

MIL-STD-1546 (USAF)

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SUPERSEDING

(See 6.5)

MILITARY STANDARD

**PARTS, MATERIALS, AND PROCESSES
STANDARDIZATION,
CONTROL AND MANAGEMENT PROGRAM
FOR
SPACECRAFT AND LAUNCH VEHICLES**



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DEPARTMENT OF THE AIR FORCE

Washington, D.C. 20360

Parts, Materials, and Processes Standardization, Control and Management Program for Spacecraft and Launch Vehicles.

MIL-STD-1546 (USAF)

1. This Military Standard is approved for use by the Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.
2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USAF/Space Division/AQM, P.O. Box 92960, Worldway Postal Center, Los Angeles, CA. 90009, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWARD

1. Analysis of space mission failures and on orbit anomalies by the USAF Space Division revealed that the non-availability 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 higher "space quality" level of piece parts for space borne missions.
2. This standard implements the guidelines and requirements established by DODI 4120.19, Department of Defense Parts Control Program, MIL-STD-965 Parts Control Program and is applicable to all new USAF Space Division contracts for new or modified designs of spacecraft and launch vehicles. In addition, this standard extends these guidelines and requirements to include materials and processes. Portions of this standard are also applicable to parts procurements for existing spacecraft/launch vehicle designs. Contracts for control segments and user segments of SD space systems should apply MIL-STD-965 unless it is determined that tailored application of this standard is more appropriate for the reliability or standardization objective of the program.
3. The objective of this Space Division parts, materials, and processes control program is to assure total, integrated, and coordinated management of the selection, application, and procurement, control and standardization of parts, materials and processes, to reduce failures at all levels of assembly; reduce program costs, and improve both the standardization and reliability of spacecraft and launch vehicles. To the degree possible, commonality with Minuteman and National Aeronautics and Space Administration requirements is a goal of MIL-STD-1546.

CONTENTS

	<u>Page</u>
1. SCOPE.....	1
1.1 Purpose.....	1
1.2 Application.....	1
1.3 Limitation.....	1
1.4 Application to subtier contractors.....	1
2. REFERENCED DOCUMENTS.....	1
2.1 Issues of documents.....	1
3. DEFINITIONS.....	3
3.1 Procuring activity.....	3
3.2 Categories of contractors.....	3
3.3 Part.....	3
3.4 Material.....	3
3.5 Process.....	4
3.6 Standard part, material or process (PMP)....	4
3.7 Non-standard parts, materials, or processes.	4
3.8 Program approved part.....	4
3.9 Parts Review Agency (PRA).....	4
3.10 Critical PMP.....	4
3.11 Parts, Materials, and Processes Selection List (PMPSL).....	5
3.12 Parts, Materials, and Processes Control Board (PMPCB)	5
3.13 Military Parts Control Advisory Group (MPCAG).....	5
3.14 Coordinated Procurement (CP).....	5
3.15 Common Purchasing Agreement (CPA).....	5
3.16 Supplier surveillance.....	5
3.17 Supplier.....	6
3.18 Substitute Class S part.....	6
3.19 Manufacturing baseline.....	6
3.20 Limited application PMP.....	6
3.21 Prohibited PMP.....	6
3.22 Reliability suspect items.....	6
3.23 Lot (electronic parts).....	6
3.24 Lot (materials).....	7
4. GENERAL REQUIREMENTS.....	7
4.1 Parts, Materials, and Processes Control and Management Program (PMPCMP) planning.....	7

CONTENTS (Continued)

	<u>Page</u>	
4.2	Parts, Materials, and Processes Control Board (PMPCB).....	7
4.3	Management of PMP selection.....	7
4.4	Management of PMP engineering requirements..	8
4.5	Management of parts and materials procurement.....	8
4.6	Management of Parts and Materials application	
4.7	Government furnished equipment (GFE).....	8
4.8	Compliance with system requirements.....	9
4.9	Off-the-shelf equipment.....	9
5.	DETAILED REQUIREMENTS.....	9
5.1	Parts, Materials, and Processes Control Program (PMPCMP) planning.....	9
5.1.1	Subcontractor management.....	9
5.1.2	Responsibilities of PMP management.....	9
5.1.3	Responsibilities and authority and inter-relationships between "boards" and groups.	12
5.1.4	PMPCB review and information exchange.....	12
5.1.5	PMPCB task milestone schedule.....	12
5.1.6	Special or critical tasks.....	13
5.2	Parts, Materials, and Processes Control and Management (PMPCMP).....	13
5.2.1	Membership.....	14
5.2.1.1	Chairman.....	15
5.2.1.2	Meeting schedules.....	15
5.2.1.3	Responsibilities and Interrelationships.....	15
5.2.2	Prime contractor responsibilities.....	16
5.2.3	Sub-associate contractor responsibilities...	17
5.2.4	Military Parts Control Advisory Group (MPCAG) membership.....	18
5.2.4.1	MPCAG Parts Review.....	18
5.2.5	Parts Review Activity (PRA) membership.....	18
5.2.5.1	PRA parts review.....	18
5.3	Management of PMP selection.....	18
5.3.1	Selection of parts.....	19
5.3.2	Changes to PMP Selection List.....	20
5.3.2.1	Non standard Part Approval Request (NSPAR)	20
5.3.3	Use of PMP selection list.....	21
5.4	Management of PMP engineering requirements..	21
5.4.1	Reliability suspect PMP.....	22

MIL-STD-1546 (USAF)

CONTENTS (Continued)

	<u>Page</u>	
5.4.2	Limited application PMP.....	22
5.4.3	Prohibited PMP.....	22
5.4.4	PMP qualification.....	22
5.4.4.1	Configuration analysis.....	24
5.4.5	Contractor part testing and inspection responsibility.....	24
5.4.5.1	Parts screening and quality conformance requirements.....	25
5.4.5.1.1	Parts screening and quality conformance test plan.....	25
5.4.5.1.2	Parts testing.....	25
5.4.5.1.3	Parts screening and quality conformance test matrix.....	25
5.4.5.1.4	Material screening and quality conformance test requirements.....	26
5.4.5.2	Destructive physical analysis.....	26
5.4.5.2.1	DPA policy procedures and reports.....	26
5.4.6	Incoming inspection requirements.....	26
5.4.7	Failure analysis.....	27
5.4.8	Traceability and lot control.....	28
5.4.8.1	Shelf-life control.....	29
5.4.8.2	Traceability.....	29
5.4.8.2.1	Group codes.....	29
5.4.8.2.2	Element codes.....	29
5.4.9	Preservation and packaging.....	29
5.4.10	Handling and storage.....	30
5.4.11	Defective Parts and Components Control Program (DPCCP).....	31
5.5	Management of parts and material procurement	31
5.5.1	Coordinated procurement.....	31
5.5.2	Supplier selection.....	31
5.5.2.1	Control and Evaluation.....	32
5.5.2.2	Homogeneity of parts and materials.....	32
5.5.3	Supplier surveillance.....	32
5.5.4	Manufacturing baseline.....	32
5.5.5	Manufacturing baseline control.....	32
5.6	PMP application management.....	32
5.6.1	Derating.....	32
5.6.2	PMP application data.....	33

CONTENTS (Continued)

		<u>Page</u>
6.	NOTES.....	
6.1	Application and tailoring.....	34
6.2	Statement of work provisions for part configuration analysis.....	34
6.3	Data requirements.....	34
6.4	Contractual requirements.....	35

APPENDIX A
COORDINATED PROCUREMENT

10.	SCOPE.....	A-1
20.	COORDINATED PROCUREMENT.....	A-1
20.1	Intent.....	A-1
20.2	Interface agreement document.....	A-1
20.3	Prime contractor responsibilities.....	A-2
20.3.1	Management.....	A-2
20.3.2	Common purchasing agreement (CPA).....	A-2
20.3.3	Procurement.....	A-2
20.3.3.1	Parts.....	A-2
20.3.3.2	Other.....	A-2
20.3.4	Procurement status system.....	A-2
20.3.5	Supplier proposed manufacturing baseline changes.....	A-2
20.3.6	Problem resolution.....	A-2
20.3.7	Allocation of costs.....	A-2
20.3.8	Incoming inspection.....	A-2
20.4	Coordinated procurement tasks.....	A-3
20.4.1	PMPCB Interface.....	A-5
20.4.2	Relationship to PMPCB.....	A-5
20.5	Participating contractors responsibilities..	A-5

APPENDIX B
SUPPLIER SURVEILLANCE

10.	SCOPE.....	B-1
10.1	Intent.....	B-1
10.2	Applicability.....	B-1
20.	SUPPLIER SURVEILLANCE.....	B-1
20.1	Selection of surveillance contractor.....	B-1
20.2	Location of surveillance personnel.....	B-1
20.3	Duties of surveillance personnel.....	B-1

MIL-STD-1546 (USAF)

CONTENTS (Continued)

	<u>Page</u>
APPENDIX C	
PARTS SELECTION	
10. PARTS SELECTION.....	C-1
10.1 First order of preference.....	C-1
10.2 All other parts.....	C-1
APPENDIX D	
USAF SPACE DIVISION PREFERRED PARTS LIST	
10. SCOPE.....	D-1
20. PURPOSE.....	D-1
30. CONTENT.....	D-1
30.1 Part type.....	D-1
30.2 Description.....	D-1
30.3 Qual status.....	D-2
30.4 Class S part number.....	D-2
30.5 Substitute Class S part number.....	D-2
40. CRITERIA FOR AFSD PREFERRED LISTING.....	D-2
40.1 Application need.....	D-2
40.2 Technological Maturity.....	D-2
40.3 Availability.....	D-2
40.4 Test or usage history.....	D-2
40.5 Military slash sheet.....	D-3
PREFERRED PARTS LIST.....	D-4

1. SCOPE

1.1 Purpose. This standard establishes the criteria and requirements for the preparation and implementation of a Parts, Materials, and Processes Standardization Control and Management Program (PMPSCMP) for use during the design, development, fabrication, and test of spacecraft and launch vehicles. The implementation of this standard is intended; to assure total, integrated, and coordinated management of the selection, application, procurement, control and standardization of parts, materials, and processes (PMP); to reduce PMP failures at all levels of assembly; improve procurements of small quantities of parts, reduce program costs, and improve the standardization and reliability of program parts, materials and processes.

1.2 Application. This standard applies to all prime, associate and subcontractors involved in a program where parts, materials and processes (PMP) are intended to be used for spacecraft or launch vehicles. In applications such as Ground Support Equipment, or experiments where reliability is less critical to mission success, tailoring of the requirements of this standard is appropriate. This standard complies with, augments, and tailors the requirements of MIL-STD-965 for application to spacecraft and launch vehicles, including materials and processes.

1.3 Limitation. For the purpose of this standard, materials and processes (MP) shall be limited to those MP which are critical (as defined by contract or by the Parts Materials and Processes Control Board (PMPCB)) to the reliability of the equipment or system being procured.

1.4 Application of this standard to subcontractors. This standard shall apply to subcontractors as specified in the contract or in the flow down from the prime contractor. It is intended that all subcontractors conduct a tailored PMP management program to meet the objectives (standardization and reliability) of this standard. The need for a subcontractor PMPCB, as opposed to participation in the prime contractor PMPCB, shall be jointly decided upon by the prime and subcontractor. Volumes of parts and their criticality to system or subsystem reliability are determining criteria for the level of parts management required.

2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the

MIL-STD-1546 (USAF)

issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

SPECIFICATIONS

Military

MIL-B-121	Barrier Material, Greaseproof, Waterproof, Flexible
MIL-B-131	Barrier Materials, Watervaporproof, Flexible, Heat-sealable
MIL-Q-9858	Quality Program Requirements
MIL-S-19500	Semiconductor Device, General Specification for
MIL-B-22191	Barrier Material, Transparent, Flexible, Heat Sealable
MIL-M-38510	Microcircuits, General Specification for
MIL-B-81705	Barrier Materials, Flexible, Electrostatic - Free, Heat Sealable

STANDARDS

Military

MIL-STD-202	Test Methods for Electronics and Electrical Component Parts
MIL-STD-750	Test Methods for Semiconductor Devices
MIL-STD-794	Part and Equipment, Procedures for Packaging and Packing of
MIL-STD-810	Environmental Test Methods
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-965	Parts Control Program
MIL-STD-1535	Supplier Quality Assurance Program Requirements

MIL-STD-1543 Reliability Program Requirements for Space and Missile Systems

MIL-STD-1547 Technical Requirements for Parts, Materials, and Processes for Spacecraft and Launch Vehicles

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. DEFINITIONS

3.1 Procuring activity. The Government contracting office procuring the equipment, system or subsystem for which this standard is being contractually applied.

3.2 Categories of contractors. In this standard the term "contractor" signifies a producer of modules or higher level items. Most system programs have one major contractor identified as the "prime contractor", who is responsible directly to the procuring activity. Other programs may have two or more major contractors, each responsible directly to the procuring activity (neither one subordinate to the other), which are called "associate contractors". In the following text, when the term contractor is used, it shall apply to either the prime or the associate contractor, whichever is applicable. In the case of two or more associate contractors, the procuring activity shall designate the responsible associate contractor. All other contractors providing modules or higher level items to the prime or associate contractors are identified as "subtier contractors". Subtier contractors include subcontractors.

3.3 Part. One piece, or two or more pieces joined together, which are not normally subjected to disassembly without destruction or impairment of designed use (See paragraph 6.4 of MIL-STD-965 for applicable Federal Supply Classes).

3.4 Material. An element, mixture or compound used in a manufacturing operation which becomes part of the manufactured item.

MIL-STD-1546 (USAF)

3.5 Process. An operation, treatment or procedure used as a step in the manufacture of an item.

3.6 Standard part, material or process (PMP). For the purpose of this Standard, a standard electronic part, is one which is selected from the "Class S Part No." or "JAN S Part No." columns of the USAF Space Division (SD) Preferred Parts List (Appendix D). A Standard mechanical part, material or process is one which is selected from an explicit list of mechanical parts, materials or processes identified in the contract as standard mechanical parts, materials or processes.

3.7 Non-standard parts, materials, or processes. A part, material or process other than as defined in 3.6 above.

3.8 Program Approved PMP. A part, material or process which is identified as approved for use on the approved PMPSL, or an approved part which is listed on the approved Parts, Materials, and Processes Selection List (PMPSL) upgraded to space quality by the application of the requirements of MIL-STD-1547.

3.9 Parts Review Agency (PRA). An organization, usually a Systems Engineering/Technical Direction Contractor, designated by the procuring activity to establish criteria for standard PMP, to review nonstandard PMP data and to provide technical advice and recommendations to the procuring activity.

3.10 Critical PMP. Critical PMP are those which meet any of the following criteria:

3.10.1 The part or material is used in a single point failure application, and critically affects system operation of mission essential equipment, or prevents obtaining data to evaluate accomplishment of mission objectives.

3.10.2 The use of a part or material which has a high technical risk; i.e., stringent performance requirement(s) in its intended application relative to state-of-the-art techniques for the item.

3.10.3 The part or material used is stressed in excess of recommended derating criteria.

3.10.4 The part or material is a long lead time procurement item as defined by the contract or the PMPCB.

3.10.5 A process is considered critical when it is essential to workmanship such that failure to comply will effect system performance.

