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MIL-STD-5400

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MILITARY STANDARD

**ELECTRONIC EQUIPMENT, AIRBORNE,
GENERAL REQUIREMENTS FOR**



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FOREWORD

1. This military standard is approved 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: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, Code SR3, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.
3. This standard implements and tailors those requirements and documents contained in MIL-STD-454 Standard General Requirements for Electronic Equipment, which have applicability in the design and production of electronic equipment for airborne applications. Included in this standard are references to the applicable requirements, an index of applicable documents, and a guide for tailoring and application of those requirements and documents in conjunction with the various equipment design, development and production phases.

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1. SCOPE

1.1 Scope. This standard covers the general requirements for electronic equipment for operation in piloted aircraft and helicopters, missiles, boosters and allied vehicles. Detail electrical and mechanical design, performance and test requirements shall be as specified in the detail equipment specification or contract.

1.1.1 Application. This standard should not be invoked on a blanket basis; however, each requirement should be assessed in terms of need. This standard is a compendium of general requirements, the majority of which have been selected from MIL-STD-454, for specific applicability to airborne electronic equipment. Individual detail equipment specifications or contract should invoke only those requirements which are applicable and necessary to that specific equipment.

1.1.2 Tailoring. A tailoring guide, Appendix B, is included to assist the acquisition activity and the contractor to apply only minimal essential requirements relative to the various phases of equipment design, development and production.

1.2 Classification. The electronic equipment for which the general requirements for design and manufacture are outlined shall be of the following classes, as specified (see 6.2).

- Class 1 - Equipment designed for 15.20 km (50,000 feet) altitude and continuous sea level operation over the temperature range of -54° to $+55^{\circ}\text{C}$ ($+71^{\circ}\text{C}$ intermittent operation).
- Class 1A - Equipment designed for 9.12 km (30,000 feet) altitude and continuous sea level operation over the temperature range of -54° to $+55^{\circ}\text{C}$ ($+71^{\circ}\text{C}$ intermittent operation).
- Class 1B - Equipment designed for 4.56 km (15,000 feet) altitude and continuous sea level operation over the temperature range of -40° to $+55^{\circ}\text{C}$ ($+71^{\circ}\text{C}$ intermittent operation).
- Class 2 - Equipment designed for 21.28 km (70,000 feet) altitude and continuous sea level operation over the temperature range of -54° to $+71^{\circ}\text{C}$ ($+95^{\circ}\text{C}$ intermittent operation).
- Class 3 - Equipment designed for 30.40 km (100,000 feet) altitude and continuous sea level operation over the temperature range of -54° to $+95^{\circ}\text{C}$ ($+125^{\circ}\text{C}$ intermittent operation).

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- Class 4 - Equipment designed for 30.40 km (100,000 feet) altitude and continuous sea level operation over the temperature range of -54° to +125°C (+150°C intermittent operation).
- Class 5 - Equipment designed for altitudes greater than 30.40 km (100,000 feet) for periods of time not exceeding 6 hours and continuous sea level operation over the temperature range of -54° to +95°C (+125°C intermittent operation).

1.2.1 External cooling. The addition of the letter "X" after the class number, e.g., (Class 2X), will identify the equipment as operating in the ambient environment of that class, but requiring cooling from a source external to the equipment.

2. APPLICABLE DOCUMENTS

2.1 Documents. The documents listed in Appendix A form a part of this standard to the extent specified herein. Requirements of MIL-STD-454 invoked by this standard are limited to those documents listed in Appendix A.

2.2 Applicable issues. Unless otherwise specified, the applicable issues of documents listed in Appendix A shall be those listed in the Department of Defense Index of Specifications and Standards (DODISS) specified in the solicitation. The applicable issue of nongovernment documents not listed in the DODISS shall be the issue specified in the solicitation.

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

3. DEFINITIONS

3.1 For definitions of part, subassembly, assembly, unit, set, system and models, MIL-STD-280 will apply.

3.2 Accessory. An accessory is an assembly of a group of parts or a unit which is not always required for the operation of a set or unit as originally designed but serves to extend the functions or capabilities of the set, such as headphones for a radio set supplied with a loudspeaker, a vibratory power unit for use with a set having a built-in power supply, or a remote control unit for use with a set having integral controls.

3.3 Equipment. Equipment is a general term characterizing the broad category of electronic items (units, subsystems, systems, etc.).

3.4 Complete operating equipment. A complete operating equipment is defined as an equipment, together with the necessary detail parts, accessories and components, or any combination thereof, required for the performance of a specified operational function. Certain equipments may be complete within themselves and not require the addition of detail parts, accessories or components to perform a specified operational function.

3.5 Installation (complete equipment). An installation (complete equipment) is defined as a combination of assemblies, accessories and detail parts required to make one complete operating equipment. An installation comprises a group of permanently installed parts and a group of removable assemblies.

3.6 Permanently installed part. A permanently installed part is defined as a detail part or assembly which is permanently installed as a part of the vehicle. Examples: Rigid or whip antenna, bracket, cable assembly, fairlead, mounting and plug.

3.7 Removable assembly. A removable assembly is defined as an assembly which is easily removable from the vehicle. Examples: Dynamotor unit, indicator unit, radio receiver and radio transmitter.

3.8 Electronics. The term "electronics" is defined as a system or equipment, the primary purpose of which is the transmission or reception of intelligence. This includes or comprises communications or signal equipment, radio, radar, radiation, radio-controlling devices, meteorological, fire control, bombing, flight and navigational instruments, powerplant controls, synchronizers, photographic and test equipment, when such portions employ circuits which utilize a combination of electrical or electronic devices to generate, control, indicate or record any form of alternating or direct currents, or both.

3.9 Hermetic sealing. Hermetic sealing is the process by which an item is totally enclosed by a suitable metal structure or case by fusion of metallic or ceramic materials. This includes the fusion of metals by welding, brazing or soldering; the fusion of ceramic materials under heat or pressure; and the fusion of ceramic materials into a metallic support.

3.10 Performance requirements of the equipment. Wherever referenced in this document, the "performance requirements of the equipment" is to be understood to mean the satisfactory performance of all electrical and mechanical characteristics performed under the "condition," "destructive," and "accelerated life" tests described in the detail equipment specification for the purpose of simulating anticipated field service demands as closely as possible.

3.11 Intermittent and short-time operation. Intermittent and short-time operations are the alternating periods of operation for the specified time after which the equipment shall be required to remain operational following the high temperature transient.

3.12 Reordered production equipment. Reordered production equipment is equipment acquired on each contract after the original Category III contract for the equipment, regardless of the contractor, e.g., if contractor "X" is granted the original production, then the equipment acquired on a second or subsequent contract is considered reordered production equipment, whether it is acquired from contractor "X" or a new contractor.

3.13 Acquisition activity. The military or federal agency contracting for equipment.

3.14 Airborne. For purposes of this standard, the term "airborne" combines applications of electronic equipment within aircraft, helicopters, missiles, boosters and allied vehicles as defined and limited by the classifications and requirements contained herein.

3.15 Detail equipment specification. For purposes of this standard, the term "detail equipment specification" is defined as the document which describes and controls the detail features of a specific equipment for acquisition by the Government. These details include, but are not limited to, such features as mechanical and electrical design parameters, quality and reliability requirements, performance and environmental requirements. The detail equipment specification may be prepared by the Government, the equipment manufacturer for the Government, or the prime vehicle contractor. The preparing activity of the detail equipment specification should utilize the applicable general and detail requirements of this standard in the preparation of that specification.

4. GENERAL REQUIREMENTS

4.1 This section contains general requirements for common application to all airborne electronic equipment design and construction. Also included in this section are requirements for the design selection and application of parts, materials and processes, selected primarily from MIL-STD-454 as applicable to airborne electronic equipment.

