stated in this

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standard should be applied. For those acquisition contracts, this standard may be cited to specify the applicable requirements. However, a statement should be included in the contract or the statement of work indicating that the words "space and launch vehicle" in this standard are to be interpreted as the applicable equipment. The requirements in this standard should therefore be interpreted as applying to the parts, materials, and processes control program requirements for the acquisition of the applicable equipment. The specific wording in the statement of work or in the contract could avoid any possible misinterpretation or misapplication.

6.1.1 Related Statement of Work Requirements. This standard cannot achieve a successful program standing alone. There is an implied assumption that other critical management requirements will be implemented. Other critical management requirements to be implemented in the statement of work include, but are not limited to, requirements for:

- a. Quality program (MIL-STD-1586, MIL-STD-1535, and MIL-Q-9858)
- b. Reliability program (MIL-STD-1543)
- c. Nonconforming material reviews (MIL-STD-1520)
- d. Program reviews (MIL-STD-1521)

6.1.2 Related Equipment Specification Requirements. This standard cannot achieve a successful program standing alone. There is an implied assumption that critical technical requirements will be implemented. Critical technical requirements to be implemented in the equipment specifications include, but are not limited to:

- a. Technical requirements for parts for space and launch vehicles (JAN CLASS S parts and MIL-STD-1547)
- b. Technical requirements for materials for space and launch vehicles
- c. Technical requirements for processes for space and launch vehicles
- d. Technical requirements for destructive physical analysis (MIL-STD-1580)

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6.2 TAILORED APPLICATION

The parts, materials, and processes control program requirements in each contract should be tailored to the needs of that particular acquisition. Military specifications and standards need not be applied in their entirety. Only the minimum requirements needed to provide the basis for achieving the PMP required should be imposed. The cost of imposing each requirement of this standard should be evaluated by the program office against the benefits that should be realized. Provisions (section, paragraphs, or sentences) not required for the specific application should be excluded. The surviving provisions should be tailored to impose only the minimum requirements necessary to support the system. All tailored applications of this standard shall be clearly identified in the compliance document section of the statement of work of the contract.

In the case of programs with two or more associate contractors, the acquisition activity should include in each of the contractor contracts one of the following:

- a. The PMP program shall comply with MIL-STD-1546. The contractor is responsible for all requirements including the Program PMPCB management tasks. Other contractors responsible for supporting the PMPCB are:_____.

(Note: this statement would be for the contractor identified as the Program PMPCB Contractor that would be responsible for the Program PMPCB management tasks. All paragraphs of MIL-STD-1546 are applicable. The other contractors responsible for supporting the PMPCB should be identified so coordination can start.)

- b. The PMP program shall comply with MIL-STD-1546 except for paragraphs 5.1.1, 5.1.2 and 5.2.4. The contractor is responsible for supporting the PMPCB organized by_____, the Program PMPCB Contractor responsible for the program level PMPCB management tasks.

(Note: this statement would be for contractors not directly responsible for the Program PMPCB management tasks. The Program PMPCB Contractor responsible for the Program PMPCB management tasks should be identified).

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The planned responsibility and interrelationship of the PMPCB to any other PMP efforts should also be stated in each contract involved. In all cases, the Space Quality PMP Baseline of approved PMP for design selection, application, and procurement should be specified in the solicitation, if available, to simplify the contractors efforts.

6.3 TAILORING TO CONTRACT PHASE

This standard contains a comprehensive management program that requires reliability and standardization considerations be applied during all phases of the program. When this standard is made compliant in a contract for a concept development phase or for a validation and demonstration phases, it does not imply that space quality technical requirements and management procedures apply to anything other than qualification and flight hardware (e.g. they do not apply to ground demonstration models). Contracts for the demonstration and validation phase are encouraged to require the development of a parts, materials, and processes control program plan and at least a first draft of the PMPSL. The contractor should, therefore, have a complete understanding of the entire PMP program to successfully transition into subsequent phases of the contract. The standard is intended to be "self tailoring" in this respect so that specific tailoring to each phase of the contract would not be required.