3.11 Parts, Materials, and Processes Selection List (PMPSL). A list of all parts, materials, and processes approved for use in a specific system or equipment. It is composed of standard and nonstandard items which have been approved by the PMPCB and the Procuring Activity.

3.12 Parts, Materials, and Processes Control Board (PMPCB). An organization established by contract according to the requirements of this Standard to assist the prime contractors in managing and controlling the selection and documentation of parts, materials, and processes to be used in the system.

3.13 Military Parts Control Advisory Group (MPCAG). 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. Final approval for the selection of a PMP rests with the Procuring Activity (See paragraph 6.4 of MIL-STD-965).

3.14 Coordinated Procurement (CP). The combined effort of the prime contractor and subtier contractor(s) on a given program to procure parts through the use of common specifications, common purchase agreements, and unified management (see Appendix A).

3.15 Common Purchasing Agreement (CPA). An agreement between a prime contractor and a parts supplier for procurement of coordinated procurement parts. The CPA guarantees a minimum combined quantity, provides the economics of large purchases, and contains a delivery schedule for support of the need date for each participating contractor. The CPA also provides for the separate procurement of parts by each participant.

3.16 Supplier surveillance. The monitoring by the contractor or his designated representative, of the manufacturing, inspection and test operations of a supplier and which is based on pre-established criteria. Supplier surveillance includes Contractor Source Inspection (CSI).

MIL-STD-1546 (USAF)

3.17 Supplier. The organization that manufactures the PMP being procured.

3.18 Substitute Class S Parts. Those parts listed in the "Substitute Class S Part No." columns of the USAF Space Division Preferred Parts List (see Appendix D).

3.19 Manufacturing baseline. A description of the sequence of manufacturing operations necessary to produce a specific part, (normally in the form of a flow chart). All documents pertaining to the procurement and inspection of materials, the production processes, the production environments and production controls are identified. Documents are identified by name, number and current approved revision.

3.20 Limited application PMP. PMP with restriction on their use and approved for listing on the PMPSL.

3.21 Prohibited PMP. PMP that are prohibited from use on the system.

3.22 Reliability suspect PMP. A part, material or process will be considered reliability suspect if it meets any one of the following criteria:

- a. The PMP has unsatisfactory operating (performance) history.
- b. The PMP is new or has low Program usage, thus it does not have sufficient history of its own (or similarity to other items which have demonstrated high reliability) to provide confidence in its reliability.
- c. The PMP is known to require special handling, transportation, storage, or test precautions.
- d. The PMP has a known age, cycle or other limitation which warrants controlled surveillance.
- e. The PMP is difficult to procure or manufacture relative to state-of-the art techniques.
- f. Reliability suspect PMP or designs listed in MIL-STD-1547.

3.23 Lot (Electronic Parts). For microcircuits, the lot definition of MIL-M-38510 applies. For other electronic parts

a lot is defined as consisting of a single type, defined by a single part number, produced in a common production run by means of the same production processes, materials, control, design and tested within the same period (normally not exceeding six weeks). All parts in the lot shall have the same lot date code.

3.24 Lot (Materials). Unless the existing procurement specification applies a more restrictive definition, a lot (or batch) is defined as the specific quantity of material produced in a continuous operation or production cycle and offered for acceptance at any one time.

4. GENERAL REQUIREMENTS

4.1 Parts, Materials, and Processes Control and Management Program (PMPCMP) planning. The contractor shall plan for, establish, and conduct a PMPCMP in accordance with this Standard. The prime contractor shall be responsible to the procuring activity for ensuring that all subcontractor or subtier contractors conduct their PMP activities in accordance with the requirements of this standard, as tailored in the sub contract flow down. For the purpose of this standard, materials and processes shall be limited to those which are critical (as defined by contract or by the Parts Materials and Processes Control Board) to the reliability of the equipment being procured.

4.2 Parts, Materials, and Processes Control Board (PMPCB). The prime contractor, or the responsible associate contractor designated by the procuring activity, shall establish a PMPCB to manage the selection and standardization of PMP throughout the design development, fabrication and test of spacecraft and launch vehicles equipment or contract and shall provide the chairperson for the PMPCB.

4.3 Management of PMP selection. Contractors shall manage the selection of PMP for program designs and hardware in accordance with the criteria specified in this standard. This is done to maximize the use of standard PMP and to minimize the variety of PMP used to satisfy program design and performance requirements. The proposed program Parts Material and Processes Selection List (PMPSL) submitted with the contractor's proposal shall maximize the use of parts listed in Appendix "D" and shall include PMP proposed for use by the contractor or subcontractors. Addition of non-standard PMP to the PMPSL shall require substantiation documents such as the

MIL-STD-1546 (USAF)

Non Standard Part (or Material or Process) Approval Request (NSPAR). Procuring activity approval is required.

4.4 Management of PMP engineering requirements. The contractor shall ensure that all PMP engineering requirements are managed by the PMPCB in accordance with the requirements of this standard.

4.5 Management of parts and materials procurement. The contractor shall plan for and coordinate the procurement of parts and materials and provide for source surveillance in accordance with the requirements of this Standard.

The contractor shall be responsible for "coordinated procurement" of appropriate electronic and electrical parts for use by the contractor and subcontractors in accordance with the criteria and guidelines of Appendix A in order to improve part reliability and decrease procurement difficulties (see 5.5.1).

The contractor shall conduct supplier surveillance (see Appendix B) of all critical processes required to produce microelectronic and semiconductor parts. Microelectronic and semi-conductor parts produced on existing monitored lines that meet all USAF Space Division requirements may be used without additional surveillance if approved by the procuring activity (see 5.5.3).

Supplier surveillance shall not be conducted on Class S or JANS parts listed on the Part II or Part I Military QPL, unless specifically authorized to do so by the procuring activity. Supplier surveillance may be conducted on part types other than microcircuits and semiconductor if approved by the PMPCB and the procuring activity.

4.6 Management of parts and materials application. The contractor shall ensure that parts and materials are properly designed into the system and that each application is derated in accordance with the requirements of this standard (see 5.6.1) and MIL-STD-1547.

4.7 Government furnished equipment (GFE). Parts materials and processes contained in unmodified GFE used in the end item of the contract need not be subjected to parts control procedures nor listed on the PMPSL. The contractor shall implement the PMP selection and approval provisions described herein for PMP to be used for modification of any portion of GFE intended for use in the end item of the contract. The PMP

contained in the GFE shall be reviewed for compliance with program performance and reliability requirements.

4.8 Compliance with system requirements. The requirements of this standard for program PMP management 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 system-equipment specifications and contracts.

4.9 Off-the-shelf equipment. Parts, materials or processes contained in unmodified off-the-shelf equipment to be used in the space or critical ground end-items of the contract need not be subject to the control procedures specified in this standard. Parts, materials and processes lists of off-the-shelf equipment shall be reviewed to ensure that the requirements of the system are met. Those PMP that result in the off-the-shelf equipment not meeting system requirements shall be analyzed and replaced as directed by the procuring activity. The contractor shall implement the PMP selection and approval provisions described herein for PMP to be used for modification of any portion of the off-the-self equipment intended for use in the end item of the contract.

5. DETAILED REQUIREMENTS

5.1 Parts, Materials, and Processes Control and Management Program (PMPCMP) planning. The contractor shall plan for satisfying the requirements of this standard. The plan shall be comprehensive and describe how a fully integrated contractor effort will be organized, managed, and conducted.

5.1.1 Subcontractor management. The prime contractor shall describe the methods, procedures, planning and reporting requirements of this standard which he will contractually place on subtier contractors. A special section of the PMPCMP shall be included that deals with audits of subtier contractors for assurance of contract compliance.

5.1.2 Responsibilities of PMP management. The contractor shall establish an operating procedure to outline the function and procedures that will be followed by all members of the PMPCB to ensure that the requirements of this standard are complied with. This operating procedure shall be maintained by the PMPCB and shall be reviewed by the procuring activity prior to being implemented. The contractor PMP management function

MIL-STD-1546 (USAF)

shall identify the responsibilities and authorities for PMP management efforts including the number and types of standardization and control boards, methods for integrating and the coordination of PMP engineering, reliability analysis and quality control efforts. Methods for integration and coordination of associate and subtier contractor effort; methods for tracking program performance; plans and schedules for technical program reviews; methods for formal and informal review of program status with the procuring activity shall be included. Special topics to be covered shall include the following:

- a. Compliance by all program participants with the requirements of this standard.
- b. Designation of the policies and procedures for PMP selection; supplier evaluation and selection; documentation preparation; and, the evaluation, qualification and analysis of PMP.
- c. Designation of the responsibility and authority and membership of required control boards and working groups in accordance with this standard. Approve policies and operating procedures.
- d. Preparation of PMPCB meeting agenda, meeting notices and agenda at least 14 calendar days prior to the meetings.
- e. Preparation of and distribution of PMPCB meeting minutes.
- f. Development and delivery of the PMP data items as required by the contract, data requirements list (CDRL).
- g. Development of PMP milestones and task schedule chart and the required management reporting system for their maintenance.
- h. Timely coordination among all control boards, working groups, and functional organizations of the associate and subtier contractors.
- i. Participation in program design reviews.
- j. Participation in supplier evaluation and audits.
- k. Scheduling and the performance of audits of subtier contractors for review of the implementation of program PMP plan and management policies and procedures.

- l. Identification of PMP candidates, and their PMP reviews and approvals on a timely basis.
- m. Submission of proposed PMP Selection Lists (PMPSL) to the procuring activity for review. Publish the PMPSL and additions thereto when approved by the procuring activity (see 5.3).
- n. Arrangements for timely preparation of required PMP documentation.
- o. Coordinated procurement plan. (see 5.5.1).
- p. Timely inputs to the PMPCB regarding items pertaining to procurement and supplier surveillance of parts and materials.
- q. Establishing and implementation of a supplier surveillance monitoring program for parts and materials manufacturers (see 5.5.3).
- r. Timely PMP evaluations, qualifications, DPA and failure analysis.
- s. Assurance that only those parts, materials and processes listed on the approved PMPSL are used in design and manufacture and that all engineering drawings or associated lists specify the part numbers listed on the PMPSL.
- t. Assurance that updated PMPSL information is provided to the contractor's and each subtier contractors' design groups in a timely manner.
- u. Identification to the procuring activity those changes required in parts, materials or process specifications to meet the equipment, system, or subsystem requirements.
- v. Implementation of a Defective Parts & Components Control Program (DPCCP). (see 5.4.11)
- w. Establishment of procedures for reporting to the procuring activity immediate program status and problem identification. As required, present evidence to the procuring activity that a part, material or process complies with the requirements of this standard.

MIL-STD-1546 (USAF)

- x. Establishment of procedures for review of part procurement documentation for inclusion of the requirements of MIL-STD-1547.

5.1.3 Responsibilities and authority and inter-relationships between "boards" and "groups". The PMPCMP shall identify the responsibilities and authority of the PMPCB and its interfaces with other "Boards" and/or "Groups" within the prime, associate or sub-tier contractor organization as they effect PMP Control and Management.

5.1.4 PMPCB review and information exchange. PMP planning shall include methods for coordination of information and the accomplishment of information exchanges between the PMPCB, failure review, and MRB activities, and shall include the following functions:

1. Design engineering
2. Manufacturing
3. Receiving inspecting
4. Quality control
5. Calibration
6. Reliability
7. Test engineering
8. Program schedule control
9. Procurement
10. Evaluation groups interface

5.1.5 PMPCB task milestone schedule. The prime contractor shall develop a master task schedule chart that presents those PMPCB tasks identified and required in accordance with the requirements herein. The task schedule charts shall cover the time period from the commencement of contract or authority to proceed through hardware delivery and shall depict the PMPCB milestones and planned program formal design reviews. Separate schedules shall be shown for electronic parts, and for materials and for processes.

Separate sections shall be provided for the activities at each subtier contractor. A method shall be developed for closed loop task control and reporting to management and the procuring activity, and shall include a provision for problem identification and recommendation for their resolution. This milestone schedule shall be presented to the PMPCB for review.

5.1.6 Special or critical tasks. Special or critical tasks in the PMPCB Task Milestone Schedule shall be identified where criticality of PMP is based upon technical risk, high cost, or procurement long lead time. These tasks shall define the specific actions required to deal with the identified criticality and to implement the prescribed action.

5.2 Parts, Materials, and Processes Control Board (PMPCB). The contractor shall establish a PMPCB for the control and management of parts, materials and processes. The procuring activity retains the right of disapproval of PMPCB decisions. The responsibilities of the PMPCB are to include:

- a. Establish PMPCB operating procedures in accordance with this Standard to meet program requirements. This operating procedure shall be reviewed by the procuring activity prior to its implementation.
- b. Accumulate input from all program contractors and establish a PMPSL for the program.
- c. Provide recommendations for reducing the number of different types of parts and materials used.
- d. Ensure the maximum use of standard parts, materials, and processes.
- e. Identify, control, and limit the application of Reliability Suspect PMP.
- f. Evaluate and recommend approval or disapproval to the procuring activity of nonstandard parts, materials, and processes proposed for listing on the PMPSL.
- g. Ensure that all PMP documents for program use comply with the requirements of this standard.
- h. Review and recommend approval or disapproval to the procuring activity for deviations from the requirements of this standard.

MIL-STD-1546 (USAF)

- i. Review and approve or disapprove recommendations for certification, qualification, and evaluation plans for PMP.
- j. Participate in design reviews for PMP to meet the requirements as listed in MIL-STD-1547.
- k. Review analyses on application of parts and materials for compliance with derating requirements of MIL-STD-1547.
- l. Identify age or cycle limited parts or materials and approve recommended control procedures.
- m. Review the results of receiving inspection, DPA, failure analysis and reports, Material Review Board and Failure Review Board actions; and problems identified in the field and participate in decision making.
- n. Approve manufacturing baselines and changes thereto.
- o. Identify and assure timely procurement of long lead procurement parts and materials.
- p. Keep MPCAG informed of actions involving parts requirements.

5.2.1 Membership. The PMPCB membership shall include a member from each of the contractors: prime, associate, and subtier. Each member shall be capable of being supported in the following technical disciplines as required:

- a. Program product effectiveness (e.g., quality assurance, reliability and standardization, survivability, etc.).
- b. Parts applications and technology.
- c. Materials and processes technology.
- d. Program systems engineering.
- e. Purchasing department.

The procuring activity shall be represented as a member of the PMPCB. Other members may be designated by the procuring

activity and/or the Chairman of the PMPCB. Each member shall have the authority to commit his company to PMPCB decisions and actions which are within the scope of the PMPCB and the applicable contract. Other technical support representatives from the contractors may attend as consultants, when required. PMPCB attendance shall include, when required, representatives from MPCAG, and other parts review activities (PRAs) that the procuring activity may designate (see 5.2.4 and 5.2.5).

5.2.1.1 Chairperson. Unless otherwise specified by the procuring activity, the chairperson of the PMPCB will be the prime contractor. If more than one prime or associate contractor is involved with a system procurement, the procuring activity will designate the responsible contractor to act as chairperson.

5.2.1.2 Meeting schedules. Meetings shall normally be held as follows:

- a. A post-award PMPCB organizational meeting shall be convened by the prime contractor within 30 days after contract award to establish working relationships, responsibilities, and procedures for implementation of PMPCMP. The contractor shall coordinate the date and location of the meeting with the procuring activity, and its designated representatives, including MPCAG and PRAs. This meeting may be held in conjunction with other scheduled contract review meetings.
- b. Subsequent PMPCB meetings shall normally be held once a month and then less frequently thereafter as required and as the program progresses.
- c. Special PMPCB meetings may be called by the PMPCB chairman or procuring activity, as required, with adequate notification provided to the PMPCB members and representatives of MPCAG and the PRAs.