4.1.1 Tailoring of MIL-STD-454 requirements. The requirements of MIL-STD-454 have been tailored for inclusion in this standard, and those documents applicable to airborne electronic equipment extracted and specified herein. Appendix A of this document lists those documents extracted from MIL-STD-454 determined to be suitable for airborne electronic equipment applications. The extent of applicability of any individual MIL-STD-454 requirement is limited to only those documents extracted and listed in Appendix A. Where reference is made to a complete MIL-STD-454 requirement, all documents listed in that requirement are considered applicable unless otherwise supplemented or restricted herein or in MIL-STD-454.

4.1.2 Standard hardware acquisition and reliability program (SHARP). This standard is intended primarily for use in the design of militarized developmental electronic equipment for airborne applications. However, the use of militarized non-developmental items (NDI), standardized under SHARP for airborne electronics, shall be utilized to the maximum extent possible. SHARP developed hardware includes standard electronic modules (SEMs), standard enclosure systems (SES), standard power supply systems (SPS), and standard battery systems (SBS). SEMs shall be implemented in accordance with MIL-STD-1378, SES in accordance with MIL-STD-2200, and SPS in accordance with MIL-STD-2038. Non-use of SHARP requires approval of the acquisition activity.

4.1.3 Requirements, tables and figures. Tables I through IV contain reference to subject matter cross-referenced to the applicable MIL-STD-454 requirement or MIL-STD-5400 paragraph number. Table V provides a cross-reference of temperature and altitude ranges to the applicable class of equipment for tests under operating and nonoperating conditions. Figures 1 through 4 provide operational (temperature vs altitude) requirements for the various classes of equipment.

<u>Requirement</u>	<u>Table</u>
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4.4 Materials Selection	III
4.5 Processes and Finishes	IV
4.6 Environmental Service Requirements	V
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Figure 2 - Operational Requirements - Class 2	
Figure 3 - Operational Requirements - Class 3, 5	
Figure 4 - Operational Requirements - Class 4	

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4.2 Design and construction.

4.2.1 Table I lists general subject areas for consideration in the design and construction of airborne electronic equipment.

TABLE I. General design and construction.

Subject	MIL-STD-454 Rqt. No. or MIL-STD-5400 Para. No.
Accessibility	Requirement 36
Anti-jamming	Para. 4.2.3
Castings	Para. 4.2.4
Corona	Requirement 45
Derating parts and materials	Para. 4.2.6
Electrical overload	Para. 4.2.7
Electrical power	Para. 4.2.8
Electromagnetic interference control	Para. 4.2.9
Electrostatic discharge control	Para. 4.2.10
Enclosures	Para. 4.2.11
Fabrication	Para. 4.2.12
Grounding, bonding and shielding	Para. 4.2.13
Human engineering	Para. 4.2.14
Interchangeability	Para. 4.2.15
Maintainability	Para. 4.2.16
Marking	Para. 4.2.17
Microphonics	Para. 4.2.18
Moisture pockets	Para. 4.2.19
Multiplexing	Para. 4.2.20
Nomenclature	Para. 4.2.21
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Thermal design	Para. 4.2.30
Tools	Para. 4.2.31
Standardized power supplies	Para. 4.2.32
Workmanship	Para. 4.2.33

4.2.2 Accessibility. Provisions for accessibility to parts, wiring and terminations within equipment shall be in accordance with MIL-STD-454, Requirement 36.

4.2.3 Anti-jamming. The electronic system or equipment shall be designed to obtain the maximum inherent protection against possible interfering signals caused by enemy jamming. The contractor shall solicit and obtain the approval of the acquisition activity for the basic anti-jamming concepts before proceeding with the design of the models.

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4.2.4 Castings, metal. Metal castings shall be designed, classified, inspected and repaired in accordance with MIL-STD-2175. Porous nonferrous castings shall be impregnated in accordance with MIL-STD-276. Refer to MIL-STD-454, Requirement 21 for guidance in the choice of casting process and repairs to castings.

4.2.5 Corona and electrical breakdown prevention. Provisions for the protection of equipment against corona and electrical breakdown shall be in accordance with MIL-STD-454, Requirement 45.

4.2.6 Derating. In the application of electronic parts and materials, the parts and materials selected shall be used within their electrical ratings and environmental capabilities (e.g., any ambient or hot spot temperatures, voltage, current, or power dissipation). Derating shall be accomplished as necessary to assure the required equipment reliability within the specified operating conditions. Derating should be accomplished based upon cooling conditions (either ambient or forced air) applied to the equipment when installed in the vehicle.

4.2.7 Electrical overload protection. Current overload protection for the equipment shall be provided by fuses or circuit breakers. Circuit breakers shall not be used as switches unless such breakers have been specifically designed and tested for that type service. Protective devices employed in the equipment should be in a readily accessible, safe location.

4.2.7.1 Resettable circuit protectors. Circuit breakers or other resettable devices should be used to protect critical circuits, or where predictable overloads or surges occur because of peculiar equipment functions or operator effects which are unavoidable.

4.2.7.2 Spare fuses. When fuses are used, a minimum of one spare fuse for each size and rating but a quantity of not less than 10 percent of the total shall be incorporated in the equipment and shall be contained in the same compartment.

4.2.8 Electrical power. The equipment shall be designed to operate from power sources in accordance with MIL-STD-704.

4.2.8.1 Warm-up time. Warm-up time shall be such as to provide the specified performance within a period as specified by the detail equipment specification. Unless otherwise specified, the warm-up time at temperatures down to -54°C shall not exceed 2 minutes for equipment essential to flight safety, and shall not exceed 5 minutes for equipment not essential to flight safety.

4.2.8.2 Electronic equipment which will require shipboard alternating current (ac) power to be supplied for purposes of test or aircraft servicing shall have electrical interface characteristics compatible with the applicable power system classification of MIL-STD-1399, Section 300.

4.2.9 Electromagnetic interference control. Electromagnetic interference requirements shall be as specified in MIL-STD-461. Tests and test methods shall be as specified in MIL-STD-462. For other than Air Force applications, MIL-STD-469 shall also apply for radar equipment and systems.

4.2.9.1 Radar equipment. Radar systems and equipment shall also conform to the provisions of section 5.3 of NTIA Manual as specified in the contract and to MIL-STD-469 except that MIL-STD-469 shall not be used for Air Force applications. In the event of conflict, the following descending order of precedence shall prevail: NTIA Manual, MIL-STD-469, MIL-STD-461.

4.2.10 Electrostatic discharge control. Requirements for the establishment and implementation of an electrostatic discharge control program in accordance with MIL-STD-1686, including its deliverable data requirements, shall be tailored for applicability to equipment and specified directly in the contract or detail equipment specification. DOD-HDBK-263 provides guidance for the implementation of an ESD control program. Refer to MIL-STD-454, Requirement 75, for additional guidance in this area.

4.2.11 Enclosures.

4.2.11.1 Standardized avionics enclosures. As an integral part of the SHARP program (see 4.1.2), the selection of standardized enclosure systems shall be as specified in MIL-STD-2200. Enclosures conforming to MIL-E-85726 and racks conforming to MIL-R-85725 are examples of standardized hardware which are available for use as conforming to the requirements of MIL-STD-2200.

4.2.11.2 Other enclosures. Requirements for the design and construction of other equipment enclosures (e.g., consoles, cabinets, cases), shall be in accordance with MIL-STD-454, Requirement 55, except that performance for mounting bases shall be met at the same vibration test frequencies and energy density levels as required for the specific equipment. Mounts and vibration isolators, whether integral or not, shall be subject to approval of the acquisition activity. Positive self-locking case mounting fasteners shall be used on all mountings. The fasteners chosen shall be of a size specified for the weight of the equipment unit.