6.4 DATA ITEM DESCRIPTION

Data requirements of this document are not to be considered deliverable unless specifically identified as deliverable data in the contract or purchase order and the appropriate Data Item Description (DID) is referenced. When this standard is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below should be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of the DoD FAR clause on data requirements (currently DoD FAR Sub Part 27.475-1 are invoked and the DD Form 1423 is not used, the data specified below should be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this standard is cited in the following paragraphs:

Paragraph No.	Data Requirement Title	Applicable DID No.
4.1 & 5.1.1	Parts Control Program Plan	DI-MISC-80526
4.3 & 5.3.1	Program Parts Selection List	DI-MISC-80072
4.3 & 5.3.3	Part Approval Request	DI-MISC-80071
5.2.4	Conference Agenda	DI-A-7088
5.2.4	Conference Minutes	DI-A-7089

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(Data item descriptions related to this standard are listed in DoD 5010.12-L., AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

The appropriate data item description of the Contract Data Requirement List (CDRL: DD Form 1423) should contain an instruction in Block 16 to ensure that submittals include all required parts, materials, and processes data. The tailoring of the data required by this standard is as follows:

- a. Parts, Materials, and Processes Control Plan. Data Item Description, DI-MISC-80526, Parts Control Program Plan. To satisfy the requirement for a Parts, Materials, and Processes Control Program Plan, tailor the DID to include materials and processes in the scope. Tailor the DID to reference paragraph 5.1.1 of this standard for contents. For USAF Space Division contracts, place SD/ALT on distribution. The preliminary parts, materials, and processes control program plan should be provided to the PMPCB for review and to the acquisition activity for approval shortly after contract award. The final parts, materials, and processes control program should be provided to the PMPCB for review and to the acquisition activity for approval prior to the Preliminary Design Review.
- b. Program Parts, Materials, and Processes Selection List (PMPSL). Data Item Description DI-MISC-80072 Program Parts Selection List (PPSL). Tailor the DID to include materials and processes in the scope. Tailor the DID to reference paragraph 5.3.1 of this standard for information required on the PMPSL. It is important to require that the contractor list the industry generic number on the PMPSL to allow independent computer searches for suspect parts. For USAF Space Division contracts, include The Aerospace Corporation Reliability and Components Data Center on distribution. The initial issue of the PMPSL should be provided to the PMPCB for review and to the acquisition activity for approval shortly after contract award and always prior to the Preliminary Design Review.

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- c. Additions to the PMPSL. Data Item Description DI-MISC-80071, Part Approval Request, is used to add PMP to the PMPSL. Tailor the DID to include materials and processes in the scope. Tailor the DID to reference paragraph 5.3.3 of this standard for contents.
- d. Electronic data base. Tailor the CDRL or applicable DIDs to require reports and data generated on an electronic data base to also be delivered using a copy of the data base. The delivered electronic data base media and format should be as approved by the acquisition activity.

6.5 CONTRACTOR PROPOSAL

The contractor proposal should clearly set forth the plans and procedures for implementing a cost effective high reliability parts management program. The proposed plan should define the scope and depth of the contractors efforts including his management approach, organization, staffing planning, technical aspects, and the relationship of the parts program to the contractors other technical and management programs. This should cover the technical and management requirements of the standard. Invitations for bids, request for proposals and contractual statements of work, should include requirements for:

- a. Compliance with the Space Quality PMP Baseline, when furnished, to the maximum extent practicable. Note that on contracts for follow-on production of existing designs, the Space Quality PMP Baseline may be the as-designed parts and materials list for the earlier production, updated to account for recommended PMP improvements.
- b. Time period for acquisition activity response to the proposed PMPSL, and proposed additions to the PMPSL is normally 30 calendar days, although a different time may be specified to suit a contract application.
- c. Submission of a Parts, Materials, and Process Control Program Plan

6.6 MPCAG FUNCTIONS

The function of the MPCAG is to act as an advisor to the acquisition activities and contractors in its assigned commodity classes. The MPCAG would recommend standard parts or inventory

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parts that meet the design requirements of the equipment or system in which the part is to be used. Moreover, the MPCAG accepts technical information about specification changes necessary to make a specification usable, and request action with the military activity responsible for that specification to expedite appropriate changes. NOTE: For a complete listing of the commodity classes for which the MPCAG is responsible as well as a listing of contact points with addresses and telephone numbers, see MIL-STD-965.