5.2.1.3 Responsibilities and Interrelationships. The contractor shall:

- a. Coordinate the identification and approval of parts, materials, and processes candidates proposed for the PMPSL.
- b. Ensure compliance with the requirements of this standard to the extent invoked by the contract.

MIL-STD-1546 (USAF)

- c. Ensure that only those PMP approved for listing on the PMPSL are used in design, and that all equipment, system, or subsystem drawings specify these designated PMP.
- d. Identify to the MPCAG or the procuring activity those changes required in parts specifications to meet the equipment, system, or subsystem requirements.
- e. When contractually required, prepare PMP documentation.
- f. Develop a critical PMP list based on such things as technical risks, high costs or procurement lead time. Identify methods for their control.
- g. Ensure maximum use of standard parts, materials, and processes.
- h. Minimize the number of different types and styles of parts and materials and parts used.

5.2.2 Prime contractor responsibilities. The prime contractor shall:

- a. Provide PMPCB chairperson (see 5.2.1.1).
- b. Assign document preparation tasks, when applicable, to PMPCB members.
- c. Prepare PMPCB meeting agenda, distribute meeting notices and agenda at least 14 calendar days prior to the PMPCB meeting.
- d. Prepare and distribute meeting minutes.
- e. Ensure that subcontractor PMPCB members support the PMPCB as follows:
 - 1. Maximize the use of standard parts, materials, and processes.
 - 2. Prepare justification for use of nonstandard PMP and submit to the PMPCB for review and approval.
 - 3. Accomplish supplier surveys as required. Make survey data available when required.

4. Provide to the PMPCB test and other applicable data on proposed candidate PMP. Limitations on use of the PMP, which will affect the quality or reliability, shall be identified.
 5. Prepare PMP documentation when requested by PMPCB chairman.
 6. Submit PMP test data to PMPCB.
- f. Request MPCAG and PRA review of applicable PMP proposed for the approved PMPSL.
 - g. Submit the proposed PMPSL to the procuring activity for approval.

5.2.3 Sub-associate contractor responsibilities. Provide to the PMPCB as required:

- a. Designate PMPCB representative and support PMPCB meetings as required.
- b. Assure designated representative is provided required in-house support.
- c. Provide inputs to PMPCB for proposed PMPSL.
- d. Maximize the selection and use of standard PMP.
- e. Provide recommendations for PMP certification, qualification and evaluation plans.
- f. Ensure PMP design reviews are conducted as required.
- g. Provide summary of parts and materials stress analyses.
- h. Provide age or cycle limited part and materials data to PMPCB for approval (see 5.6).
- i. Prepare a listing of and make available justification data for nonstandard or reliability suspect PMP and make the data available to the PMPCB using Non-Standard Part Approval Request format.
- j. Provide to the PMPCB test and other applicable data on a proposed candidate PMP. Limitations on the use of the PMP which will affect the quality or reliability shall be identified.

MIL-STD-1546 (USAF)

- k. Prepare documentation on requests for approval of PMP when required.
- l. Provide timely information to PMPCB on parts problems.
- m. Provide critical PMP lists and their method of control.

5.2.4 Military Parts Control Advisory Group (MPCAG) membership. Military Parts Control Advisory Groups have been established to assist the Procuring Activity and Contractors in the selection of standard parts for use in new systems and equipment design. The MPCAG consists of professional engineers and experienced technicians who have the latest information available on military standard parts and who can quickly disseminate this information to Government agencies and their contractors upon request .

5.2.4.1 MPCAG Parts Review. The prime contractor shall request a MPCAG review of applicable parts (see paragraph 6.4 of MIL-STD-965) proposed for PMPSL. Telephone requests to MPCAG for information is permissible provided immediate written follow-up notification to MPCAG and the procuring activity is taken to document the request. All MPCAG recommendations are subject to approval by the procuring activity, and do not relieve the contractor of any contractual requirements.

5.2.5 Parts Review Activity (PRA) membership. A Parts Review Activity will assist the procuring activity and contractors in the selection of PMP for use in new systems and equipment design. The PRA for USAF Space Division shall be as designated by the procuring activity.

5.2.5.1 PRA review. The prime contractor shall request from the PRA, a review of PMP proposed for the PMPSL, including those not under MPCAG review.

5.3 Management of PMP selection. Each contractor and subcontractor shall update (as required by the CDRL) the proposed PMPSL submitted with his proposal. The number of different PMP shall be held to a minimum while the use of standard PMP shall be maximized (see Appendix C).

The Prime Contractor shall develop a complete program PMPSL. This proposed program PMPSL shall be submitted to the PMPCB for review and to the procuring activity for approval. The PMPSL shall include NSPAR data on all non-standard PMP listed (see 5.3.2.1).

Records shall be kept for the life of the contract on the Program PMPSL. The records shall include as a minimum the following:

- a. Approved PMP (including NSPAR justification).
- b. Additions and deletions.
- c. Limited usage PMP, critical PMP and reliability suspect PMP.
- d. Disapproved PMP.

Reliability suspect and critical PMP shall be highlighted and specific control methods to be applied shall be presented to the PMPCB.

5.3.1 Selection of PMP. The contractor shall select for new designs and procure for system hardware microcircuits specified to MIL-M-38510 Class "S" and listed on Part I or Part II of Military Qualified Products List (QPL) and semiconductor specified in MIL-S-19500, JAN "S" and listed on Part I or Part II Military QPL, whenever applicable. When other than military qualified Class "S" or JAN "S" devices must be used, the contractor shall strive to procure these parts to design and construction, qualification, screening certification, quality conformance, process control, and failure analysis requirements equivalent to or better than MIL-M-38510, Class "S", or MIL-S-19500, JAN "S".

In determining PMP candidates for the PMPSL the contractor and subcontractors shall as a first priority, select standard PMP. When standard parts, materials, and processes are not available, nonstandard PMP shall be selected in accordance with the requirements specified in Appendix C. The contractor and subcontractor may request assistance from the MPCAG or other review activities (PRAs) pertaining to the selection and identification of PMP to meet specific functional requirements of the end item in which the PMP are to be used. PMP selection from contractor lists is permissible with PMPCB approval.

All nonstandard PMP shall be clearly identified at design reviews and adequate information shall be provided to substantiate their selection and use (See Appendix C). Limited use and Reliability Suspect PMP shall also be identified at design reviews and their method of control as well as adequate information to substantiate their use shall be provided.

MIL-STD-1546 (USAF)

5.3.2 Changes to PMP Selection List. Changes to the approved PMPSL can be accomplished only with the approval of the procuring activity or its designated representative. The PMPCB is responsible for making recommendations to the procuring activity for approval of any changes to the PMPSL.

When it has been determined by a design engineer that the design of the equipment required by the contract cannot be accomplished by program approved PMP, he shall request the PMPCB to take action to have the required PMP added to the PMPSL. All requests shall include engineering analyses and test reports demonstrating that the newly identified PMP has performance, reliability, and quality characteristics satisfactory for the intended application. If nonstandard PMP must be used the request shall take the form of a NON-Standard Part (or PMP) Approval Request (NSPAR). (If the new, PMP is for limited use, or if it is reliability suspect it shall be so identified on the PMPSL).

After the proposed program PMPSL has been approved, all subsequent changes require PMPCB review and approval. The prime contractor shall submit proposed changes to the PMPSL to all PMPCB members and representatives for review at least 14 calendar days prior to a PMPCB meeting. Disapproval by the procuring activity of changes to the PMPSL shall be exercised in a timely manner after receipt of PMPCB recommended changes.

If the procuring activity has approved the listing of additional PMP, or if approval for the use of PMP is withdrawn, the prime contractor shall so revise the PMPSL. The revision shall be either by amendment or reissuance, at the contractor's option.

5.3.2.1 Non-standard Part Approval Request (NSPAR). A nonstandard part approval request shall be submitted to the PMPCB on all parts other than Standard Parts. Data required for this request shall include as minimum the following:

- a. Justification (also include why a USAF Space Division Standard PMP, if available, cannot be used).
- b. Complete reliability history, test data, other program usage and history and applicable failure analysis.
- c. Availability and potential sources.

- d. Data (quality to be used, application, procurement requirements, previous usage, critical application, derating requirements, qualification status, qualification of manufacturer, known precautions, electrostatically sensitive, etc.).
- e. Comparison with MIL-STD-1547 and space quality requirements for its type, design and construction and screening requirements.
- f. When applicable, critical, reliability suspect or limited use PMP shall be so noted. Control requirements shall be specified.
- g. Others as appropriate.

5.3.3 Use of PMP selection list. The PMPSL shall not be formally issued until after it has been approved by the procuring activity. Only the PMP listed on the approved PMPSL, shall be used in design or modification of the equipment, system, or subsystem. When the procuring activity restricts the use of certain PMP to specific applications, including critical applications, these PMP shall then be used only in accordance with the limitations specified in the approved PMPSL.

The PMPSL shall be provided to each contractor and/or subtier contractor for use by their design group. All drawings shall specify only the PMP that are listed on the PMPSL.

5.4 Management of PMP engineering requirements. Management of the PMP engineering efforts shall require review and control of all program PMP engineering methods, procedures and planning to ensure compliance with MIL-STD-1547 requirements, and to achieve required PMP reliability. All PMP specifications shall be approved by the PMPCB.

The PMPCB shall assure that all standard (JAN S and Class "S") parts are procured to the full conditions of the applicable military specification, applied in accordance with MIL-STD-1547, and meet the requirements of para. 5.4.4, 5.4.5.2, 5.4.6, 5.4.7, 5.4.8, 5.4.8.1, 5.4.8.2, 5.4.9, 5.4.10, and 5.4.11.

The PMPCB shall assure that all non-standard PMP (see 3.7) meet the requirements of para. 5.4 through 5.4.12 of this standard. "Substitute Class S" parts shall be procured to the full requirements of the governing specification (see Notes, USAF

MIL-STD-1546 (USAF)

Space Division Preferred Parts List, Appendix D) applied in accordance with MIL-STD-1547, and shall meet the requirements of 5.4.4, 5.4.5.2, 5.4.6, 5.4.7, 5.4.8, 5.4.8.1, 5.4.8.2, 5.4.9, 5.4.10, and 5.4.11.

5.4.1 Reliability suspect PMP. Reliability suspect PMP shall not be used without PMPCB approval. MIL-STD-1547 shall be used to identify in-process controls and special screens for all reliability suspect PMP. The procuring activities may authorize the use of reliability suspect PMP when tradeoff studies demonstrate that no acceptable alternative exists and that suitable protection against inherent part weaknesses have been incorporated in each application.

5.4.2 Limited application PMP. Use of limited application PMP shall be controlled by the PMPCB and approved by the procuring activity. Justifications and data shall be made available for each use of limited application PMP, submitted to the PMPCB. Approved limited application PMP shall be so designated on the approved PMPSL.

5.4.3 Prohibited PMP. Prohibited (reliability suspect) PMP are listed in MIL-STD-1547. The procuring activity may permit exceptions when trade-off studies demonstrate that no alternative exists and that suitable protection against inherent PMP weaknesses have been incorporated in each application.

5.4.4 PMP Qualification. Parts qualification must be current at time of equipment or system acceptance. Such testing performed within the preceding six months can be used as a valid basis for full or partial qualification. Qualification test methods shall be in accordance with MIL-STD-1547, or the applicable space quality MIL specification (e.g., MIL-M-38510 and MIL-STD-883 for microcircuits, MIL-STD-202 for passive devices), and additional tests as necessary to fully qualify the part for its intended use.

Materials and processes qualification must be current at time of use. The contractor shall qualify all materials by applying the following procedures:

- a. Initial selection of materials using applicable mil-specified materials previously qualified for use on Air Force space and missile programs.
- b. Proof testing of all materials to the program requirement levels.

- c. Vendor audit and certification.
- d. Satisfactory completion of tests on materials used on engineering and qualification model equipment.

Methods, data and use decisions shall be available for review by the PMPCB. Materials and processes previously qualified for use on Air Force spacecraft and launch vehicles can be, with PMPCB approval, considered qualified.

The contractor shall qualify assembly processes. The requirements and procedures applicable to the qualification of materials shall apply to processes. In addition, all process procedures shall have been successfully demonstrated prior to use on qualification or flight hardware. This demonstration shall be certified by materials and processes engineers and manufacturing engineers prior to design release. Any process generated to accomplish rework or retrofit shall be qualified and certified in the same manner.

PMP shall not be listed on the approved PMPSL until they are qualified to the levels required for the program. The PMPSL shall show the documentation (such as military specifications or contractor requirements) to which the item is qualified and the level of completion (i.e., fully qualified, partially, or none). The contractor's plan for raising unqualified PMP to full qualification status shall require approval by the PMPCB. Only fully qualified PMP shall be used on flight hardware. For each non-qualified part, material and/or process, the contractor shall prepare a qualification procedure which identifies the conditions that must be met and the testing requirements necessary to assure reliability. These procedures shall be reviewed by the PMPCB and submitted to the procuring activity for approval. A summary report of qualification test results shall be made available to the PMPCB. The PMPCB shall maintain a current listing of the qualification status of all program approved parts and materials.

Parts, materials or processes may be qualified by extension when one or more of the following criteria are met:

- a. The part, material or process has been successfully used in a prior space application in which the environment conditions of use and test are at least as severe as those required of the candidate for qualification and the PMP can be procured to the previously used manufacturing baseline.

MIL-STD-1546 (USAF)

- b. The part is of identical construction or the material contains similar constituents and is manufactured to the same manufacturing baseline as a qualified part of material and the utilization of the part or material will not result in critical stresses, e.g., temperature, thermal mismatch, etc. greater than the previously qualified part.

Data to support qualification by extension shall be reviewed and approved by the PMPCB and the Procuring Activity.

5.4.4.1 Configuration analysis. The contractor shall institute a continuous in-house assessment of physical characteristics of electronic parts. This configuration analysis program shall include tasks that develop the following three interrelated data forms:

- a. A configuration sketch that geometrically delineates and numerically indexes each individual constituent of the examined device. This sketch should normally be a dimensionless pictorial view and should not be used as an absolute inspection criteria.
- b. A materials list of all materials used in the manufacture of the part that defines each of the indexed constituents of the sketch by name and composition; or by complete physical/chemical characteristic of the material from which the constituent element was fabricated, or by both.
- c. A manufacturing process flow chart that accurately defines the degree of monitoring (including inspection points and procedures) of each operation, and which operations are critical (i.e., may inadvertently cause a degradation of reliability).

Configuration analysis and DPA, when used together, shall provide for a closed loop system for delineating and monitoring physical characteristics and quality parameters that are undetectable by normal screening methods.

5.4.5 Contractor part testing and inspection responsibility. The contractor shall review all manufacturing processes prior to production of the part. The contractor shall participate in precap visual inspections (if applicable), shall monitor the screening and quality conformance tests performed by the supplier, and shall review resulting

data. The contractor shall be responsible for authorizing shipment of the parts from the supplier. After the purchased lot is received by the contractor, the contractor shall perform the DPA (see MIL-STD-1547) and other specialized receiving/inspection tests which verify the integrity of the parts.