4.2.12 Fabrication. Boxes, cases, shields and compartment walls shall be made by casting, drawing or bending, and welding, brazing or adhesive bonding except when ease of servicing of the equipment requires that a removable panel construction be used. When the applied stresses dictate the use of a strong aluminum alloy which does not provide a good weld or braze, riveting or bolting may be used.

4.2.13 Grounding, bonding and shielding. Grounding, bonding and shielding interface and installation requirements shall be in accordance with MIL-B-5087. MIL-HDBK-274 provides guidance information relative to grounding practices for aircraft.

4.2.14 Human engineering. Requirements for human engineering in accordance with MIL-H-46855 shall be tailored for applicability to the equipment and specified directly in the contract or detail equipment specification. MIL-STD-1472 provides design criteria which may be selectively applied as requirements or guidance.

4.2.15 Interchangeability.

4.2.15.1 Design tolerances shall permit parts, subassemblies and assemblies to be used in their parent assemblies without regard to the source of supply or manufacturer. Parts, subassemblies and assemblies having the full range of dimensions and characteristics permitted by the governing specification shall be usable as replacement items without selection or departure from the specified performance requirements of the parent items.

4.2.15.2 When permission is granted to use a nonstandard part or material because the existing standard part or material is not available, the equipment shall be so designed that the nonstandard part or material and the standard part or material are interchangeable. When the specification for the part or material contains substitutability or supersession information, the design shall permit the substitute or superseding parts or materials to be used interchangeably.

4.2.15.3 Interchangeability of reordered equipment. For reordered equipment, interchangeability shall exist between units and all replaceable assemblies, subassemblies and parts of a designated model of any previously manufactured equipment supplied or designated by the acquisition activity.

4.2.16 Maintainability. Requirements for the establishment of a maintainability program (maintainability program tasks, quantitative requirements, and verification or demonstration requirements) in accordance with MIL-STD-470 shall be tailored for applicability to the equipment and program phase, and specified directly in the contract or detail equipment specification. Other maintainability documents which may be invoked through MIL-STD-470 or which may be cited directly as a basis for contract requirements include MIL-STD-471, MIL-STD-721 and MIL-HDBK-472.

4.2.17 Marking. Items shall be marked in accordance with MIL-STD-454, Requirement 67. Marking shall not adversely affect the leakage path between conductors or any other factor of equipment performance.

4.2.17.1 Labels. Labels showing wiring and schematic diagrams of parts, lubricating and operating instructions, safety notices, list of tools, list of contents and similar information shall be provided where space permits. Labels shall be designed to remain legible and affixed for the service life of the equipment on which they are mounted.

4.2.17.2 Wire coding for identification. Hookup wires in the equipment shall be distinctly coded by color or numbers, insofar as practicable. Codes shall be in accordance with MIL-STD-681, unless otherwise specified. Short hookup wire, 150mm or less in length between termination points, need not be marked if the path of the wire can be easily and visually traced. Numbers shall not be used where they would be difficult to read or trace. Flat cable conductors may be identified at termination points. The outer conductor of a flat multiconductor cable should be coded continuously for identification and orientation. Hot or cold stamping shall be allowed only on insulated wire which will not accept ink. Marking shall not be used on wires where the dielectric capability of the wire is reduced by such marking. Wire used for external wiring between units shall be coded in accordance with MIL-W-5088.

4.2.17.3 Operational program marking. Operationally programmed units shall provide a means to identify the software part number for the version in accordance with MIL-STD-454, Requirement 67.

4.2.18 Microphonics. Microphonic effects shall not be detrimental to equipment performance.

4.2.19 Moisture pockets. Pockets, wells, traps, and the like in which water or condensate could collect when the equipment is in normal position should be avoided. Where moisture pockets are unavoidable in unsealed equipment, provision shall be made for drainage of such pockets. Desiccants or moisture-absorbent materials shall not be used within moisture pockets. In sealed equipment or assemblies such as waveguides, the use of desiccants or other methods, such as gas purging, is permitted.

4.2.20 Multiplexing. Unless otherwise specified, multiplexing shall be used to transmit bilevel signals for logic functions for ON-OFF, interlocking and proportional control of utilization equipments and components. The multiplex data bus system shall be in accordance with MIL-STD-1553. MIL-HDBK-1553 provides guidance information for implementation of MIL-STD-1553.

4.2.21 Nomenclature assignment. Nomenclature assignment shall be in accordance with MIL-STD-196, along with MIL-N-18307 for the Navy, MIL-N-7513 for the Air Force, and the contract for the Army.

4.2.22 Orientation. Normal installation position or range of positions shall be as specified in the detail equipment specification. The equipment shall operate within specified limits in any position specified in the detail equipment specification.

4.2.23 Panels.

4.2.23.1 Control panels. Console and rack mounted control panels shall conform to MIL-C-6781 and MIL-C-81774. Control panels shall be integrally illuminated and conform to the requirements of MIL-P-7788.

4.2.23.2 Electroluminescent panels. The use of electroluminescent panels shall require approval of the acquisition activity.

4.2.23.3 Ranges of adjustable parts. The electronic circuitry shall be designed to provide a reserve in the adjustment range from the normal adjustment setting of all variable parts that require adjustment during operation or maintenance. This adjustment range shall be sufficient to compensate for composite variations which may develop in the associated circuitry because of normal changes in part values during the specified life cycle of the equipment. The adjustment range shall also be capable of compensating for variations resulting from replacement with parts within the tolerances specified.

4.2.24 Pressurization. Whenever pressurization of the electronic equipment is required, or is utilized to meet specification requirements, the following provisions shall be met:

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- a. The case shall withstand a positive or negative 5 psi pressure difference over the applicable pressure range.
- b. The case shall be of a type that will permit ready opening and clearing for access to the equipment for repair and maintenance. If practicable, the equipment shall be completely operable after removal from the case, and alignment shall be unaffected by replacement in the case.
- c. When possible and advantageous, external points shall be provided for check without removal from the case.
- d. A means shall be provided for determining the effectiveness of the seal. This may consist of an automobile-tire-type valve stem fitting to permit the use of an air pump for increasing the pressure approximately 5 psi above sea level pressure. Measurement of the pressure by means of a Schrader type 3715 gage, or equivalent, shall be possible.
- e. Sealing instructions shall be placed on one side of the case, if practicable.
- f. Those parts of an equipment, including transmission lines, that are pressurized shall be capable of withstanding any pressures developed under the required external operation conditions, after having been pressurized initially on the ground to not more than 5 psi gage at -20° to $+50^{\circ}\text{C}$, to such an extent that no arcing or loss of power caused by corona occurs that would not occur at atmospheric pressure on the ground. Nor shall leakage be such as to permit the entrance of moisture or air to an extent that permanent damage or impaired operation occurs under any of the required operating conditions. Vacuum relief valves shall be provided.
- g. Unless specified or permitted in the detail equipment specification, pressure shall be maintained without the use or need of a pressurization pump. When a pressurization pump is required, redundant barostatic switches, or similar automatic means, shall be provided to assure equipment is pressurized during flight, even though it is not being operated. The switch or automatic means shall be energized from a common point and shall be energized as part of the take-off procedure.
- h. The equipment shall maintain pressure to accommodate the maximum operating time; in addition, and where applicable for captive and nonoperating flight, the equipment shall maintain operating pressure for periods up to 24 hours. Unless otherwise determined as satisfactory, the loss of pressure shall not exceed 5 pounds in a 24-hour period at the altitude and temperature specified in the detail equipment specification.
- i. If required, a desiccant shall be provided within the case.

- j. Parts used in pressurized container shall meet the requirements of this standard, except that the altitude requirements may differ.