6.7 JAN CLASS S OPERATING STOCK PROGRAM

A JAN Class S Operating Stock has been initiated by the Defense Logistics Agency to allow contractors to procure JAN Class S parts that are readily available from stock. This reduces procurement lead times, and allows small quantity ordering. Standard contract clauses which authorize contractors to use the stock should be inserted in a separate section of the contract.

6.8 SUBJECT TERM (KEY WORD) LISTING

Baseline
Class S
control board
JAN Class S
lot
parts
materials
MPCAG
operating stock
PMP
PMP baseline
PMPCB
PMPSL
processes
registered
selection list
space

Custodians
Air Force - 19

Preparing Activity
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APPENDIX A

RETESTING OF ELECTRONIC PARTS

The contents of this section are noncompliant and are intended for guidance and information only.

10. SCOPE.

This appendix provides the retesting instructions necessary to meet Shelf-life Control requirements.

20. ADDED REFERENCED DOCUMENTS

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-1285	Marking of Electrical and Electronic Parts

30. SHELF-LIFE CONTROL.

Parts with lot date codes within four years of installation may be installed without further action. Parts with lot date codes older than four years of installation shall be subjected to a pedigree review and retesting as specified by the program PMPCB prior to installation on equipment. Parts which initially met all program part specification requirements but have not been subjected to screening tests, inspections, and sample tests within four years shall be subjected to a pedigree review and retesting as specified by the program PMPCB prior to installation on equipment. Parts which have had any waiver or deviation granted to the program parts specification requirements shall automatically be subjected to program PMPCB review and approval before installation regardless of age. The PMPCB's decision for retesting shall be based upon lot size, part quality procurement requirements, original screening data, Government Industry Data Exchange Program (GIDEP) data, other ALERTs for problems on the same part or generic family of parts, the original destructive physical analysis results, significant changes in the part being reviewed from current produced parts, available failure history, part construction variables, the manufacturing records, storage and handling environments, and other related considerations.

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30.1 Lot Size and Part Quality. The lot size and the original part quality procurement requirements shall be identified. Part quality requirements are JAN Class S QPL devices, parts in full compliance with MIL-STD-1547, and other devices.

30.1.1 JAN Class S QPL Devices and MIL-STD-1547 Devices. JAN Class S QPL devices and parts in full compliance with MIL-STD-1547 shall have randomly selected samples tested as directed by the PMPCB. The sampling schedule in Table A-1 is intended as a guide for the PMPCB. The sample size is similar to General Inspection Level III per MIL-STD-105D. The specific sample size selected should be based upon all information gathered. The testing shall be in accordance with the requirements of Table A-2; however, additional tests or changes may be required by the PMPCB when so indicated by information gathered from other considerations. Any failures shall require analysis to determine screenability of the failure mechanism and disposition by PMPCB to reject the lot or to screen 100 percent.

Table A-1 Retesting Sample Size Guide

<u>Lot Size</u>	<u>Retesting Sample Size</u>
1-50	ALL
51-90	20
91-150	32
151-280	50
281-500	80
501-1200	125
1201-3200	200
3201-10,000	315

30.1.2 Other Devices. All devices other than JAN Class S QPL devices, and devices that are in accordance with MIL-STD-1547, shall be retested 100 percent unless the PMPCB determines retest is not necessary. As a minimum, the screens of Table A-2 are required. PMPCB shall assess the need for additional screens based upon considerations in the following paragraphs.