5.4.5.1 Parts screening and quality conformance requirements. All parts to be incorporated into qualification and production equipment shall be subjected to nondestructive screening tests and sample quality conformance tests. MIL-STD-1547 or the applicable space quality MIL specification shall be used. Proposed deviations to the screening or quality conformance test requirements of MIL-STD-1547, including those required for Reliability Suspect Designs shall be reviewed and approved by the PMPCB and submitted to the procuring activity for approval.

5.4.5.1.1 Parts screening and quality conformance test plan. All screens shall be defined in new or modified specifications or standards, and in specification control, source control, and altered item drawings used to control their procurement. The contractor shall include a percent defective allowable (PDA) requirement in all parts procurement documentation used in the program. Screening accept and reject requirements shall require PMPCB approval prior to purchase of the respective devices for qualification and production equipment.

5.4.5.1.2 Parts testing. All parts to be incorporated into qualification and production equipment shall be subjected to space quality level screening and quality conformance sample testing. The contractor shall select and apply tests appropriate to the specific part type, part design, and part manufacturing process. Test methods shall be selected from MIL-STD-202, MIL-STD-750, MIL-STD-810, MIL-STD-883 and MIL-STD-1547. These tests and any augmentation are to be defined in the new or modified specification or standard, and in specification control, source control, and altered item drawings used to control their procurement.

5.4.5.1.3 Parts screening and quality conformance test matrix. The contractor shall develop and maintain a screening and quality conformance test matrix listing all part types for the program and their various screening requirement (tests). Screening and quality conformance tests shall include but not be limited to those listed in MIL-STD-1547 for each respective part. This matrix shall require review and approval by the

MIL-STD-1546 (USAF)

PMPCB. A preliminary matrix should be submitted with the contractors proposal.

5.4.5.1.4 Material screening and quality conformance test requirements. All materials to be incorporated into qualification and production equipment shall be subjected to the screening and quality conformance tests of the applicable MIL specifications or to an approved materials screening test plan. The materials testing plan shall be approved by the PMPCB. Where appropriate a materials testing matrix shall be developed and maintained and submitted to the PMPCB for approval.

5.4.5.2 Destructive physical analysis. A destructive physical analysis (DPA) on a sample basis shall be performed in accordance with MIL-STD-1547, by the contractor on each lot date code of integrated circuits, semiconductor devices, filters, magnetic components, variable capacitors, resistors and inductors; fixed capacitors; hybrid devices and networks, relays, bimetallic thermal switches, connectors, crystals, and diodes. Other devices may be added for analysis by the PMPCB. The contractor shall prepare and implement DPA procedures that define the methods and lot accept and reject criteria for inspecting the internal materials, design, construction, and workmanship of the part. These procedures shall be approved by the PMPCB. DPA shall not be performed by the supplier of the part without prior approval of the PMPCB. The DPA may, however, be performed by an independent laboratory with approval of the PMPCB.

5.4.5.2.1 DPA policy procedures and reports. A standardized DPA policy, procedure, and summary report format shall be established by the PMPCB and used by all participants in the program. The contractor's and subtier contractor's DPA findings shall be reviewed by the PMPCB on a regular basis. The PMPCB review shall be on a sample basis for non problem devices and on a one hundred percent basis for critical or problem devices.

5.4.6 Incoming inspection requirements. Upon receipt of parts or materials, each contractor's incoming inspection shall perform testing and inspection to applicable part or material specifications and lot acceptance criteria. As a minimum requirement, this shall consist of the following:

Parts

- a. One hundred percent external inspection at 10X magnification (min) for such things as permanent and legible marking, body finish, lead finish, insulation, lead straightness, pinholes, excessive material misalignment, and any other visual or mechanical defects. Specific external inspection criteria shall be defined for each part or material in the appropriate parts specification.
- b. Unless previously monitored by contractor field personnel:
 1. One hundred percent electrical testing at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ to detail specification requirements.
 2. Sample electrical testing at specified temperature extremes.
- c. Sample destructive physical analysis (see 5.4.5.2).
- d. All data accompanying parts (including x-rays) shall be reviewed to provide lot-by-lot trend analysis, as well as to determine acceptability of received parts.
- e. Lots not meeting acceptance criteria shall not be used on qualification or flight hardware.

Materials

- a. Sample analysis of significant physical properties of the "as received" material.
- b. Sample analysis of significant physical properties of the processed material (where appropriate).
- c. Lots not meeting acceptance criteria shall not be used on qualification or flight hardware.

5.4.7 Failure analysis. Failure analysis shall be performed on failures experienced, to include those during manufacturing or testing. All parts failing to survive any post-burn-in electrical screen test or any subsequent screening or lot acceptance test because of opens, shorts, or inoperability shall be analyzed at the contractor's facility to the extent necessary to ensure understanding of failure mode and cause. A sufficient quantity of failed piece parts occurring in any lot that fails any specified lot acceptance

MIL-STD-1546 (USAF)

criteria (e.g., Percent Defective Allowable, Lot Tolerance Percent Defective, Acceptance Number) shall be analyzed to establish cause(s) of failure(s) and necessary corrective action, detect and correct out-of-control processes, and determine lot disposition. Failure analysis requirements can be reduced when program contractors implement sufficient destructive physical analysis on piece part lot, process baseline control, receiving inspection screen tests or other risk reducing parts controls that compensate for the reduced piece part failure analysis. The PMPCB shall assure adequate failure analysis requirements are contained in all program piece part specifications. When military specifications selected for program use do not contain failure analysis requirements compliant with this policy, the PMPCB assisted by Defense Electronics Supply Center (DESC), or the Defense Industrial Supply Center (DISC) shall take action to add appropriate failure analysis requirements to the military documentation. All part failure analysis shall be standardized to support the trouble and failure reporting system specified in MIL-Q-9858 and MIL-STD-1543. Failure analysis data shall be reduced to establish trend analysis. Corrective action shall be determined and implemented for each failure. All failures shall be reported to the PMPCB and the procuring activity. Failed parts shall be available to the procuring activity for independent examination and shall be retrievable for the duration of the contract.

Failures attributed to materials or processes shall be recorded and analyzed to identify cause of failure and need for corrective action. All such data and supporting analyses shall be submitted to the PMPCB. Subcontractors shall be required to meet these failure analysis requirements.

5.4.8 Traceability and lot control. The contractor shall establish a two-way traceability system that categorizes parts and materials to be used in deliverable equipment. (Monolithic microcircuits shall require traceability to the wafer level).

The contractor shall record, at the lowest assembly level, the lot identification of each part or material which is fabricated into a system. The data shall be stored such that the assemblies into which a given lot has been fabricated can be identified. The absence or presence of a given lot date code in a system shall be subject to verification.

5.4.8.1 Shelf-life control. Parts and materials shall have been subject to screening tests or inspections and sample tests within two years of installation. Parts or materials shall be rescreened or retested as necessary to comply with this requirement.

5.4.8.2 Traceability. A clerical system shall be established, or the contractors existing system shall be implemented, that maintains and assigns a group code and element code so that each of these accounting units can be traced from their inception through fabrication, assembly, test, and equipment delivery to the procuring activity.

5.4.8.2.1 Group codes. Criteria for these groupings shall reflect manufacturing date, screening data, and supplier. Individual parts within their groups need not be serialized except for identified critical components. Individual parts that have previously been serialized shall return their serialization traceability. These groups shall be identified by a group number or code.

5.4.8.2.2 Element codes. Equipment shall be categorized into such elements as trays, boards, modules, and assemblies. A number or code shall be established that uniquely identifies and maintains the serial identity of all these elements.

5.4.9 Preservation and packaging. Preservation, packaging and packing shall be in accordance with MIL-STD-794. The following guidance supplements the MIL-STD-794 paragraphs on electronic parts susceptible to damage by excessive electrostatic forces.

Electronic parts such as thin or thick film resistors, semiconductors (MOS devices), field effect transistors or circuitry containing any of these can be degraded by static-electricity discharge. The contractor will assure that design engineering identifies such devices and communicates the essential precautions, to prevent damage to electronic parts, to all in-plant manufacturing, handling and packaging personnel.

All parts which are subject to degradation by electrostatic discharge and which are to be packed in bags or wraps manufactured from MIL-B-22191, MIL-B-121, MIL-B-131, or other static-generating materials shall be wrapped individually in properly anti-static material meeting the requirements of MIL-B-81705 Type II. Anti-static packaging material shall in all cases be intimate to the item. A label clearly advising

MIL-STD-1546 (USAF)

that the contents can be destroyed by static electricity and should be handled only by personnel instructed in the necessary precautions shall be affixed to each unit package.

5.4.10 Handling and storage. To prevent part/material degradation special handling and storage procedures shall be formulated by components, quality, and materials handling specialists. These procedures shall apply until the parts and materials lose their individuality when assembled into modules, boards, or higher identified items. The identified handling shall be retained through inspection, kitting, and assembly on "build to" documentation.

The following criteria as a minimum shall be used when 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 the materials review crib or to a laboratory for inspection, or returned to the manufacturer from unaccepted shipments. Use of easily identifiable containers to identify space quality parts shall be used.
- c. Housekeeping practices, including provisions for the routine disposal of used packaging materials.
- d. Control measures to limit personnel access to parts and materials during the receiving inspection and storage cycle.
- e. Facilities for the interim storage of parts and materials.
- f. Provisions of protective cushioning, as required, on storage area shelves, and in storage and transportation containers.
- g. Protective features of transportation equipment design to ensure that packages will not be accidentally dropped or dislodged in transit.
- h. Non-degradable cushioning of bench surfaces on which parts and materials are handled during operations such as test, assembly, and inspection.

- i. Electronic and electrical parts shall be protected from contact by bare hands. Gloves, finger cots, tweezers, etc., should be used when handling these parts.
- j. Provisions for protection of parts susceptible to damage by electrostatic discharge (See 5.4.9).

5.4.11 Defective Parts and Components Control Program (DPCCP). The contractor's parts management organization shall assure compliance with the GIDEP Alert development and review requirements contained in MIL-STD-1543 as they relate to parts, materials and processes.

The PMPCB shall review and evaluate GIDEP Alerts and other available information relating to defective PMP to assure that defective PMP are not selected for the design or procured for use in system equipment. PMP indicated as defective in any GIDEP or other Alert shall not be approved for use or listed on the approved PMPSL unless the indicated failure causes have been corrected and the indicated failure cause preventions have been implemented on the parts to be used in the system/equipment.

5.5 Management of parts and material procurement. All electronic piece parts shall be purchased directly from the supplier or procured from an authorized dealer. Parts and materials supplied from an authorized dealer, must be traceable to the supplier and a written certification of specification compliance from the supplier must be furnished.

5.5.1 Coordinated procurement. The prime (or as otherwise designated by the procuring activity) contractor shall consolidate the procurement of parts. This effort shall include using common specifications, assigning common management responsibilities and common monitoring and quality assurance responsibilities in accordance with the requirements of Appendix A.

5.5.2 Supplier selection. Suppliers for parts and materials shall be selected from the following list which is in descending order of preference.

- a. Suppliers who have existing separate facilities and personnel engaged in the production of high reliability parts or materials, who are qualified to the highest quality assurance level of the applicable military specification, and who will permit contractor monitoring of production and test.

- b. Suppliers who have existing separate facilities and personnel engaged in the production of high reliability parts or materials.
- c. Suppliers who have been qualified to other than the highest quality assurance level of the applicable military specifications.

5.5.2.1 Control and Evaluation. The supplier of parts and materials shall maintain a system providing two-way traceability from raw materials through final assembly to acceptance testing, and in the reverse order. The records to be maintained shall include lot travelers, batch identification of critical materials and assemblies, and inspection and test data.

5.5.2.2 Homogeneity of Parts and Materials. Each production lot, shall contain parts or materials that meet the homogeneity and lot definition requirements of MIL-STD-1547 or the applicable MIL-specification.

5.5.3 Supplier surveillance. The prime contractor shall arrange for surveillance of the part suppliers by the monitoring of processing and testing in accordance with Appendix B. Surveillance of material suppliers shall be maintained to assure that the materials continue to meet the specified requirements.

5.5.4 Manufacturing baseline. Parts and materials shall be procured to an approved manufacturing baseline.

5.5.5 Manufacturing baseline control. The supplier shall maintain a system for approval of changes to the approved manufacturing baseline including approval by the procuring activity.

5.6 PMP application management.

5.6.1 Derating. The prime/associate contractor and the PMPCB shall prepare a uniform policy regarding the derating of parts to be commonly applied by all contractors. Derating requirements of MIL-STD-1547 shall be used to the maximum extent possible. Changes to these requirements require PMPCB approval. This uniform derating policy shall encompass application conditions such as voltage, current, power, temperature, mechanical, and duty cycles. It shall include degradation sensitive parameters and maximum rating variations

expected over the stated mission life. It shall also include derating due to radiation effects if program applicable. A preliminary derating policy shall be documented in the PMPCMP. The final derating policy shall be provided to the procuring activity through the PMPCB prior to PDR. The parts application data (see 5.6.2) shall be consistent with the approved derating policy.

5.6.2 PMP application data. The prime or associate contractor and sub tier contractor shall generate PMP application data for each item on the PMPSL and provide it to the PMPCB for the establishment of program PMP application requirements. Parts, materials, and processes application requirements of MIL-STD-1547 shall be used. Use of PMP application data by all the circuit and equipment designers is mandatory. The data shall, as a minimum, contain the following:

- a. Controlled configuration.
- b. Recommended mounting procedures.
- c. Controlled part parameters derated (see 5.6.1).
- d. Failure modes and relative probability of occurrence.
- e. Estimated failure rate under derated operating conditions.
- f. Environmental capability.
- g. Expected degradation due to radiation and aging.
- h. Identification of critical items and description of the factors that classify them as critical.

This information is to be derived from MIL-STD-1547, parts supplier's technical data, contractor-controlled part evaluation tests, and the equipment environment requirements as well as criteria developed from the part acceptance and screening tests. The updated data shall be used by the designers during the design phase of the program and shall be available for review by the procuring activity through the PMPCB and at design reviews.

During design, the contractor shall identify all critical areas in each component and subsystem operational function. He shall perform a stress analysis for each part employed in each identified critical area. These analyses shall relate the

stress of parts to circuits, modules, components, and subsystem performance as they are influenced by parametric variations (due to such factors as operating points, aging and initial tolerances), environmental effects, radiation effects, and input and output limits. These analyses shall always compute worst-case part stress and consider all derating factors identified in the approved derating criteria. These analyses shall be available for procuring activity and PMPCB review before critical design review (CDR).

6. NOTES

6.1 Application and tailoring. This standard is intended to be tailored by means of the RFP and SOW and to apply to USAF Space Division procurements. Space Division programs shall invoke applicable paragraphs of this standard commensurate with the program reliability and standardization requirements, and shall be tailored by the procuring activity to meet the requirements of the contract or internal Government program and shall apply only to the extent and in the manner specified in the contract.

6.2 Statement of work provisions for part configuration analysis. When a part configuration analysis in accordance with paragraph 5.4.4.1 is required on a particular contract, it will have to be specifically identified in the contract.