4.2.25 Reliability. Requirements for the establishment of a reliability program (reliability engineering and accounting tasks, quantitative requirements, and verification or demonstration requirements) shall be tailored for applicability to the equipment and program phase in accordance with MIL-STD-785, and specified directly in the contract or detail equipment specification. Other reliability documents which may be invoked through MIL-STD-785 or which may be cited directly as a basis for contract requirements include MIL-STD-721, MIL-STD-756, MIL-STD-781, MIL-STD-1629 and MIL-HDBK-217.

4.2.26 Repairability. Repairability shall be determined in terms of warranties, mean time to repair (MTTR), stocking spare replacement parts and identifying procedures and personnel for the repair of the specified equipment. The detail equipment specification shall specify the MTTR for militarized equipment, not to exceed thirty (30) minutes. Level of repair guidance is provided in MIL-STD-1390, and should be evaluated when making Repairability and Training decisions.

4.2.27 Safety.

4.2.27.1 System safety. Requirements for the development and implementation of a system safety program shall be tailored for applicability to the equipment and acquisition phase in accordance with MIL-STD-882, and specified directly in the contract or detail equipment specification.

4.2.27.2 Personnel safety. Provisions for safety of personnel during installation, operation, maintenance and repair shall be in accordance with MIL-STD-454, Requirement 1.

4.2.28 Test provisions. Test provisions to provide means for monitoring performance, calibration and fault isolation shall be in accordance with MIL-STD-415.

4.2.28.1 Built-in test devices. Built-in test devices shall maintain their accuracy under all operating conditions required by the equipment under test. These devices shall be provided with connections or access for their operational checkout or calibration.

4.2.28.2 External test points. Protection shall be provided in the test point circuitry to prevent equipment damage caused by the external grounding of test points.

4.2.28.3 Failure effect. Unless otherwise specified, provisions for testing shall be so designed that any failure of built-in test devices will not degrade equipment operation or cause equipment shutdown.

4.2.29 Testability program. Requirements for the development and implementation of a testability program (program planning, design, prediction, demonstration, data, and review) shall be tailored for applicability to the

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equipment and program phase in accordance with MIL-STD-2165, and specified directly in the contract or detail equipment specification.

4.2.30 Thermal design. Requirements and guidance for thermal design shall be in accordance with MIL-STD-454, Requirement 52.

4.2.30.1 Cooling design data. Cooling design data shall be developed as soon as possible after major circuit parameters have been established. Initially, this data shall include calculations, drawings and other information related to the choice of a particular cooling system configuration. As part of this initial data, the first set of applicable thermal design evaluation data shall be developed, based on preliminary calculations at the specified operating conditions. The approval of the cooling system will be based upon consideration of this information. Applicable part temperatures from these calculations should be utilized in the reliability prediction analyses. As equipment development proceeds, this data should become more final and should be based on more actual thermal test results. Upon completion of the engineering development or preproduction models, and when required by the contract, a thermal evaluation test program shall be conducted.

4.2.31 Tools.

4.2.31.1 Setscrew wrenches. One wrench for each size and type setscrew head employed for operational adjustments shall be securely mounted within the equipment in a readily accessible location. Each wrench shall be processed to resist corrosion.

4.2.31.2 Special tools. Special tools include jigs, fixtures, stands, and templates not listed in the Federal Supply Catalog, and require approval of the acquiring activity for use. The design of equipment should be such that the need for special tools for tuning, adjustment, maintenance, replacement, and installation is kept to a minimum. Only when the required function cannot be provided by an existing standard tool should special tools be considered. Necessary tools should be identified as early as possible.

4.2.31.3 Furnishing and stowing. Special tools needed for operation and organization level maintenance shall be furnished by the contractor except that the contractor shall not mount tools in the equipment or make space provisions therefore, unless required by the detail equipment specification or contract.

4.2.32 Standardized power supplies. As an integral part of the SHARP program (see 4.1.2), the selection of standardized power supplies for airborne applications shall be as specified in MIL-STD-2038. Power supplies conforming to MIL-P-29590 shall be of primary consideration for airborne applications.

4.2.33 Workmanship. Workmanship for mechanical assembly shall be in accordance with MIL-STD-454, Requirement 9. Workmanship for electrical/electronic assembly shall be in accordance with MIL-STD-2000.

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4.3 Parts selection.

4.3.1 Government-furnished baseline (GFB). When specified by contract or system specification, the applicable GFB shall be the primary selection source for standard parts when MIL-STD-965 is specified for parts control procedures (see 4.3.3). The applicable GFB parts meet the special part selection standard requirements referenced herein (e.g., 4.3.24 for MIL-STD-199 resistors). Table II provides identification of parts which are included in the applicable GFB. GFB parts, when specified by contract requirement, hold prior approval status. All parts listed in the applicable GFB are considered standard parts and shall be used whenever suitable.

TABLE II. Parts selection.

Subject	MIL-STD-454 Rgt. No. or MIL-STD-5400 Para. No.
Batteries*	Requirement 27
Bearings*	Requirement 6
Capacitors*	Para. 4.3.8
Circuit breakers*	Para. 4.3.9
Connectors, electrical*	Para. 4.3.10/Requirement 10
Controls (knobs, dials)*	Para. 4.3.11
Crystal units (quartz)*	Para. 4.3.12
Fasteners	Requirement 12
Filters, electrical*	Para. 4.3.14
Fuses and fuseholders	Para. 4.3.15
Gears	Para. 4.3.16
Hydraulics	Para. 4.3.17
Indicator lights, lamps, lampholders, LEDs*	Para. 4.3.18
Meters, electrical indicating	Para. 4.3.19
Microelectronic devices*	Para. 4.3.20/Requirement 64
Motors and shunts	Para. 4.3.21
Readouts and displays	Para. 4.3.22
Relays*	Para. 4.3.23
Resistors*	Para. 4.3.24
Semiconductors*	Para. 4.3.25/Requirement 30
Servodevices, rotary	Requirement 56
Sockets and accessories	Para. 4.3.27
Springs	Requirement 41
Standard electronic modules (SEMs)	Para. 4.3.29
Switches*	Para. 4.3.30
Terminations*	Para. 4.3.31
Transformers, inductors and coils*	Para. 4.3.32
Tubes, electron	Para. 4.3.33
Waveguides	Requirement 53
Wire and cable*	Para. 4.3.35
Internal, hook-up	Para. 4.3.35.1
Wiring practices, internal	Para. 4.3.35.2
External, interconnection	Para. 4.3.35.3
Coaxial	Para. 4.3.35.4
Printed wiring	Para. 4.3.35.5

* Indicates subject parts covered by a Government Furnished Baseline (GFB).

4.3.1.1 Choice of parts. Whenever the applicable selection standard, GFB or specification provides multiple characters or tolerances on items, the equipment manufacturers shall consider the use of the broadest characteristics and greatest allowable tolerances to fulfill the overall requirement. The manufacturer shall also consider limiting the variety of part types and review the system Program Parts Selection List (PPSL) for candidates prior to reaching a part decision. All new equipment shall be designed to accommodate the maximum envelope dimensions specified in the military part specification.

4.3.2 Nonstandard parts. When the applicable GFB fails to provide an applicable part or Appendix A does not provide an applicable part standard or specification, the contractor shall select a part from other established specifications or standards in accordance with MIL-STD-970. Nonstandard parts must be equivalent to or better than similar standard parts and must be compliant with applicable contract requirements. Each vendor source for nonstandard parts documented by a source control drawing requires approval of the acquisition activity.

4.3.3 Parts control program. Requirements for the implementation of a contractor parts control program in accordance with MIL-STD-965, including parts approval by the acquisition activity, shall be directly specified in the detail equipment specification or contract. Refer to MIL-STD-454, Requirement 22 and MIL-HDBK-402 for guidance in this area.

NOTE: MIL-STD-965 is a "Parts Control Program" and requires the approval and listing of all parts in a PPSL unless the requirements have been otherwise tailored.