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Table A-2. Retests 1/

Part Type	Screening Tests <u>2/</u>
Capacitors (all types)	1. Thermal Shock (except glass) 2. Capacitance and Dissipation Factor 3. Seal (Hermetic only)
Tantalum Variable	+DC Leakage +DC Leakage, Torque and Linearity
Connectors	None
Crystals	1. Electrical Parameters (+25 deg C) 2. Seal
Filters	1. Thermal Shock 2. Seal (Hermetic only) 3. Electrical Parameters (+25°C)
Fuses	1. Seal (Hermetic only) 2. DC Resistance (+25°C)
Inductors, Coils and Transformers	1. Thermal Shock 2. Seal (Hermetic only) 3. Electrical Parameters (+25°C)
Relays	1. Seal 2. Electrical Parameters (25°C)
Resistors (all types) Variable	1. DC Resistance (+25 deg C) +Mechanical Performance
Semiconductors and Microcircuits	1. Seal 2. Electrical Parameters (+25°C)dc
Switches	1. Contact Resistance 2. Operating Mechanical Performance 3. Seal (Hermetic only)
Thermistors	1. Seal (Hermetic only) 2. DC Resistance (+25°C)

1/ This table reflects the minimum retesting for JAN Class S QPL devices and parts in full compliance with MIL-STD-1547 when originally procured.

2/ Tests and electrical parameters shall be as specified in the detail specification.

30.2 Original Screening Data. Examine the original screening data to determine extent of rejects during screening, including the actual percent defective allowed compared to the specified percent defective allowed (when specified). If the actual percent defective allowed was "high" compared to other lots of the same part type, 100 percent retesting should be performed.

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30.3 GIDEP. Examine data contained in the Government Industry Data Exchange Program (GIDEP) to determine problems which may have occurred during qualification, evaluation, or other testing by other contractors.

30.4 ALERTS. Search ALERTs for problems on the same part or generic family of parts, which would indicate a time-related degradation problem or some anomaly for which tests had not previously been performed.

30.5 Destructive Physical Analysis. Perform a review of the original destructive physical analysis results to determine if lot was considered marginal, types of anomalies detected and if time-related.

30.6 PMP Control. When possible, determine from the manufacturer or other sources, any significant changes in the part being reviewed from current produced parts which would indicate the parts should be retested, or have a special test performed if the parts have a potential reliability hazard.

30.7 Usage History. Review available failure history for potential reliability hazards which would indicate special testing or retesting of the parts is required. This may include using history and quantity of parts used.

30.8 Part Construction. Component specialists shall support the PMPCB in the assessment of part construction variables and their impact upon time-related failure mechanisms. Some typical concerns are the need to bake-out carbon composition resistors, moisture effects on capacitors, and aging of gold-aluminum bonds.

30.9 Part Supplier. Verify that the manufacturer has been maintained as an approved source per QPL or contractor approved vendor list.

30.10 Storage Environment. Determine what the environments were during storage (such as temperature, relative humidity, and transportation vibration).

30.11 Storage Control. Determine what electrostatic discharge, handling, packaging, bonded inventory, and similar controls were used.

30.12 Storage Period. Determine what the total duration of storage at the manufacturer and the contractor has been.

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30.13 Next Assembly Usage. When possible, determine the criticality of the application, the stress, the derating parameters, and the ability of box level tests to detect latent part failures.

40. RETESTING.

When the retests in Table A-2 are performed, the number of rejects during the retesting plus the number of rejects during the original screening shall not exceed the original specified percent defective allowed, when specified. When a percent defective allowed was not a requirement for the original screening, the number of rejects allowed during the retesting shall be determined by the PMPCB.

50. EXTERNAL VISUAL EXAMINATION.

Following the retesting, an external visual examination shall be conducted on all parts to determine that there are no degradation effects due to time.