6.3 Data requirements. The appropriate data item description of the Contract Data Requirement List (CDRL) DD Form 1423) should contain an instruction in Block 16 to assure that the data submittals include parts, materials, and processes. Data requirements of this document are not to be considered deliverable unless specified on the CDRL referencing the appropriate Data Item Description. The data required by this standard is as follows (Data Item Description - DD Form 1664):

- a. Parts control program plan. Data Item Description, DI-E-7026A, Parts Control Program Plan, applies to 4.1.
- b. Program Parts Selection List (PMPSL). Data Item Description number DI-E-7027A, Program Parts Selection List (PPSL), applies to 5.3. The PMPSL is essential to the parts control program, and this data item should be contractually required.

- c. Additions to the approved PMPSL. Data Item Description number DI-E-7028A, Nonstandard Part approval Requests/Proposed Additions to an Approved PMPSL, applies to 5.3.2, and should be contractually required.

6.4 Contractual requirements. The contractor proposal should clearly set forth the plans and procedures for implementing a cost effective high reliability parts management program. The Plan (proposed) should define the scope and depth of the contractors efforts including the management approach, organization, staffing planning, technical aspects and the relationship of the parts program to the contractors other technical and management programs. This will include adequate technical and management requirements of the standard. To assure correct application to this standard, Invitations for Bids, Request for Proposals and contractual statements of work should include requirements for:

- a. Submission of proposed PMPSL (see 4.3 and Appendix D).
NOTE: The proposed PMPSL may not be required on contracts for follow on production to existing design.
- b. Submission of proposed additions to an approved PMPSL.
- c. Time period for procuring activity response to the proposed PPSL, and proposed additions to the approved PPSL will normally be 30 calendar days, although a different time period may be specified to suit a contract application.
- d. Submission of test data, as required (see 5.4.5).
- e. Submission of a parts control program plan (see 4.1).
- f. Designation of the contractor responsible directly to the procuring activity for the PMP Management and Control program. In the case of two or more associate contractors, the procuring activity shall designate the responsible associate contractor.
- g. Submittal, with proposal, of screening test matrix required by para. 5.4.5.1.3.

MIL-STD-1546 (USAF)

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PREPARING ACTIVITY
AIR FORCE -19
(PROJECT 1810-F008)

6.5 Supercession Information. This standard supersedes the following USAF Space Division documents:

- a. SAMSO-STD-73-2C Electronic Parts, Materials and Processes for Space and Missile Applications.
- b. SD STANDARD 73-4B List of Preferred Parts for Space and Missile Systems.

APPENDIX A

COORDINATED PROCUREMENT

10. SCOPE

10.1 This appendix defines and establishes the criteria and necessary guidelines for the implementation of a coordinated procurement (CP) program for electronic piece parts. These criteria are specifically applicable to the procurement of microelectronic and semiconductor piece parts. The use of coordinated procurement for other part types shall be implemented when its use would improve reliability, schedule and/or cost effectiveness. The prime contractor (unless otherwise designated by the procuring activity) shall organize and manage the coordinated procurement program.

20. COORDINATED PROCUREMENT

20.1 Intent. Each contractor (prime, associate or subtier) shall procure the parts directly from a supplier under the provisions of a common purchase agreement. It is not intended under a coordinated procurement that the prime contractor procure the parts and furnish them as contractor furnished material.

20.2 Interface agreement document. Each contractor, associate contractor or subtier contractor shall be a party to a document prepared by the prime contractor under which the following agreements are covered:

- a. Agreement to the coordinated procurement of selected parts.
- b. Agreement to the purchase of parts to the general, detail and test specifications approved by PMPCB.
- c. Agreement to the designation of the identified contractors field surveillance.
- d. Agreement to accept responsibility for the reliability and performance of parts obtained through coordinated procurements.

MIL-STD-1546 (USAF)

- e. Agreement to provide parts list(s), quantity(s), and need date(s) on a timely basis, to the prime contractor to be used in establishing a list of parts suitable for a coordinated procurement.
- f. Agreement to hold proprietary data confidential.
- g. Agreement to assist in supplier selection through provision of review of data and parts evaluation.
- h. Agreement to utilize supplier selected and approved by the PMPCB.
- i. Agreement to cost-sharing for activities such as part qualification, supplier selection and field surveillance, unless otherwise provided by contract.
- j. Agreement that any participating contractor may conduct his own inspections and witness tests to the extent necessary to acquire confidence in the parts to be delivered. Such effort to be coordinated with the prime contractor. prior to performing the inspecting or witnessing the test.
- k. Agreement to participate as required in joint Material Review Board (MRB) actions. Each participant reserves the right for his own MRB decisions.
- l. Agreement to provide data on an expedited basis to all program contractors, on discrepant parts identified at receiving inspection, at DPA, or removed during equipment build-up or test.
- m. Agreement to expedite Failure Analysis on all CP parts and to provide data to prime contractor.

20.3 Prime contractor responsibilities

20.3.1 Management. Provide overall management of coordinated procurements in accordance with the requirements of this standard.

20.3.2 Common purchasing agreement (CPA). The prime contractor will negotiate a common purchasing agreement with suppliers approved by the PMPCB using the list of CP parts and including technical requirements approved by PMPCB and the procuring agency. Coordinate any supplier exceptions with

PMPCB. The CPA shall include costs, procurement schedule and any other schedules for qualification, certification and supplier surveillance required by contract. The negotiated common purchasing agreement including cost and delivery information shall be submitted to the procuring activity for review.

20.3.3 Procurement

20.3.3.1 Parts. Assure placement in a timely manner of long lead and other purchase orders for parts.

20.3.3.2 Other. Assure timely placement of purchase orders for certification, qualification and interface activities.

20.3.4 Procurement status system. Establish a reporting system to keep each participant informed of status of each line item.

20.3.5 Supplier proposed manufacturing baseline changes. Submit all proposed manufacturing baseline changes to PMPCB for approval.

20.3.6 Problem resolution. Identify schedule and/or technical problems to PMPCB with requested action. Follow-up to assure timely problem resolution.

20.3.7 Allocation of costs. Submit to the procuring activity for approval a plan for allocation of CP costs (over the actual part cost) to each of the participants. The plan shall include proposed allocation for activities such as part qualification, supplier selection and field surveillance. Implement plan upon approval.

20.3.8 Incoming inspection. Perform or arrange for performing incoming inspection requirements as specified for the coordinated procurement.

20.4 Coordinated procurement tasks. All tasks and/or decisions are subject to review and approval by the procuring activity.

MIL-STD-1546 (USAF)

- a. Selection of CP parts. All parts on the approved PMPSL should be considered for CP. CP parts will nominally be those used by more than one contractor and those used in high volume. However, parts whose reliability, delivery, or cost can be improved by a common purchase shall be identified as CP candidates. Special consideration for coordinated procurement shall be given to parts whose design and construction are defined as reliability suspect in MIL-STD-1547 or which are used in critical applications.
- b. Review and approve, as appropriate, supplier selection(s).
- c. Ensure that data exchanges take place between all participants and suppliers including alerts, deviations, and the results of MRB actions.
- d. Establish a procedure whereby immediate action can be taken on decisions which have system or program impact.
- e. Establish a rapid reaction mechanism such that communication between each supplier and each participating contractor and the chairman of the PMPCB can be made within 24 hours of problem identification. Appropriate follow-up action shall be recommended to the PMPCB.
- f. Establish ad hoc groups for the purpose of identifying, resolving or expediting part procurement or contractual problems which may adversely impact schedule or costs.
- g. Monitor failure reporting, failure analysis on CP parts and corrective action activities.
- h. Perform a periodic review of the supplier surveillance activities and provide recommended corrective actions for noted discrepancies.
- i. Establish operating procedures to include rules for ordering, reordering and modification of order per the common purchasing agreement, final acceptance, data distribution and part allocation.
- j. Review purchase orders for inclusion of all PMPCB requirements.

- k. Prepare the interface agreement document described in 20.2 above, and ensure that each CP member sign and abides by the provision of this document.
- l. Ensure that all changes to coordinated procurement actions are coordinated with participating contractors.

20.4.1 PMPCB Interface. Ensure all PMPCB approval changes are implemented in CP documentation.

20.4.2 Relationship to PMPCB. All technical matters relating to CP including selection of parts, selection of suppliers, procurement specification, qualification, and establishment of and changes to the manufacturer baseline shall be approved by the PMPCB.

20.5 Participating contractors responsibilities.

- a. Provide usage requirements for parts on approved PMPSL.
- b. Provide required delivery dates.
- c. Identify long lead items.
- d. Provide technical requirements which are not covered in MIL-STD-1547 to the PMPCB for their review and recommendations.
- e. Assure placement of purchase orders, including those for long lead items in a timely manner.
- f. Assess the impact of changes to part requirements, specifications to include description, magnitude, and scope, applicable data, suspected cause(s) and indication for actions.
- g. Review and conduct field inspection and reviews to the extent necessary to acquire confidence in part reliability and promised delivery schedules.
- h. Provide data and failure analyses on discrepant parts found at receiving inspections, DPA and during equipment assembly or test to PMPCB on an expedited basis.
- i. Coordinate all changes to coordinated procurement actions with the PMPCB.

MIL-STD-1546 (USAF)

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APPENDIX B

SUPPLIER SURVEILLANCE

10. SCOPE

10.1 Intent. This appendix establishes the procedures for surveillance of fabrication inspection and testing of electronic piece parts at the supplier's location. Parts that are procured using supplier surveillance shall be so annotated on the approved program parts materials and processes list. The surveillance to be conducted shall be by individual lot and shall be distinct from quality surveillance and other requirements of MIL-STD-1535 and from normal QC lot acceptance procedures. However, the surveillance required by this Appendix may be performed by contractor personnel assigned to accomplish source surveillance, MIL-STD-1535 requirements or QC lot acceptance.

10.2 Applicability. These procedures are applicable to coordinated procurements, non coordinated procurements, or combinations thereof. They are to be conducted in addition to (not in lieu of) Government inspection imposed by the Contract Administration Office.

20. SUPPLIER SURVEILLANCE

20.1 Selection of surveillance contractor. The prime contractor shall perform the surveillance function or select a contractor to do so. The surveillance contractor shall be approved by the procuring agency.

20.2 Location of surveillance personnel. Surveillance personnel shall be resident at each manufacturer (or geographically close group of manufacturers) such that effective full-time monitoring is provided. Itinerant surveillance personnel may be used if appropriate and with the approval of the procuring activity.

20.3 Duties of surveillance personnel. Operating procedures for field surveillance personnel shall include the following tasks:

MIL-STD-1546 (USAF)

- (1) Verify that the parts are manufactured to the approved manufacturing baseline and the requirements of the procurement documentation.
- (2) Conduct mandatory inspections as defined in applicable military specifications or in MIL-STD-1547.
- (3) Witness or perform (one hundred percent or sample verification) low power and high power visual examination as necessary during the fabrication, inspection and assembly operation to ensure the items meet the requirements of the procurement document.
- (4) Notify the prime contractor and the PMPCB regarding identified or suspected problems including description, magnitude, and scope, applicable data, suspected cause(s) and indication for action. Prepare alerts.
- (5) Monitor identified and suspect problems until evidence demonstrates that the problem has been reduced to an acceptable level eliminated, or did not exist. Notify the PMPCB regarding the action taken and reason for closing previously identified problems.
- (6) Develop and maintain data and information summary files so that applicable information is available during consideration of problems.
- (7) Provide recommendations to the prime contractor and to the PMPCB for changes to specifications, standards, certification requirements and suppliers "baseline" operation.
- (8) Participate in assigned tasks, relative to qualification of supplier products and to the certification of the line.
- (9) Interpret or solicit interpretations for the supplier on specifications, standards and procedures which may be unclear or which may be subject to more than one interpretation.

- (10) Act upon supplier request for approval of changes in baseline procedures in accordance with coordinated procurement and PMPCB ground-rules including "hot-line" telephone report to the prime contractor and the PMPCB on decisions or actions which may have major impact.
- (11) Ensure that product qualification is accomplished in accordance with applicable requirements.

MIL-STD-1546 (USAF)

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APPENDIX C

PMP Selection

10. PARTS SELECTION

Unless otherwise specified by contract, only the Class "S" and JAN S parts listed in Appendix "D" are approved for use in Space Division space or launch vehicle systems. All other parts shall be treated as non-standard items. PMPSL parts shall be selected from those listed in Appendix "D" in the following order of precedence:

10.1 First Order of Preference

- a. JAN S/Class "S": Parts selected from the Class "S"/JAN S column of Appendix "D" are approved for use in space or launch vehicle systems unless otherwise specified by contract.

10.2 Second Order of Preference: Select either (a) or (b) items based on program cost effectiveness trade offs:

- a. Substitute Class "S"/JAN S: When Class "S"/JAN S parts are not available, parts may be selected from this category subject to approval of the PMPCB.
- b. Military Specification Parts: When Class "S"/JAN S and Substitute Class "S"/JAN S parts are not available, parts shall be selected from the preferred part type column of Appendix "D" and specified/procured in accordance with the requirements of MIL-STD-1547. PMPCB approval for these parts will be required in accordance with paragraph 5.3.

10.3 All Other Parts: Items from classes of parts not yet listed in Appendix "D" or other parts that must be used to satisfy operational requirements shall be considered "non-standards" unless otherwise specified. Contractor specifications or drawings for these items shall conform to applicable Sections of MIL-STD-1547 and paragraphs 5.4 thru 5.4.12 of this standard.

MIL-STD-1546 (USAF)

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APPENDIX D

USAF SPACE DIVISION PREFERRED PARTS LIST

10. SCOPE

This appendix provides a list of the Class "S" parts preferred by AFSD for use in the design of Air Force Satellite and space launch vehicle systems. Class "S" parts are defined as microcircuits and semiconductors which meet the requirements of MIL-M-38510/Class "S" or MIL-S-19500/JAN S, respectively. In addition, the AFSD Class "S" designation is also used to identify other items such as capacitors and resistors which are judged to have met "S" level requirements either because of past performance history or because the parts can be procured to specifications which meet the requirements for procurement controls and services set forth in MIL-STD-1547.

20. PURPOSE

20.1 To provide Program Management with a list of Class "S" parts and Class "S" candidate parts - that can be used as a basis for the development of a PMPSL.

20.2 To control and minimize the variety of parts and part types that are used in space and launch vehicle systems.

20.3 To provide a listing of military and commercial part types that appear to be viable candidates for future upgrade to "S" level.

30. CONTENT

From left to right, the information contained in each column is as follows:

30.1 Part Type: The commercial or military nomenclature for the item that has been selected as a candidate for Class "S" status.

30.2 Description: A brief description of the part or part type.

MIL-STD-1546 (USAF)

30.3 Qual Status: For microcircuits, this column will indicate MIL-M-38510, Class "S", Part II or Part I (fully qualified) QPL listing. For semiconductors, this column will show the highest level to which the part has been qualified in accordance with MIL-S-19500, i.e., JAN, JANTX, JANTXV, or JANS. (Not applicable for resistors and capacitors.)

30.4 Class S Part No.: This column lists the part or type number of items that are approved (unless otherwise specified by contract) for use in satellite and launch vehicle systems without further process controls or screening tests (except DPA).

30.5 Substitute Class "S" Part No.: This column lists the part or type number of items that may prove to be useful as substitutes if Class "S" or JANS devices cannot be obtained in time to support program milestones. The recommended substitutes have been selected from parts that have performed well on other programs. The use of substitute items requires the approval of the PMPCB and AFSD. Every effort should be made to upgrade candidate parts to Class "S" before trying to obtain substitutes or preparing new contractor specifications.