4.3.4 Approval of parts. In considering the approval of parts, contracts for electronic equipment are divided into the following categories:

Category I: Contracts which are fundamentally for the purpose of investigation or study and not for the fabrication of equipment.

Category II: Contracts for one or more models of equipment designed to meet the performance requirements of a specification or to establish technical requirements for production equipment. This category includes contracts for models to be used for test under service conditions for the evaluation of their suitability and performance.

Category III: Contracts for production equipment. These contracts will usually include requirements for a prototype or first article model.

4.3.4.1 Contracts under category I. Approval of parts shall not be required under contracts or orders which fall under Category I. General parts information is available upon request to the Military Parts Control Advisory Groups (MPCAGs).

4.3.4.2 Contracts for equipment which fall under categories II and III. For a single contract covering like equipments which fall in both Categories II and III, parts approval shall be required only for those items used in Category II equipments, and any new item sources or new nonstandard items used in Category III equipment. As specified by contract, approval of all parts used in the equipment shall be obtained by the contractor prior to delivery of any equipment required by the contract.

4.3.4.3 Reordered production equipment. A design review directed toward replacement of nonstandard parts with standard parts shall be performed on contracts for reordered equipment, whether reordered from the original contractor or from a different contractor. Where applicable, the PPSL listing shall be utilized for the review function by the MPCAGs under MIL-STD-965. Changes must conform to interchangeability requirements. The original part procured from the same source, when required by interchangeability or lack of a standard replacement part, may be used without reapproval.

4.3.4.3.1 Continuation of production. In those cases wherein the reordered production equipment represents continuous production by the same contractor, a review directed toward nonstandard parts replacement with standard parts shall not be required.

4.3.4.4 Replacing of approved parts. Whenever permission is sought by the contractor to use an item that is not the part approved for use in the system/equipment, the procedure used shall be a "Request for Deviation" in accordance with the applicable configuration management requirements of the contract. The standard/approved item shall be listed in technical manuals, parts lists, etc.

4.3.4.5 Equipment performance. The requirements of this standard with regard to the use of parts, either standard or approved nonstandard, shall not relieve the contractor of the responsibility for complying with all equipment performance and other requirements set forth in the detail equipment specification or contract. Approvals for nonstandard parts are contingent on subsequent satisfactory performance during required equipment tests.

4.3.5 Substitution of parts. The selection and application of substitute parts shall be in accordance with MIL-STD-454, Requirement 72.

4.3.6 Batteries. The use of batteries requires approval of the acquisition activity. Batteries shall be selected and applied in accordance with MIL-STD-454, Requirement 27.

4.3.7 Bearings. Bearings shall be selected and applied in accordance with MIL-STD-454, Requirement 6.

4.3.8 Capacitors. Capacitors shall be selected and applied in accordance with MIL-STD-198.

4.3.8.1 Fixed, tantalum electrolytic. For Naval Air Systems Command, the use of wet slug tantalum capacitors (except tantalum-cased units in accordance with MIL-C-39006/22 and MIL-C-39006/25) requires the approval of the acquisition activity, and silver-cased tantalum capacitors shall not be used.

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4.3.8.2 Aluminum electrolytic. Aluminum electrolytic capacitors shall not be used in airborne electronic equipment applications.

4.3.9 Circuit breakers. Circuit breakers shall be selected and applied in accordance with MIL-STD-1498. Trip-free circuit breakers shall be used. Nontrip-free circuit breakers shall be used only when the application requires overriding of the tripping mechanism for emergency use.

4.3.9.1 Manual operation. Circuit breakers shall be capable of being manually operated to the ON and OFF positions. Circuit breakers shall not be used as ON-OFF switches unless such breakers have been specifically designed and tested for that type of service.

4.3.9.2 Position identification. Circuit breakers shall have easily identified ON, OFF and TRIPPED positions except that the TRIPPED position may be the same as the OFF position with no differentiation between OFF and TRIPPED being required.

4.3.9.3 Orientation. Circuit breakers shall operate when permanently inclined in any direction up to 30 degrees from the normal vertical or normal horizontal position. The trip point of an inclined unit shall not vary more than ± 5 percent of the current specified for normal position mounting. Circuit breakers used on flight equipment shall operate within the limits of the detail equipment specification when the equipment is in any position or rotation about its three principal axes.

4.3.10 Connectors, electrical. Electrical connectors shall be selected and applied in accordance with MIL-STD-1353. Additional selection and application requirements are specified in MIL-STD-454, Requirement 10.

4.3.10.1 Mounting of electrical receptacles. Where practical, when receptacles are mounted on a vertical surface the largest polarizing or prime key or keyway of the receptacle shall be at the top center of the shell of the receptacle. Mounting connectors on a top horizontal surface should be avoided, in order to prevent pooling of moisture in the connector.

4.3.10.2 Adjacent locations. The use of identical connectors in adjacent locations shall be avoided. When the use of connectors of the same shell size in adjacent locations cannot be avoided, differences in keying arrangement shall be used to prevent mismating.

4.3.10.3 Jacks. Microphone jacks shall be type M641/5-1 and headset jacks shall be type M641/6-1 conforming to MIL-J-641. Use of these jacks for other than microphone and headset use is prohibited in areas accessible to flight personnel.

4.3.11 Controls (knobs, handles, dials). Control knobs shall be selected and applied in accordance with MIL-K-25049. Handles shall be selected and applied in accordance with MIL-H-8810. Multiturn counter control dials shall be selected and applied in accordance with MIL-D-28728. Additional application requirements are specified in MIL-STD-454, Requirement 28.

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4.3.12 Crystals (quartz and oscillator). Quartz crystal units shall be selected and applied in accordance with MIL-STD-683. Crystal oscillator units shall be in accordance with MIL-O-55310.

4.3.13 Fastener hardware. Fastener hardware shall be in accordance with the applicable fastener specification specified in MIL-STD-454, Requirement 12. Additional guidance information on mounting methods and techniques is provided in MIL-STD-454, Requirement 12.

4.3.14 Filters, electrical. Electrical filters shall be selected and applied in accordance with MIL-STD-1395.

4.3.15 Fuses, fuseholders and associated hardware. Fuses, fuseholders and associated hardware shall be selected and applied in accordance with MIL-STD-1360. Additional guidance information is provided in MIL-STD-454, Requirement 39.

4.3.16 Gears. Gears shall be designated, dimensioned, toleranced and inspected in accordance with applicable specifications of the American Gear Manufacturers Association (AGMA). Gears not operating in a lubricant bath shall be made of a corrosion resistant material. Gears operating in a lubricant bath containing a corrosive inhibiting additive may be made of non-corrosive resistant material. Planetary gearing is preferred to worm gearing. Non-metallic gears may be used when they meet the load, life and environmental requirements of the applicable specification.

4.3.17 Hydraulics. Hydraulic systems which function as an integral part of an electronic system shall be as follows:

4.3.17.1 Aircraft. The design and installation of hydraulic systems for aircraft shall be in accordance with the applicable type, class or system of MIL-H-5440.

4.3.17.2 Missiles. The design and installation of hydraulic systems for missiles shall be in accordance with the applicable type, class or system of MIL-H-25475.

4.3.17.3 Additional guidance information and document references are provided in MIL-STD-454, Requirement 49.

4.3.18 Lights and associated items.

4.3.18.1 Indicator lights. Indicator lights, light housings, lamp-holders and lenses shall be selected and applied in accordance with MIL-L-3661.

4.3.18.2 Press to test indicator lights. Press to test indicator lights shall be selected and applied in accordance with MIL-L-7961.

4.3.18.3 Instrument lights. Instrument lighting shall be integral red in accordance with MIL-I-25467, or integral white in accordance with MIL-L-27160, as required. The use of non-integral lighting requires approval of the acquisition activity, and when approved shall be in accordance with MIL-L-5057.