60. IDENTIFICATION OF RETESTED LOTS.

After retesting, a new lot date code shall be marked on the part in accordance with MIL-STD-1285 that indicates the week of the completion of the retesting. Hand printing is acceptable. The marking shall be capable of meeting the permanency requirements specified in MIL-STD-202, Method 215. If space does not permit the marking of the new lot date code, the first digit of the original lot date code may be changed to the number "9". The original marking to be retained.

70. RETEST DATA REVIEW

A satisfactory review shall be performed of the variables data (recorded) between the original screening data and the retesting data indicating no parameter degradation with time.

80. DESTRUCTIVE PHYSICAL ANALYSIS

For those parts where a destructive physical analysis had been previously performed on the original lot, an additional destructive physical analysis may be necessary depending upon the review results of the original destructive physical analysis data. Attention shall be made to determine any effect on the part due to time during the analysis.

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90. FINAL ACCEPTANCE

Final acceptance of the parts is based upon evaluation of the data analysis and retesting data (when parts are retested) by the Program. Concurrence shall be obtained from the PMPCB. Lots or parts failing the retesting may be submitted to the PMPCB for consideration for usage with ample justification.

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APPENDIX B
HARDNESS ASSURANCE

This Appendix is a mandatory part of the standard.

10. SCOPE.

This appendix provides the detailed requirements for managing the radiation hardness assurance of piece parts.

20. HARDNESS ASSURANCE PROGRAM.

The contractor shall develop and implement a radiation hardness assurance program for piece parts during the design, construction, and production of the spacecraft. The hardness assurance tasks include but are not limited to:

- a. Formation of an hardness assurance organization.
- b. Development of an hardness assurance program plan.
- c. Development of hardness assurance requirements.
- d. Representation of hardness assurance issues at preliminary design review and critical design review.
- e. Representation at PMPCB meetings and during capability audits.
- f. Development of hardness assurance design documentation.

20.1 Hardness Assurance Organization. The contractor shall identify a survivability and vulnerability organization whose responsibilities include the implementation, control, and coordination of all hardness assurance activities associated with piece parts. This organization shall interface with their management on hardness assurance issues and assign responsibilities as required to ensure that all aspects of the hardness assurance Program are carried out.

20.2 Hardness Assurance Program Plan. The contractor shall develop and document an hardness assurance program plan for piece parts which details the hardness assurance tasks and identifies responsibilities for assuring that the tasks are carried out. This hardness assurance program plan shall be

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incorporated as a section of the parts, materials, and processes control program plan. Applicable sections shall also be incorporated in the overall quality assurance plan for piece parts. The hardness assurance program plan shall address the following items:

- a. Description of the hardness assurance organization with designated responsibilities.
- b. Responsibilities of representatives to the PMPCB, to preliminary design reviews, to critical design reviews, and to capability audits.
- c. Definition of the system radiation environments.
- d. Specification of worst-case radiation environments for piece parts.
- e. Definition of failure of piece parts in each radiation environment and in each critical circuit applications.
- f. Specification of end point electrical parameters, tolerances, recovery times following a nuclear event and parameter values at the end of mission.
- g. Maintenance of a radiation characterization data base for piece parts.
- h. For custom LSI:
 1. A feasibility analysis which demonstrates that the proposed design and technology are adequate for the radiation requirements.
 2. Identification of hardness assurance critical factors in design, layout, processing, assembly, and handling.
 3. Identification of hardness assurance testability requirements and test chips.
- i. Verification analyses and tests.
- j. Device categorization in each environment and in each critical circuit.
- k. Preparation of the radiation test requirements.
- l. Development of hardness assurance design documentation.

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20.3 Hardness Assurance Requirements. When military hardness assured parts levels M, D, R, or H per MIL-S-19500 or MIL-M-38510 are unavailable or do not meet specified radiation environments, the contractor shall attempt to incorporate his radiation requirements within the framework of the existing military specification system. When incompatibility of the contractor's requirements and the military specification system has been verified and approved by the acquisition activity, the contractor may develop detailed specifications or source control documents (SCDs) for the piece parts. All technical requirements for radiation hardness shall be included in the detailed specifications or SCD, either directly stated or by reference to other documents. These requirements shall conform to MIL-STD-1547. The requirements shall include:

- a. Radiation test methods and test circuits.
- b. Sample size and sampling method.
- c. Radiation types and specification level.
- d. Pre-and post-radiation response parameters and failure criteria.
- e. Required confidence level (C) and survival probability (P).
- f. Dosimetry requirements.
- g. Special radiation tests such as electrical or radiation screening tests.
- h. Categorization criteria.