40. CRITERIA FOR AFSD PREFERRED LISTING

A part will be considered for listing in the "Part Type" column of this standard only if it meets the following criteria:

40.1 Application Need: There must be a general need for the part or part type in the development or production of AFSD space or launch vehicle systems. Emphasis will be placed on selecting parts that satisfy a broad range of applications.

40.2 Technological Maturity: The design of the part must utilize proven materials and technologies.

40.3 Availability: The part should be in production by one or more manufacturers whose past performance indicates that their product can be qualified.

40.4 Test or Usage History: There must be sufficient part test or use experience to:

- a. Determine predominant failure modes and mechanisms.
- b. Provide reasonable confidence that the part will perform reliably when produced in accordance with an adequate specification.

c. Establish the derating and application restraints necessary for reliable operation in flight hardware.

40.5 Military Slash Sheet: Published or proposed.

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

1. Linear Devices: Operational Amplifiers

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
LM741	Op. Amp. internally compensated			95122-001 & -002 (4)
LM747	Dual Op. Amp. internally compensated	II	10102SIC	95123-001 thru -004
LH2101A	Dual Op. Amp. externally compensated			
LM101A	Op. Amp. internally compensated	II	10103SCB	95101-001 thru -107
LM108A	Op. Amp. externally compensated			95102-001 thru -007
LM110	Op. Amp., high speed			95121-001 thru -004
LM118	Op. Amp., high speed			95116-001 thru -004
LM112	Quad. Op. Amp.			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

1. Linear Devices: Voltage Regulators

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
723	Voltage regulator, precision			95124-001
LM109	Voltage regulator, 5 volts			
LM140K-05	Voltage regulator, 5V, 1.0A			
LM140K-12	Voltage regulator, 12V, 1.0A			
LM104K-15	Voltage regulator, 15V, 1.0A			
LM140K-24	Voltage regulator, 24V, 1.0A			
LM141H-05	Voltage regulator, 5V, 0.5A			
LM141H-12	Voltage regulator, 12V, 0.5A			
LM141H-15	Voltage regulator, 15V, 0.5A			
LM141H-24	Voltage regulator, 24V, 0.5A			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-385101. Linear Devices: Voltage Comparators

Part Type	Description	Qual (1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
LM710	Single, differential			95105-001 & -002
LM711	Dual differential			95128-001
LH2111	Dual, precision, comparator, buffer			95118-001 thru -003
LM106	Single, comparator/buffer			95103-001 thru -004
LM111	Precision, comparator/ buffer			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

1. Linear Devices Bi-FET Operational Amplifiers

Substitute Class "S" (3)
Part No.

Qual (1)
Status

Class "S" (2)
Part No.

Part Type

Description

LF155 JFET Input, Low Power
LF156 JFET Input, Wideband
LF157 JFET Input, Wideband,
under compensated

Voltage Comparators:

LM139 Quad. Voltage Comparator,
single supply, low power

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-385101. Linear Devices: Interface

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
DAC-08	D to A converter, 8 bit			
26LS32	Quad. Diff. Receiver			
26LS33	Quad. Diff. Driver			
7820	Dual line receiver			
7830	Dual line driver			
HA6402	Universal dysynchronous receiver transmitter			
	<u>Multiplexers:</u>			
D6508	8 Channel MUX			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

1. Linear Devices: Analog Switch with Driver

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
DG181A	Dual Channel, 30 Ω , SPST			
DG182A	Dual Channel, 75 Ω , SPST			
DG184A	Dual Channel, 30 Ω , DPST			
DG185A	Dual Channel, 75 Ω , DPST			
DG187A	Single Channel, 30 Ω , SPDT			
DG188A	Single Channel, 75 Ω , SPDT			
DG190A	Dual Channel, 30 Ω , SPDT			
DG191A	Dual Channel, 75 Ω , SPDT			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

2. Digital TTL - 54XXX Standard: and NAND Gates

Part Type	Description	Qual (1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
5400	Quad, 2-input NAND	II	00104SCB/SDB	95008-001 & -002 5 M0038510-00104S
5401	Quad, 2-input NAND, (open collector output)	II	00107SCB/SDB	95036-001 & -002 M0038510-00107S
5403	Quad, 2-input NAND, (open collector output)			
5408	Quad, 2-input AND	II	01601SCB/SDB	95038-001 & -002
5409	Quad, 2-input AND, (open collector output)			
5410	Triple, 3-input NAND	II	00103SCB/SDB	95006-001 & -002 M0038510-00103S
5412	Triple, 3-input NAND, (open collector output)			95039-001 & -002 M0038510-00106S
5413	Dual, 4-input NAND, Schmitt Trigger			
5420	Dual, 4-input NAND	II	00102SCB/SDB	95009-001 & -002 M38510-00102S
5430	Single, 8-input NAND	II		95010-001 & -002 M38510-00101S
54132	Quad, 2-input NAND, (Schmitt trigger)	II	15103SSB/SDB	

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

2. Digital TTL - 54XXX Standard: Inverters and Buffers

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
5404	Hex, 1-input	II	00105SCB/SDB	95011-011 & -012 M0038510-00105S
5405	Hex, 1-input (open collector output)			
5406	Inverter/buffer driver, 30 volt output			95012-001 & -002
5407	Buffer driver, 30V output			95013-001 & -002
5414	Hex, Schmitt Trigger			
5426	Quad, 2-input inverter buffer driver, 15V output	II	00805SCB	95041-001 & -002
5437	Quad, 2-input NAND buffer			95072-001 & -002 M0038510-00302S
5438	Quad, 2-input NAND buffer (open collector output)			M0038510-00303S
5440	Dual, 4-input NAND buffer			95079-001 thru -003 M0038510-00301S

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS

MIL-M-38510

2. Digital TTL - 54XXX Standard: Flip Flops, MV's & Latches

Part Type	Description	Qual(1) Status	Class "S"(2) Part Number	Substitute Class "S"(3) Part No.
5470	Single, edge triggered J-K F-F			
5472	Single, J-K master slave F-F			95015-001 & -002 M0038510-00201S
5473	Dual, J-K master slave, no preset F-F			95007-001 & -002 M0038510-00202S
5474	Dual, D-type edge-triggered F-F	II	00205SCB/SDB	M0038510-00205S
5475	4-bit, bistable latch, complementary outputs	II	01501SEB/SFB	
5476	Dual, J-K master slave F-F	II	002045SEB/SFB	95042-001 & -002
5477	4-bit latch			
5479	Dual, D-type, edge-triggered buffered output F-F			
54107	Dual, J-K master slave F-F, no preset	II	00203SCB	
54116	Dual, 4-bit latch	II	01503SJB	
54121	Single, monostable MV	II	01201SCB/SDB	M0038510-01201S
54122	Single, retriggerable with clear monostable MV			95084-001 & -002
54123	Dual, retriggerable with Clear monostable MV	II	01203SEB/SDB	

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

2. Digital TTL - 54XXX Standard: Flip Flops, MV's and Latches (cont'd)

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54174	Hex, D-type positive edge F-F, triggered with clear and single outputs	II	01701SEB/SCB	
54175	Quad, D-type, positive edge F-F triggered with clear and complementary outputs	II	01702SEB/SFB	

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS

MIL-M-38510

2. Digital TTL - 54XX Standard: OR, NOR Gates

Part Type	Description	Qual (1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
5402	Quad, 2-input NOR	II	00602SEB/SFB	95037-001 & -002 M0038510-00401S
5423	Dual, 4-input with strobe and expandable NOR			
5425	Dual, 4-input NOR, with strobe			
5427	Triple, 3-input NOR	II	00404SCB/SDB	
5428	Quad, 3-input positive NOR buffer			
5432	Quad, 2-input positive OR	II	16101SCB/SDB	
5450	Expandable, dual 2 wide, 2 input AND-OR invert			
5451	Dual, 2 wide, 2-input AND-OR invert			95014-001 & -002 M0038510-00502S
5453	Expandable, 4 wide, 2-input AND-OR invert			
5454	4 wide, 2-input, AND-OR invert			
5486	Quad, 2-input, exclusive OR	II	00701SCB/SDB	

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

2. Digital TTL - 54XXX Standard: Shift Registers

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
5495	4-bit, right-left shift	II	00901SCB	95045-001 & -002 M0038510-00901S
5496	5-bit	II	00902SEB/SFB	
54164	8-bit, paralalled-out, serial	II	00903SCB	95099-001 & -002
54165	8-bit, parallel load			
54194	4-bit, bidirectional	II	00905SEB/SFB	
54195	4-bit, parallel access			

MIL-STD-1546 (USAF)

I. AFSD. PREFERRED MICROCIRCUITS
MIL-M-38510

2. Digital TTL - 54XX Standard: Counters

Part Type	Description	Qual (1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
5490	Hi-speed decade	II	01307SCB/SDB	M0038510-01307S
5492	Divide by 12			
5493	4-bit binary	II	01302SCB/SDB	95044-001 & -002 M0038510-01302S

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

3. Digital TTL - 54SXXX Schottky: AND-NAND Gates

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54S00	Quad., 2 Input, NAND	II	07001SCB/SDB	
54S03	Quad., 2 Input, NAND, (Open Collector Output)			
54S08	Quad., 2 Input, AND			
54S09	Quad., 2 Input, AND, (Open Collector Output)			
54S10	Triple, 3 Input, NAND	II	07005SCB/SDB	
54S11	Triple, 3 Input, AND	II	08001SCB/SDB	
54S20	Dual, 4 Input, NAND			
54S30	Single, 8 Input, NAND			
54S133	Single, 13 Input, Positive NAND	II	07009SEB/SFB	
54S140	Dual, 4 Input, NAND, Line Driver	II	08101SCB/SDB	

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS

MIL-M-38510

3. Digital TTL - 54SXXX Schottky: Inverters & Buffers

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54S04	Hex Inverter	II	07003SCB/SDB	
54S05	Hex Inverter, Open Collector			
54S40	Dual, 4 Input, NAND Buffer	I	07201SCB/SDB	

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

3. Digital TTL - 54SXXX Schottky: Flip Flops

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54S74	Dual, D-type, Edge triggered	II	07101SCB/SDB	
54S112	Dual, J-K, Edge triggered			
54S114	Dual, J-K, Edge triggered			
54S174	Hex, D-type, Positive Edge Flip Flop with clear and single outputs			
54S175	Quad., D-type, Positive Edge Flip Flop with clear complementary outputs			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

3. Digital TTL - 54SXXX Schottky: OR, NOR Gates

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54S02	Quad., 2 Input, NOR	II	07301SCB/SDB	
54S51	Dual, 2 Wide, 2 Input, AND-OR Invert	II	07401SCB/SDB	
54S64	4-2-3-2 Input, AND-OR Invert	II	07402SCB/SDB	
54S86	Quad., 2 Input, Exclusive OR	II	07501SCB/SDB	
54S135	Quad., Exclusive OR/NOR			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54SXXX Schottky: ALU's, Shift Registers, Data Selectors, MUX Comparators

Part Type	Description	Qual(I) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part Ni.
54S181	ALU/Function Generator	II	07801SJB	
54S182	Lookahead Carry Generator		07802	
54S194	4 Bit, Bidirectional, Shift Register		07601	
54S195	4 Bit, Parallel Access, Shift Register		07602	
54S151	8 Input, Data Selector, MUX	II	07901SEB/SFB	
54S153	Dual, 4 Input, with Enable	II	07902SEB/SFB	
54S157	Quad,, 2 Input		07903SEB/SFB	
54S158	Quad., 2 Input, with Inverted Output	II	07904SEB/SFB	
54S251	8-Input with 3-State Outputs		07905	
54S257	Quad., 2 Input, with 3-State Outputs		07906	
54S258	Quad., 2 Input with 3-State Inverted Outputs		07907	
54S85	4 Bit Magnitude Comparator		08201	

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54LSxxx LP Schottky: Gates, Inverters and Buffers

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54LS00	Quad., 2 Input, NAND	II	30001SCB/SDB	95065-003 & -004
54LS03	Quad., 2 input, open collector, output, NAND			
54LS04	Hex inverter	II	30003SCB/SDB	95063-003 & -004
54LS05	Hex inverter, open collector			95051-001 & -002
54LS08	Quad., 2 input, AND	II	31004SCB/SDB	
54LS10	Triple, 3 input, NAND	II	30005SCB/SDB	95062-003 & -004
54LS11	Triple, 3 input, AND			95088-001 & -002
54LS12	Triple, 3 input, open collector, NAND			
54LS13	Dual, 4 input, Schmitt-Trigger, positive NAND			
54LS14	Hex, Schmitt-Trigger inverter	II	31302SCB/SDB	
54LS15	Triple, 3 input, AND gate, (open collector output)			
54LS20	Dual, 4 input, NAND	II	30007SCB/SDB	95089-001 & -002
54LS21	Dual, 4 input, AND			
54LS22	Dual, 4 input, NAND (Open collector output)			95067-003 & -004

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54LSxxx LP Schottky: Gates, Inverters and Buffers (cont'd)

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
54LS26	Quad., 2 input, inverter buffer/driver, 15V output	II		
54LS30	Single, 8 input, NAND			95091-001 & -002
54LS37	Quad., 2 input, NAND buffer	II	30202SCB/SDB	
54LS38	Quad., 2 input, open collector NAND buffer	II	30203SCB/SDB	95093-001 & -002
54LS40	Dual, 4 input, NAND buffer			
54LS132	Quad., 2 input, Schmitt- trigger, positive NAND	II	31303SCB/SDB	

MIL-STD-1546 (USAP)

I. AFSD PREFERRED MICROCIRCUITS

MIL-M-38510

4. Digital TTL - 54LSxxx, LP Schottky: Flip Flops

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54LS73	Dual, J-K, f-f with clear			
54LS74	Dual, D-type, f-f with clear and preset	II	30102SCB/SDB	95075-003 & -004
54LS76	Dual, J-K, f-f with clear and preset	II	30110SEB/SFB	95060-003 & -004
54LS107	Dual, J-K, f-f with clear	II		
54LS109	Dual, J-K, f-f with clear and preset	II	30108SCB/SDB 30109SEB/SFB	
54LS112	Dual, J-K, f-f with clear and preset	II	3013SEB/SFB	95096-001 & -002
54LS113	Dual, J-K, f-f with preset	II		
54LS114	Dual, J-K, f-f with preset, common clear and common preset	II	30104SCB/SDB	95083-002 & -003
54LS174	Hex, D type, f-f with common clear and common clock	II	30106SEB/SFB	95069-003 & -004
54LS175	Quad., D type, f-f with clear and common clock	II	30107SEB/SFB	95070-003 & -004

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54LSxxx LP Schottky: OR, NOR Gates

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
54LS02	Quad., 2 input, NOR	II	30301SCB/SDB	95064-003 & -004
54LS27	Triple, 3 input, NOR	II	30303SCB/SDB	95090-001 & -002
54LS28	Quad., 2 input, positive NOR buffer			
54LS32	Quad., 2 input, OR	II	30501SCB/SDB	95092-001 & -002
54LS51	Dual, 2 wide, 2 input, AND-OR invert			
54LS54	4 wide, 2 input, AND-OR invert			95094-001 & -002
54LS86	Quad., 2 input, exclusive OR			95095-001 & -002

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54LSxx LP Schottky: Shift Registers