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4.3.18.4 Lamps. Incandescent lamps shall be selected and applied in accordance with MIL-L-6363. When used as indicator lights, light emitting diodes (LEDs) shall be selected and applied in accordance with MIL-S-19500.

4.3.18.5 Visual display and legend lights. Visual display and legend lights shall comply with the requirements in MIL-STD-1472.

4.3.18.6 Night vision compatibility. When compatibility of equipment is required for night vision imaging, the requirements of MIL-L-85762 shall apply.

4.3.19 Meters. Panel type electrical indicating meters shall be selected and applied in accordance with MIL-M-10304 (color schemes W, B, Y, F and P). Time totalizing meters shall be selected and applied in accordance with MIL-M-7793. When required, external meter shunts shall conform to MIL-S-61 or MIL-I-1361.

4.3.20 Microelectronic devices. Microelectronic devices, including hybrids, shall be selected and applied in accordance with MIL-STD-454, Requirement 64. Devices selected shall be connected by means of soldering, welding, or the use of shape memory metal alloy connectors.

4.3.21 Motors.

4.3.21.1 Motors, alternating current. Alternating current motors (400 Hz, 115/200 volt) shall be in accordance with MIL-M-7969, except that motors used with a miniature blower for cooling electronic equipment shall be in accordance with MIL-B-23071.

4.3.21.2 Motors, direct current. Direct current motors (28 volt) shall be in accordance with MIL-M-8609.

4.3.22 Readouts and displays.

4.3.22.1 Readouts. Readouts shall be selected and applied in accordance with MIL-R-28803.

4.3.22.2 Displays. Light emitting diode (LED) displays shall be selected and applied in accordance with MIL-D-87157, quality level A or B. Liquid crystal displays (LCDs) exhibit limited operation of temperature extremes, and require acquisition activity approval for use in airborne electronic equipment.

4.3.23 Relays. Relays shall be selected and applied in accordance with MIL-STD-1346. Hermetically sealed types only shall be used. Reed relays shall be in accordance with MIL-R-83516, and require acquisition activity approval for use in airborne electronic equipment.

4.3.24 Resistors. Resistors shall be selected and applied in accordance with MIL-STD-199. Thermistors shall be in accordance with MIL-T-23648.

4.3.25 Semiconductor devices. Semiconductor devices shall be selected and applied in accordance with MIL-STD-701, subject to the order of precedence and restrictions specified in MIL-STD-454, Requirement 30.

4.3.26 Servodevices, rotary. Rotary servodevices shall be selected and applied in accordance with MIL-STD-454, Requirement 56.

4.3.27 Sockets, shields and mounting pads.

4.3.27.1 Sockets. Sockets for plug-in electronic parts shall be of the single unit type and shall conform to MIL-S-12883, MIL-S-83502 or MIL-S-83734. The use of sockets for microcircuits requires approval of the acquisition activity.

4.3.27.2 Shields. Heat dissipating tube shields shall conform to MIL-S-24251.

4.3.27.3 Mounting pads. Where mounting pads are required for use with small electrical or electronic devices, they shall conform to MIL-M-38527.

4.3.28 Springs. Springs and spring material shall be selected and applied in accordance with MIL-STD-454, Requirement 41.

4.3.29 Standard electronic modules (SEMs). As an integral part of the SHARP program (see 4.1.2), standard electronic modules (SEMs) conforming to MIL-M-28787 shall be utilized to the maximum extent possible. Requirements for the design of SEMs shall be in accordance with MIL-STD-1389. Requirements for the application of SEMs shall be in accordance with MIL-STD-1378. Guidance information for the SEMs program is contained in MIL-HDBK-246.

4.3.30 Switches. Switches and associated hardware shall be selected and applied in accordance with MIL-STD-1132. Toggle switches shall be selected and applied in accordance with MIL-S-83731.

4.3.30.1 Mounting.

4.3.30.1.1 Rotary switches. Rotary switches with thru-panel shafts shall be mounted to the panel by means of a single threaded bushing concentric with the shaft. A positive mechanical means, in addition to lock washers, shall be provided to prevent rotation of the switch body.

4.3.30.1.2 Toggle switches. The mounting of toggle switches shall be such that the handle of the switch operates in a vertical direction. The "off" position shall be in the center position on three-position switches and in the bottom position on two-position switches. When clarification of a control function or convenience of operation would result (for example, a "left-right" function control), toggle switches may be so mounted that the handle of the switch operates in a horizontal direction.

4.3.31 Terminations. The selection of stud terminals, lug terminals, feed-thru terminals, binding posts, terminal boards, terminal junction systems and splices shall be in accordance with MIL-STD-1277.

4.3.31.1 Number of wires per terminal or lug. The number of wires terminated in an individual terminal or lug shall not be greater than three. Multisection turret, bifurcated, or multi-hole lug terminals shall have not more than three wires per section, tongue, or hole. In no case shall the total cross sectional area of the terminated wires exceed the cross sectional area

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capacity of the terminal or lug. If a greater number of wires is required than those specified herein, approval of the acquisition activity shall be obtained.

4.3.31.2 Number of lugs per terminal. The maximum number of lugs to be connected to any one terminal on a terminal board shall be two for screw-type terminal boards covered by MIL-T-55164 and as specified in the detail specification sheets for stud-type terminal boards. Not more than four lugs shall be connected to any one terminal of a board covered by MS27212. Accessories such as stud connectors, straddle plates, jumpers and terminal board lugs shall be counted as lugs for this purpose.

4.3.32 Transformers, inductors and coils. The selection and application of transformers, inductors and coils shall be in accordance with MIL-STD-1286. Variable transformers shall conform to MIL-T-83721, and intermediate radio frequency and discriminator transformers shall conform to MIL-T-55631, Grade 1, 2 or 4. Grade 3 transformers shall be limited to hermetically sealed or encapsulated assemblies.

4.3.33 Tubes, electron. Electron tubes shall be selected and applied in accordance with MIL-STD-200.

4.3.34 Waveguides and related items. Waveguides and related items shall be selected and applied in accordance with MIL-STD-454, Requirement 53.

4.3.35 Wire and cable. Wire and cable having polyvinyl chloride (PVC) or FEP/polyimide (Kapton) insulating material shall not be used in airborne electronic equipment applications.

4.3.35.1 Wire and cable, internal. Internal hookup wires conforming to MIL-W-22759 and MIL-W-81044 are preferred for use within the equipment. Other wire types are subject to the above restrictions and those of MIL-STD-454, Requirement 20. Multiconductor cables conforming to MIL-C-7078 and MIL-C-27500 and utilizing the above specified wire types are preferred for use within the equipment. Other cable types are subject to the above restrictions and those of MIL-STD-454, Requirement 66.

4.3.35.2 Wiring practices, internal. Internal wiring practices and wiring devices shall conform to MIL-STD-454, Requirement 69.

4.3.35.3 Wire and cable, external interconnection. Wires conforming to MIL-W-22759 and MIL-W-81044 and cables conforming to MIL-C-7078 and MIL-C-27500 which utilize the above specified wire types are preferred per use for external interconnections between units. Other wire and cable types are subject to the above restrictions and those of MIL-STD-454, Requirement 71 and MIL-W-5088, as applicable.

4.3.35.4 Cable, coaxial (RF). Coaxial cables (RF) shall be in accordance with MIL-C-17, MIL-L-3890, MIL-C-22931, or MIL-C-23806.

4.3.35.5 Printed wiring. Printed wiring boards, assemblies, cards and associated hardware shall be in accordance with MIL-STD-1861. Printed wiring boards shall be connected into the equipment by means of connectors. Printed wiring boards utilizing the conductor pattern as the direct contact with the mating connector shall not be used.