In addition, the procurement paper should also indicate the list of approved radiation test facilities, the data reporting and analysis requirements, and the failure analysis requirements.

20.4 Hardness Assurance Design Documentation. The contractor shall prepare a Hardness Assurance Design Document which details all radiation analyses and test data for piece parts. This document shall include, but not be limited to:

- a. Circuit schematic, functional description, pin-out, operating conditions, and application of each critical circuit.

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- b. Specification of worst case radiation environment for piece parts in each critical circuit.
- c. The list of piece parts for each critical circuit showing the radiation design margin between worst case circuit requirements and the degradation of piece parts due to radiation.
- d. Part categorization in each critical circuit and each environment.
- e. Results of hardness verification analyses and tests.
- f. Testability requirements and description of hardness assurance test chips.
- g. List of critical design and processing parameters in each radiation environment.
- h. Lot acceptance criteria and test results.
- i. Special controls screening and testing specified for Category 1 piece parts.

20.6 Preliminary and Critical Design Reviews. The contractor shall have an hardness assurance representative present at the preliminary and critical design reviews. The contractor shall ensure that all system design decisions that affect hardness assurance of piece parts are made with the concurrence of the hardness assurance representative. In addition, the representative shall ensure that the hardness assurance program plan, the Hardness Assurance Design Document, and the detailed specification are appropriately modified, if necessary, to incorporate any hardness assurance critical decisions made at the preliminary and critical design reviews.

30. HARDNESS ASSURANCE FOR CUSTOM LARGE SCALE INTEGRATED CIRCUITS (LSIC).

Additional requirements for custom LSI devices are detailed in MIL-HDBK-339.

The hardness assurance organization shall ensure that the following tasks are included during the design and construction of custom LSIC.

- a. Designer and manufacturer capability audits.

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- b. Feasibility assessment performed by the contractor during conceptual design phase.
- c. Design requirements for hardness assurance testability. This may include testable network, test chips and special probe and bond pads.
- d. Radiation critical layout rules and circuit design considerations.
- e. Critical procedures and processes requirements during wafer fabrication and assembly.

40.0 HARDNESS ASSURANCE VERIFICATION

40.1 Hardness Verification Analyses. The contractor shall perform and document radiation analyses of the critical circuits to ensure that the piece parts used in the circuit are capable of meeting the hardness assurance requirements.

40.2 Radiation Characterization Tests. The contractor shall conduct radiation characterization of parts in the specified radiation environments. The radiation characterization tests may be waived if existing data bases are approved by the parts, materials, processes control board (PMPCB) or by the procuring activity. The radiation characterization tests shall consist of exposing the test sample to increasing radiation levels until the parameter or the functional failure value for the device has been reached. These failure values shall be based on a worst case circuit analysis.

50. PROCUREMENT OF PIECE PARTS.

Procurement of piece parts shall be per MIL-M-38510, Class S and MIL-S-19500, JAN S levels M, D, R, or H. Characterization and lot acceptance testing for total dose and neutrons are waived when the above hardness assured parts are selected. Testing requirements for other radiation environments shall be specified in the detailed specification. For other parts, the contractor shall select a wafer lot or, if unavailable, a production lot for all radiation testing except for total dose. Because of the large variation in total dose response that may be observed between wafers, the contractor shall procure and sample test parts from the same wafer. The procurement shall be from manufacturers who maintain a baseline control on the design production and quality control of the piece parts. Any changes in the baseline which may degrade the parts hardness shall be approved by the acquisition activity prior to implementation.

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