Part Type	Description	Qual (J) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54LS95	4 bit, parallel access	II	30603SCB/SDB	95076-003 & -004
54LS96	5 bit	II	30604SEB/SFB	
54LS64	8 bit, parallel-out	II	306055SDB/SDB	95098-001 & -002
54LS194	4 bit, bi-directional			
54LS195	4 bit, parallel access			
54LS295	4 bit, right shift, left shift 3 state outputs	II	30606SCB/SDB	
54LS395	4 bit, cascadable shift, 3 state outputs	II	30607SEB/SFB	

I. AFSD PREFERRED MICROCIRCUITS
MILK-M-38510

4. Digital TTL - 54LSxxx LP Schottky: Data Detectors/Multiplexers

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54LS151	8 input, with enable			
54LS153	Dual, 4-input, with enable			95081-003 & -004
54LS157	Quad., 2 input, with enable			95703-001 & -002
54LS158	Quad., 2 input, with enable			
54LS251	8 input, 3 state outputs with enable			
54LS253	Dual, 4 input, 3 state outputs, with enable			95075-001 & -002

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54LSXX LP Schottky: Decoders, Monostable MV's and Latches

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54LS42	BCD-to-decimal			
54LS47	BCD-to-seven segment decoder/driver	II		
54LS138	Single 3 to 8 line	II	30701SEB/SFB	95702-001 & -002
54LS139	Dual 2 to 4 line	II		95077-001 & -002
54LS123	Dual, Monostable MV, retriggerable, with clear			
54LS221	Dual, Monostable MV, Schmitt trigger, with clear			
54LS122	Single, Monostable MV, retriggerable, with clear			
54LS75	4-bit, bistable latch			
54LS279	Quad, \bar{S} - \bar{R} Latch			
54LS259	8-Bit Addressable Latch			
54LS375	4-Bit Bistable Latch			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

4. Digital TTL - 54SXX LP Schottky: Logic Units, Adders, Comparators & Counters

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
54LS181	Arithmetic logic/function gen.	II	30801SJB	95071-003 & -004
54LS290	Decade Counter			
54LS293	4-Bit Binary Counter			
54LS83A	4-Bit Binary, full adder			
54LS283	4-Bit Binary, full adder			
54LS85	4-Bit Comparator			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

3. Digital TTL - 54LSxxx LP Schottky: Counters

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
54LS90	Decade			
54LS92	Divide by twelve			
54LS93	4 bit binary			
54LS160	Synchronous 4 bit decade, (asynchronous clear)	II		
54LS161	Synchronous 4 bit binary, (asynchronous clear)	II		
54LS162	Synchronous 4 bit decade, (synchronous clear)	II		
54LS163	Synchronous 4 bit binary, (synchronous clear)	II		
54LS190	Synchronous 4 bit decade, (with mode control)	II		95082-003 & -004
54LS191	Synchronous, 4 bit up/down binary (with mode control)	II		
54LS192	Synchronous, 4 bit, up/down decade (with clear)	II		
54LS193	Synchronous, 4 bit, up/down) binary (with clear)	II		95704-001 & -002

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

5. Digital CMOS: AND, OR, Invert Gates

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
4081B	Quad., 2 input, AND			
4082B	Dual, 4 input, AND			
4073B	Triple, 3 input, AND			
4071B	Quad., 2 input, OR			
4072B	Dual, 4 input, OR			
4075B	Triple, 3 input, OR			
4085B	Dual, 2 wide, 2 input, AND OR, invert			
4086B	Expandable, 4 wide, 2 input, AND, OR, invert			
4070B	Quad., Exclusive OR			
4077B	Quad, Exclusive NOR			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-385105. Digital CMOS: Decoders, Encoders

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
4514B	4-Bit, Latch/4-to-16 Line Decoder, output high on select			
4515B	4-Bit, Latch/4-to-16 Line Decoder, output low on select			
4532B	8-Bit Priority encoder			
4555B	Dual binary to 1-to-4 decoder/demux, with display frequency output			
4556B	Dual binary to 1-to-4 decoder/demux, with strobed latch function			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

5. Digital CMOS: Drivers, Buffers, and Level Shifters

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
4069B	Hex inverter			
40107B	Dual, 2 input, NAND, buffer driver			
4502B	Strobbled, hex inverter/ buffer			
40109B	Quad., low to high voltage level shifter			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-385105. Digital CMOS: Latches and Schmitt Triggers

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
4099B	8-bit addressable latch			
4508B	Dual 4-bit latch			
4093B	Quad., 2 input NAND schmitt trigger			
40106B	Hex Schmitt Trigger			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

5. Digital CMOS: Flip Flops

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
4076B	4-bit "D" type register			
4095B	Gated J-K master-slave, non-inverting			
4096B	Gated J-K master-slave, inverting			
4098B	Dual, monostable MV			
4017B	Hex "D" Flip Flop			

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS

MIL-M-38510

5. Digital CMOS: Multiplexers, Demultiplexers, and Shift Registers

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
4067B	Single 16-channel Mux/ Demux			
4097B	Differential, 8-channel, Mux/ Demux			
40257B	Quad., 2-line-to-1-line data selector/Mux			
4021B	8-stage asynchronous parallel input/serial output or synchronous serial input/serial output, static shift register			

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

5. Memories: Static RAM's

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
6551	256 x 4, CMOS*			
6508	1024 x 1, CMOS*			
54C930	1024 x 1, CMOS			
54C929	1024 x 1, RAM			
TCC244	256 x 4, CMOS*			

* Total Dose and Transient Hardened

MIL-STD-1546 (USAF)

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

6. Memories: PROM's

Part Type	Description	Qual(1) Status	Class "S" (2) Part No.	Substitute Class "S" (3) Part No.
82S129 7611/5301-1 93427	256 x 4 Schottky, bipolar		20302	
82S131 7621/5306-1 93446	512 x 4 Schottky, bipolar		20402	
82S141 7641/5341-1 93448	512 x 8 Schottky, bipolar		20802	
AM9130AFC	1024 x 4 Schottky, bipolar		20602	

I. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

7. Microprocessors & Peripherals:

Part Type	Description	Qual(1) Status	Class "S"(2) Part No.	Substitute Class "S"(3) Part No.
1082D	MPU, 8 bits			
1052	8 bit I/O Port			
2901A	ALU, 4 bit Slice			
2903	ALU, 4 bits			
2904	Status and Shift Control Unit			
2910	Micro Program Controller (12 bits wide)			
2911	Micro Program Sequencer (4 bits wide)			
2914	Priority Interrupt Controller			
2940	DMA Address Generator			
29811A	Next Address Control Unit			
SBP9900A	MPU, 16 bits			
SBP9989	MPU, 16 bits			

MIL-STD-1546 (USAF)

1. AFSD PREFERRED MICROCIRCUITS
MIL-M-38510

NOTES

1. Qualification status denoted at "II" for Part II QPL listing and "I" for Part I listing (full qualification). Refer to the QPL for approved sources.
 2. The MIL-M-38510 slash number per paragraph 3.6.2 will be listed in this column after the part has been approved for Class "S", Part II QPL listing.
 3. Substitute Class "S" parts are defined in the introduction to Appendix "D".
 4. Part numbers of the form 95XX-XXX represent items that have been produced by the Lockheed "Monitored Line Parts Program".
 5. Part numbers of the form 00XXS are slash sheet numbers for items that meet the requirements of MIL-M-0038510 (USAF).
- * Substitute parts may not be two way interchangeable with MIL-M-38510 devices. All parameters and tolerances should be carefully checked before making a direct substitution.

II: AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

1. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S (3) Part Number	Substitute (2) Part Number
1N647-1		240	JTXV		
1N649-1		240	JTXV		
1N5711		444	JTXV		
1N4153-1		337	JTXV		
1N4150-1		231	JTXV		
1N4148-1		116	JTXV		
1N4938		169	JTX		
1N5804		477	JTXV		
1N5806		477	JTXV		
1N5809		477	JTXV		
1N5811		477	JTXV		
1N5617		429	JTXV		
1N5418		411	JTXV		
1N5619		429	JTXV		

General Purpose:

Switching:

Fast Recovery Rectifiers:

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

1. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S (3) Part Number	Substitute (2) Part Number
1N5419	Fast Recovery Rectifiers (cont'd):	411	JTXV		
1N5621		429	JTXV		
1N5420		411	JTXV		
1N5623		429	JTXV		
1N3911		308	JTX		
1N3912		308	JTX		
1N3913		308	JTX		
1N3891		304	JTXV		
1N3893		304	JTXV		
1N3888		304	JTXV		

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

1. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual(1) Status	JAN S(3) Part Number	Substitute (2) Part Number
400 mW Voltage Regulators:					
1N4370A		127	JTXV		
thru					
1N4372A					
1N746A		127	JTXV		
thru					
1N749A					
1N750A		127	JTXV		
thru					
1N752A					
1N753A-1		127	JTXV		
thru					
1N759A-1					

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500I. Semiconductor Diodes

Part Type	Description	Sheet No.	Qual(1)	Part Number	Supplier Number(2)
	1.5W Voltage Regulators:				
1N4451		406	JTXV		
thru					
1N4489					
	5W Voltage Regulators:				
1N4954		356	JTXV		
thru					
1N4995					

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

1. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual(1) Status	JAN S(3) Part Number	Substitute (2) Part Number
10W Voltage Regulators:					
1N2970B		124	JTXV		
1N2971B					
1N2972B					
1N2973B					
1N2974B					
1N2976B					
1N2979B					
1N2980B					
1N2982B					
1N2984B					
1N2985B					
1N2986B					
1N2988B					
1N2989B					
1N2990B					

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-195001. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual(1) Status	JAN S(3) Part Number	Substitute (2) Part Number
	10W Voltage Regulators (cont'd)				
1N2991B		124	JTXV		
1N2992B					
1N2995B					
1N2997B					
1N2999B					
1N3000B					
1N3002B					
1N3003B					
1N3004B					

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

1. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S (3) Part Number	Substitute (2) Part Number
Current Regulators:					
1N5283		463	JTXV		
thru					
1N5314					
Varactor Diodes					
1N4801B		329	JTXV		
thru					
1N4815B					
1N5139A		383	JTXV		
thru					
1N5148A					

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-195001. Semiconductor Diodes

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S(3) Part Number	Substitute (2) Part Number
Power Rectifiers:					
1N1202A		260	JTX		
1N1206A		260	JTX		
1N3673A		260	JTX		
1N1186		297	JTX		
1N1190		297	JTX		
1N3768		297	JTX		
Transient Suppressors:					
1N5629A		500	JTXV		
thru					
1N5665A					

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

2. Transistors

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S (4) Part Number	Rad Hard (2) Level	Substitute (3) Part Number
Low Power NPN:						
2N3439		368	JTXV			
2N4150		394	JTXV			
2N2484		376	JTXV			
2N3507		349	JTXV			
2N3501		366	JTXV			
2N2219A		251	JTXV			
2N2222A		255	JTXV			
2N3735		396	JTX			
2N2369A		317	JTXV			

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-195002. Transistors

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S(3) Part Number	Substitute(2) Part Number
Low Power PNP:					
2N5416		485	JTX		
2N2605		354	JTXV		
2N3868		350	JTXV		
2N3467		348	JTXV		
2N3762		396	JTXV		
2N2905A		290	JTXV		
2N2907A		291	JTXV		
2N3637		357	JTXV		
2N3251A		323	JTXV		

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

2. Transistors

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S(3) Part Number	Substitute (2) Part Number
	Hi Power (PC>5W)NPN:				
2N3749		315	JTXV		
2N3585		384	JTXV		
2N2814		415	JTXV		
2N5672		488	JTXV		
2N3716		408	JTXV		
2N3772		413	JTX		
2N5303		456	JTXV		
2N3999		374	JTXV		
	Hi Power (PC>5W) PNP:				
2N3741		441	JTXV		
2N2613		461	JTXV		
2N3792		379	JTXV		
2N4399		433	JTXV		

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-195002. Transistors

Part Type	Description	Slash Sheet No.	Qual(1) Status	JAN S(3) Part Number	Substitute (2) Part Number
	Dual Differential Amplifiers:				
2N2920		355	JTXV		95513-001 (4)
2N3811		336	JTXV		
	Dual Complementary Amplifiers:				
2N4854		421	JTXV		
	Low Power Choppers:				
2N2432A		313	JTXV		
2N2445		382	JTXV		

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

2. Transistors

Part Type	Description	Slash Sheet No.	Qual(1) Status	JAN S(3) Part Number	Substitute (2) Part Number
Radio Frequency Amplifiers:					
2N918		301	JTXV		95501-001
2N2857		343	JTXV		95502-001
2N3553		351	JTXV		
2N3866		398	JTXV		
2N4440		341	JTXV		

MIL-STD-1546 (USAF)

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-195002. Transistors

Part Type	Description	Slash Sheet No.	Qual (1) Status	JAN S(3) Part Number	Substitute (2) Part Number
Junction FET's:					
2N3823		375	JTXV		
2N4416A		428	JTXV		
2N4856		385	JTXV		
2N4858		385	JTXV		
2N5114		476	JTXV		
2N2609		296	J		95301-002
Dual JFET's:					
2N5545		430			
Thyristors:					
2N2323A		276	JTXV		
2N2324A		276	JTXV		
2N2326A		276	JTXV		
2N2328A		276	JTXV		

II. AFSD PREFERRED SEMICONDUCTOR DEVICES
MIL-S-19500

NOTES

1. Qualification Status - Highest level to which part has been qualified, JAN is represented by "J".
2. Substitute parts are defined in the introduction to Appendix "D".
3. Complete MIL-S-19500 part number will be shown when devices have completed qualification to JAN S requirements. See QPL for approved sources.
4. Part Numbers of the form 95XXX-XXX represent items that have been produced by the Lockheed "Monitored Line Parts Program".

MIL-STD-1546 (USAF)

III. AFSD PREFERRED CAPACITORS

1. Fixed, Glass Dielectric MIL-C-23269

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CYR 10	0.5 - 270pF; 300, 500 wvdc	M23269/01-XXXX(1)	M23269/01-XXXX(2)	
CYR 15	270-1200pF; 300, 500 wvdc	M23269/02-XXXX	M23269/02-XXXX	
CYR 20	500-4700pF; 300, 500 wvdc	M23269/03-XXXX	M23269/03-XXXX	
CYR 30	5600-10000pF; 300, 500 wvdc	M23269/04-XXXX	M23269/04-XXXX	

NOTE: See MIL-STD-198
for Preferred values

III. AFSD PREFERRED CAPACITORS

2. Fixed, Tantalum (Solid), MIL-C-39003

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CSR 13	.039-330mF; 6-75 wvdc, polarized	M39003/01-XXXX (3)		
CSR 33	1.2-1000mF; 6-50 wvdc, polarized	M39003/06-XXXX		

NOTE: See MIL-STD-198 for preference

MIL-STD-1546 (USAF)

III. AFSD PREFERRED CAPACITORS

3. Fixed, Tantalum (Non-solid), MIL-C-39006

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CLR 25	4-580mF; 15-150 wvdc, etched foil, polarized	M39006/01-XXXX(4)		
CLR 27	6-350mF; 15-150 wvdc, etched foil, polarized	M39006/02-XXXX		
CLR 79	2.5-1200mF; 6-125 wvdc, tantalum-tantalum, polarized	M39006/22-XXXX		

NOTE: See MIL-STD-198 for standard values

III. AFSD PREFERRED CAPACITORS

4. Fixed, Ceramic, MIL-C-39014

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CKR 05	10-100000pF; 50, 100, 200 wvdc	M39014/01-XXXX(5)		
CKR 06	0.012-1.0mF; 50, 100, 200 wvdc	M39014/02-XXXX		
CDR11,12, 14 & 15	10pF-0.1mF; 50, 100 wvdc	M39014/ XXXX		

NOTE: See MIL-STD-198 for standard values.