4.4 Material selection.

4.4.1 Choice of materials. Table III provides a list of material applicable for use in the design and construction of airborne electronic equipment. Also included in the table is reference to corresponding MIL-STD-454 requirements, where applicable, and paragraphs herein which supplement or restrict the specific requirement. Whenever an applicable material specification provides more than one characteristic or tolerance, the equipment manufacturer shall use, in the equipment, material of broadest characteristics and of the greatest allowable tolerances that will fulfill the performance requirements of the equipment. When acceptable materials of higher than minimum quality are readily available, the utilization of which would not increase the initial or life cycle cost to the acquisition activity, they may be used.

TABLE III. Materials selection.

Subject	MIL-STD-454 Rqt. No. or MIL-STD-5400 Para. No.
Adhesives	Requirement 23/4.4.5
Arc resistive materials	Requirement 26
Conformal coating	Para. 4.4.7
Dissimilar metals	Para. 4.4.8
Encapsulation and embedment materials	Para. 4.4.9
Fibrous materials	Requirement 44
Flammability of materials	Para. 4.4.11
Fungus resistant materials	Requirement 4
Insulating materials, electrical	Requirement 11
Lubricants	Para. 4.4.14/Requirement 43
Metals, corrosion resistant	Para. 4.4.15

4.4.2 Polyvinyl chloride (PVC) materials. Polyvinyl chloride (PVC) materials shall not be used in airborne electronic equipment applications.

4.4.3 Standard materials. Materials covered by documents listed in Appendix A are considered standard and shall be used whenever they are suitable for the purpose. Materials shall be acquired from QPL or QML sources when qualification is a requirement of the material specification.

4.4.4 Nonstandard materials. When Appendix A fails to provide an applicable material specification or standard, the contractor shall select a material from other established specifications or standards in accordance with the order of preference set forth in MIL-STD-970. Nonstandard materials must be equivalent to or better than similar standard materials. Each vendor source for a nonstandard material covered by a source control document requires approval of the acquisition activity. The request for approval of nonstandard material should be made at the time that the material is selected for use in the equipment design. The Government retains the right to request changes to the material, if the performance, description, test data or inspection of the material indicates that the material will not perform its intended function.

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4.4.4.1 Approval of nonstandard materials. Requirements for the acquisition activity approval of nonstandard materials shall be specified in the detail equipment specification or contract.

4.4.5 Adhesives. Adhesives shall be selected and applied in accordance with MIL-STD-454, Requirement 23. The use of adhesives in electrical applications requires the approval of the acquisition activity.

4.4.6 Arc-resistant materials. Arc-resistant materials shall be selected and applied in accordance with MIL-STD-454, Requirement 26.

4.4.7 Conformal coating. Conformal coating for use with rigid printed circuit assemblies shall conform to MIL-I-46058.

4.4.8 Dissimilar metals. Selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-889. The use of dissimilar metals shall be limited to applications where similar metals cannot be used due to peculiar design requirements.

4.4.9 Encapsulation and embedment materials. Encapsulation and embedment materials shall be of a nonreversion type and shall be selected from the following specifications: MIL-S-8516, MIL-I-16923, MIL-S-23586, MIL-M-24041, and MIL-I-81550. The materials selected shall be capable of filling all voids and air spaces in and around the items being encased. Refer to MIL-STD-454, Requirement 47 for additional guidance information.

4.4.10 Fibrous material, organic. Organic fibrous material shall be selected and applied in accordance with MIL-STD-454, Requirement 44.

4.4.11 Flammability of materials. Materials used in military equipment shall, in the end item configuration, be noncombustible or fire retardant in the most hazardous conditions of atmosphere, pressure, and temperature to be expected in the application. Fire retardant additives may be used provided they do not adversely affect the specified performance requirements of the basic materials. Fire retardance shall not be achieved by use of nonpermanent additives to the basic material. Refer to MIL-STD-454, Requirement 3 for additional guidance information on the testing of material to determine its flammability characteristics.

4.4.12 Fungus-inert materials. The selection and application of fungus-inert and fungicide treated materials shall be in accordance with MIL-STD-454, Requirement 4.

4.4.13 Insulators, insulating and dielectric materials. The selection and application of insulators, insulating and dielectric materials shall be in accordance with MIL-STD-454, Requirement 11,

4.4.14 Lubricants. The selection and application of lubricants for airborne electronic equipment shall be in accordance with MIL-STD-838. Standard lubricants shall be limited to those specified in MIL-STD-454, Requirement 43. Refer to MIL-HDBK-275 for guidance relative to application and limitations of specific lubricants.

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4.4.15 Metals, corrosion resistant. Metals shall be corrosion resistant or shall be coated or metallurgically processed to resist corrosion. Materials and processes for metallic parts shall conform to applicable requirements of MIL-STD-889 and MIL-STD-1516. Coatings shall be selected from MIL-STD-1516.

4.5 Processes and finishes. Processes and finishes, except painting, shall be in accordance with Table IV and, where applicable, the referenced MIL-STD-454 requirement or supplemental paragraph herein. Welding and brazing shall be accomplished by certified operators in accordance with the requirements of MIL-STD-248 or MIL-STD-1595, as applicable.

4.5.1 Protective platings and coating. A protective plating or coating shall be applied to all metals which are not corrosion-resistant, except as follows:

4.5.1.1 Materials. Gold, nickel, chromium, rhodium, tin, lead-tin alloys, or sufficiently thick platings of these metals, are satisfactory without additional protection or treatment other than buffing or cleaning.

4.5.1.2 Aluminum alloy.

4.5.1.2.1 Surface, general. Parts fabricated from aluminum 1100, alloys 3003, 5052, 6053, 6061, 6063 or 7072 shall be cleaned with a deoxidizing solution, other than an uninhibited caustic dip, and may be used with or without other surface treatment. Other aluminum alloys shall be anodized in accordance with MIL-A-8625 or be given a chemical treatment in accordance with MIL-C-5541.

4.5.1.2.2 Surfaces, bonded and grounded. Where bonding or grounding is necessary, aluminum 1100, alloys 3003, 5052, 6053, 6061, 6063, 7072, or equally corrosion-resistant alloys, shall be used. They may be used without other surface treatment.

4.5.1.2.3 Surfaces, extreme wear resistant. Where bonding or grounding is not necessary, hard anodic finish conforming to number E514 of MIL-F-14072 may be applied to obtain extreme wear-resistant surfaces under Type II (MIL-F-14072) exposure on desired areas of aluminum alloys not subject to repeated high tensile stresses.

4.5.2 Magnesium and magnesium alloys. Magnesium and magnesium alloys shall not be used except when approved or specified by the acquisition activity. The request for use of magnesium and its alloys should include the total environment exposure, the weight reduction and other advantages achieved, the proposed surface treatment and the application details.

4.5.3 Zinc and zinc-plated parts. Zinc and zinc-plated parts shall be given a dichromate treatment in accordance with ASTM B633.

4.5.4 Finishes. Unless contained in a hermetically sealed unit, part finishes (including hardware items of equipment not covered by subsidiary specifications) shall be resistant to corrosion. Finishes shall be capable of withstanding a 48-hour Salt Spray (Fog) test in accordance with MIL-STD-810,

TABLE IV. Processes and finishes.

Subject	Applicable Process Document
Anodizing/chemical film	Anodize per MIL-A-8625 or chemical film per MIL-C-5541
Brazing	MIL-B-7883
Cadmium plating ^{1/}	QQ-P-416
Chromium plating	QQ-C-320
Coatings and surface treatments	MIL-S-5002
Finishes	(See para. 4.5.4)
Gold plating	MIL-G-45204, Type II or III depending upon application
Nickel plating	Electrodeposited per QQ-N-290; electroless per MIL-C-26074
Soldering, component mounting, etc. - electrical/electronic assembly	MIL-STD-2000 (Refer to MIL-HDBK-2000 for guidance information)
Soldering, fabricated assemblies, non-electrical	DOD-STD-1866
Tin plating	MIL-T-10727
Welds, electrical connections	MIL-W-8939 (Refer to Requirement 24 for guidance information)
Welds, structural (arc and gas)	Aluminum alloys MIL-STD-2219 Magnesium alloys MIL-STD-2219 Steel alloys MIL-STD-2219
Welds, structural (resistance)	MIL-W-6858 (Refer to Requirement 13 for guidance information)
Zinc coating	Electrodeposited per ASTM B633

^{1/} Except where equipment may be exposed to temperatures above 205°C (400°F) or where it may come in contact with petroleum-based products.