MIL-STD-1546 (USAF)

III. AFSD PREFERRED CAPACITORS

5. Fixed, Ceramic Chip, MIL-C-55681

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CDR 01	10-4700pF; 50, 100 wvdc	CDR-XXX----- (6)		
CDR 02	200-22000pF; 50, 100 wvdc	CDR-XXX-----		
CDR 03	330-68000pF; 50, 100 wvdc	CRD-XXX-----		
CDR 04	1200-180000pF; 50, 100wvdc	CDR-XXX-----		
CDR 05	3900-330000pF; 50, 100wvdc	CDR-XXX-----		
CDR 06	6800-470000pF; 50, 100wvdc	CDR-XXX-----		

NOTE: See MIL-STD-198 for standard values

III. AFSD PREFERRED CAPACITORS

6. Fixed, Ceramic, Temperature Compensating (MIL-C-20)

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CCR 05	1.0-3300pF; 200 wvdc	CCR05--XXX--(7)		
CCR 06	390-10000pF; 100, 200 wvdc	CCR06 XXX--		
CCR 07	2200-47000pF; 100, 200 wvdc	CCR07 XXX--		

NOTE: See MIL-STD-198 for standard values

MIL-STD-1546 (USAF)

III. AFSD PREFERRED CAPACITORS

7. Fixed, Metallized, Plastic Film, MIL-C-83421

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
CRH 02	0.001-10MF, 50 wvdc	M63421/01-XXX-(8)		
CRH 03	0.001-10MF, 100 wvdc	M63421/01-XXX-		
CRH 04	0.001-3.9MF, 200 wvdc	M63421/01-XXX-		
CRH 05	0.001-20MF, 400 wvdc	M63421/01-XXX-		

III. AFSD PREFERRED CAPACITORS

NOTES

- (1) Capacitors per MIL-C-23269/1
M23269/01-XXXX
 Dash number identifies each capacitance value,
 voltage and failure rate level per spec.
- (2) Part numbers for Class "S" devices must be failure rate level
 "S" (0.0018 per 1000 hours).
- (3) Capacitors per MIL-C-39003/1
M39003/01-XXXX
 Dash number identifies each capacitance value,
 voltage and failure rate level per spec.
- (4) Capacitors per MIL-C-39006/1
M39006/01-XXXX
 Dash number identifies each capacitance value,
 voltage and failure rate per spec.

III. AFSD PREFERRED CAPACITORS

NOTES

(5) Capacitors per MIL-39014/1

M39014/01-XXXX

Dash number identifies each capacitance value, voltage and failure rate per spec.

(6) Capacitors per MIL-C-55681/0X

Rated Temperature and voltage-temperature limits

Capacitance

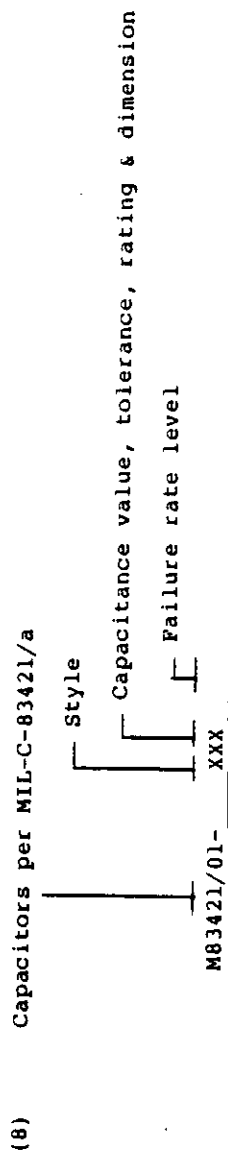
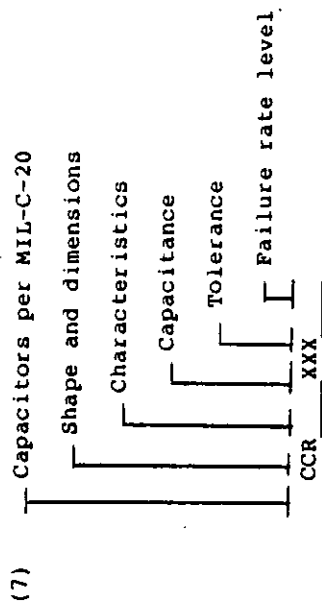
Rated Voltage, capacitance tolerance, terminal coating

Failure rate

CDR XXX

III. AFSD PREFERRED CAPACITORS

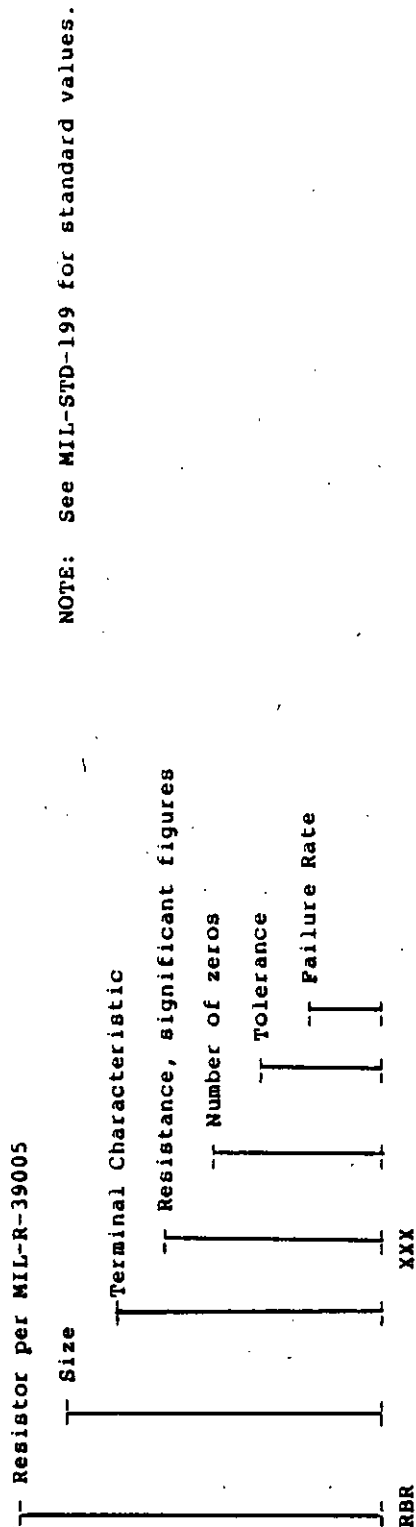
NOTES



IV. AFSD PREFERRED RESISTORS

1. Fixed, Wirewound, Accurate, MIL-R-39005

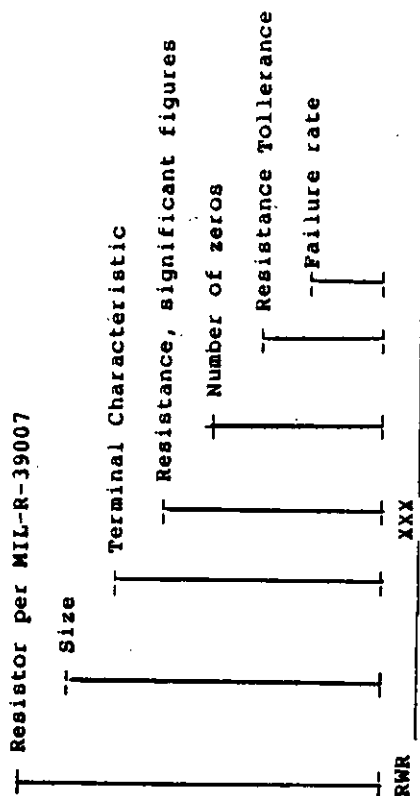
Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
	<u>Ø 1250C</u>			
	<u>Range</u>			
RBR56	.125W 10Ω → 100K	RBR56_XXXX		
RBR54	.25W 10Ω → 255K	RBR55_XXXX		
RBR52	.5W 10Ω → 806K	RBR52_XXXX		
RBR57	.75W 10Ω → 1.37M	RBR57_XXXX		



IV. AFSD PREFERRED RESISTORS

2. Fixed, Wirewound, Power, MIL-R-39007

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
	<u>e 250C</u>			
	<u>Inductive Range</u>			
RWR81	1.0W 0.10 → 464Ω	RWR81_XXXX		
RWR89	3.0W 0.10 → 3570Ω	RWR89_XXXX		
RWR84	7.0W 0.10 → 12.4K	RWR84_XXXX		



NOTE: See MIL-STD-199 for standard values.

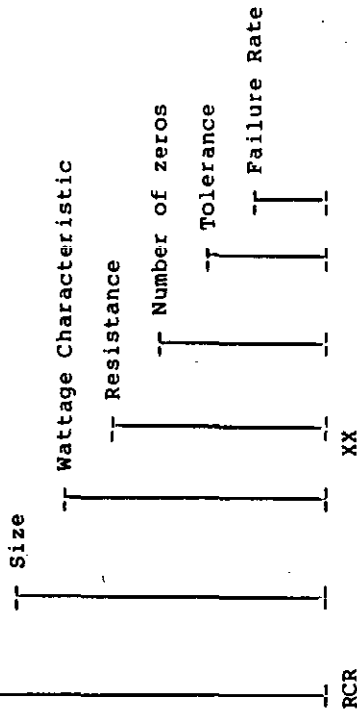
MIL-STD-1546 (USAF)

IV. AFSD PREFERRED RESISTORS

3. Fixed, Composition, MIL-R-39008

Part Type	Description	Range	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
	θ 70°C				
RCR05	.125W	2.7 Ω \rightarrow 22M	RCR05_XXX		
RCR07	.25W	2.7 Ω \rightarrow 22M	RCR07_XXX		
RCR20	.5W	2.7 Ω \rightarrow 22M	RCR20_XXX		
RCR32	1.0W	2.7 Ω \rightarrow 22M	RCR32_XXX		
RCR42	2.0W	2.7 Ω \rightarrow 22M	RCR42_XXX		

Resistor per MIL-R-39008



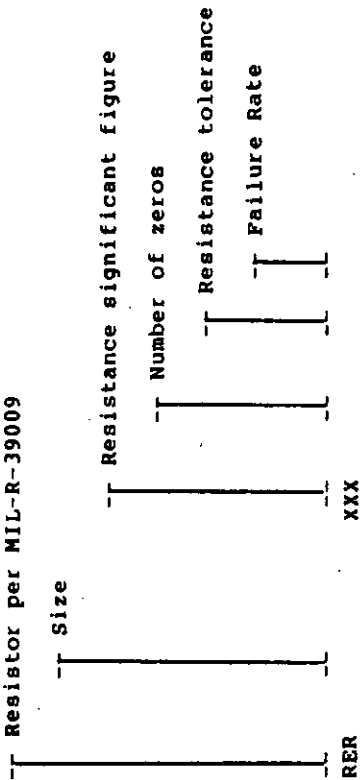
NOTE: See MIL-STD-199 for standard values.

IV. AFSD PREFERRED RESISTORS

4. Fixed, Wirewound, Chassis Mount, MIL-R-39009

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
	<u>⌀ 250C</u>			
	<u>Range</u>			
RER60	5W	0.10 → 3.32K	RER60_XXXX_	
RER65	10W	0.10 → 5.62K	RER65_XXXX_	
RER70	20W	0.10 → 12.1K	RER70_XXXX_	
RER75	30W	0.10 → 39.2K	RER75_XXXX_	

Resistor per MIL-R-39009



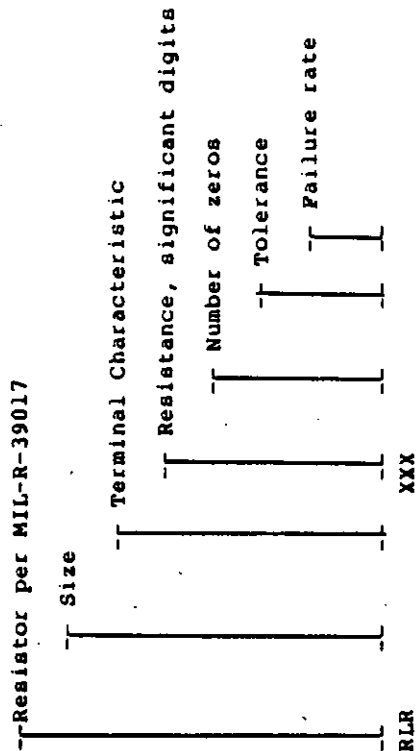
NOTE: See MIL-STD-199 for standard values.

IV. AFSD PREFERRED RESISTORS

5. Fixed, Film, General Purpose, MIL-R-39017

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
	<u>Power</u>			
	<u>at 70°C</u>			
	<u>Range</u>			
RLR05	.125W	RLR05_XXXX		
RLR07	.25W	RLR07_XXXX		
RLR20	.5W	RLR20_XXXX		
RLR32	1.0W	RLR32_XXXX		
	<u>Resistance</u>			
	<u>Range</u>			
	4.7Ω → 300K			
	10Ω → 22.1M			
	4.3Ω → 3.01M			
	10Ω → 1.0M			

Resistor per MIL-R-39017



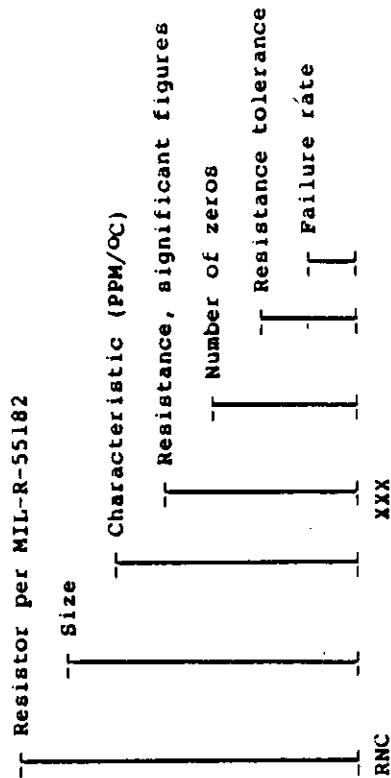
NOTE: See MIL-STD-199 for standard values.

IV. AFSD PREFERRED RESISTORS

6. Fixed, Film, Precision, MIL-R-55182

Part Type	Description	Military Spec Part No.	Class "S" Part No.	Substitute Class "S" Part No.
	<u>0 70°C</u>			
RNC55	.125W 10Ω → 2M	RNC55_XXXX		
RNC60	.25W 24.9Ω → 4.02M	RNC60_XXXX		
RNC65	.5W 10Ω → 0.06M	RNC65_XXXX		
RNC90	.6W 40.2Ω → 53.6K	RNC90_XXXX		
RNC70	.75W 24.9Ω → 15M	RNC70_XXXX		

Resistor per MIL-R-55182



NOTE: See MIL-STD-199 for standard values.

MIL-STD-1546 (USAF)

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