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Method 509, Procedure I, without showing signs of corrosion beyond those established for the particular part, material or finish specification. Where applicable, these parts shall have finishes providing suitable rates of heat lubricated condition. Lusterless finishes shall be used on all surfaces visible to operating personnel. Where cleaning operations on metal parts are not specified in detail, they shall be in accordance with MIL-S-5002. It is not the intent that parts acquired to the specifications listed in Appendix A must be refinished.

4.5.4.1 Cases and front panels. Equipment installed in the cockpit area shall be Lusterless Black, Color No. 37038, in accordance with FED-STD-595. Unless otherwise specified, finish of all other equipment shall be Lusterless Gray, Color No. 36231, in accordance with FED-STD-595.

4.5.4.2 Fasteners and assembly screws. Exposed surfaces of external fasteners and assembly screws used in areas other than the cockpit which are manipulated, loosened, or removed in the normal processes of servicing and installing the equipment shall be finished, preferably in a noncorrosive black or bright finish, so as to provide strong contrast with the color of the surface upon which they appear. Exposed surfaces of external fasteners and assembly screws used in the aircraft cockpit shall be finished in accordance with 4.5.4.1. Other external fasteners and assembly screws used for securing the internal parts to the chassis shall be similar in color to the surface upon which they appear.

4.5.4.3 Other standard finishes. Type I finishes in accordance with MIL-F-14072 are approved as alternates to any differing requirements specified under the paragraphs on finishes, except that colors specified shall be used.

4.6 Environmental service requirements.

4.6.1 MIL-STD-810 environmental tests. The contractual use of MIL-STD-810 for environmental testing requires the development of environmental management and test plans and engineering tasks to adequately tailor the specific test procedures, test conditions, variations, and limits for the life cycle environmental conditions which the equipment will realistically encounter. MIL-STD-810 provides details of these data requirements and reports and identifies the Data Item Descriptions (DIDs) which must be specified in the contract. Each specific test method required must be assessed for its applicability to the equipment deployment. The test method must be tailored for the selection of appropriate test procedure, test duration, variations, limits, tolerances, etc., and invoked directly in the detail equipment specification or contract. The services of an environmental specialist may be required to effectively tailor and apply MIL-STD-810 into the detail equipment specification or contract.

4.6.1.1 The following list of MIL-STD-810 tests and test method numbers is provided for reference only. Specific methods, test procedures and variations, and limits must be selected and stated directly in the detail equipment specification or contract for the proper performance of these tests.

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<u>Test</u>	<u>Method No.</u>
Low Temperature	502
High Temperature	501
Altitude	500
Temperature Shock	503
Shock	516
Vibration	514
Fungus	508
Salt Fog	509
Humidity	507
Bench Handling	516
Sand and Dust	510
Explosive Atmosphere	511

4.6.2 Equipment operational requirements. The equipment shall be so designed and constructed that no fixed part or assembly shall become loose, no moving or movable part or control be shifted in setting, position, or adjustment, and no degradation be caused in the performance beyond that specified in the detail equipment specification during operation or after storage in ambient conditions, as follows:

4.6.2.1 Temperature. The equipment shall be exposed to the temperature conditions for the applicable class shown in table V. The ambient temperature within the specified temperature ranges may remain constant for long periods and may vary at a rate as high as 1 degree per second.

4.6.2.1.1 Operating. The equipment shall operate under the conditions for the applicable class and within the ranges listed in columns I, II, III and VII of table V.

4.6.2.1.2 Nonoperating. The equipment in a nonoperating condition shall withstand long periods of exposure to the temperature extremes and shock as listed in table V.

4.6.2.2 Altitude. The equipment shall meet the altitude conditions, for the applicable class, listed in column VIII of table V, both for continuous operation and exposure in a nonoperating condition. The altitude may remain constant for long periods and vary at a rate as high as 0.5 inch of mercury per second.

4.6.2.3 Temperature-altitude combination. The equipment shall operate under the applicable temperature-altitude combinations shown on figures 1 through 4, as applicable.

4.6.2.4 Humidity. The equipment shall withstand the effects of humidities up to 100 percent, including conditions wherein condensation takes place in and on the equipment. The equipment shall withstand the above conditions during operating and nonoperating conditions. Fogging on the inside of the cover glass of instruments shall not occur.

TABLE V. Environmental conditions.

Equipment operating								Equipment operating and nonoperating	Equipment nonoperating	
Temperature extremes for the chamber (without external cooling provisions)				Combined temperature-altitude			Temperature shock	Altitude	Temperature extremes	Temperature shock
Equipment class	Column I continuous	Column II intermittent	Column III short-time	Column IV	Column V	Column VI	Column VII	Column VIII	Column IX	Column X
Class 1	-54°C +55°C	30 min. +71°C	---	Defined by curve A, figure 1	Defined by curve B, figure 1	---	-54°C to +71°C	Sea level (30.0 in. Hg.) (3.4 in. Hg.) 50,000 ft.	-57°C to +85°C	-57°C to +85°C
Class 1A	-54°C +55°C	30 min. +71°C	---	Defined by curve A, figure 1	Defined by curve B, figure 1	---	-54°C to +71°C	Sea level (30.0 in. Hg.) (8.89 in. Hg.) 30,000 ft.	-57°C to +85°C	-57°C to +85°C
Class 1B	-40°C +55°C	30 min. +71°C	---	Defined by curve A, figure 1	Defined by curve B, figure 1	---	-40°C to +71°C	Sea level (30.0 in. Hg.) (16.89 in. Hg.) 15,000 ft. 1/	-57°C to +85°C	-57°C to +85°C
Class 2	-54°C +71°C	30 min. +95°C	---	Defined by curve A, figure 2	Defined by curve B, figure 2	---	-54°C to +95°C	Sea level (30.0 in. Hg.) (1.32 in. Hg.) 70,000 ft.	-57°C to +95°C	-57°C to +95°C
Class 3	-54°C +95°C	30 min. +125°C	10 min. +150°C	Defined by curve A, figure 3	Defined by curve B, figure 3	Defined by curve C, figure 3	-54°C to +125°C	Sea level (30.0 in. Hg.) (0.32 in. Hg.) 100,000 ft.	-57°C to +125°C	-57°C to +125°C
Class 4	-54°C +125°C	30 min. +150°C	10 min. +260°C	Defined by curve A, figure 4	Defined by curve B, figure 4	Defined by curve C, figure 4	-54°C to +150°C	Sea level (30.0 in. Hg.) (0.32 in. Hg.) 100,000 ft.	-57°C to +150°C	-57°C to +150°C
Class 5	-54°C +95°C	30 min. +125°C	---	Same as Class 3 2/	---	---	-54°C to +125°C	Sea level (30.0 in. Hg.) (10-10 in. Hg.) 2,000,000 ft.	-57°C to +125°C	-57°C to +125°C

1/ Altitude range shown is for operation only.

Classes 1A and 1B equipment shall withstand a nonoperating altitude of 40,000 feet (5.5 in. Hg.).

2/ For altitude above 100,000 ft., the equipment's surrounding environment shall not exceed 71°C and means shall be available for rejection of heat into the surroundings by conduction, radiation or some other means.

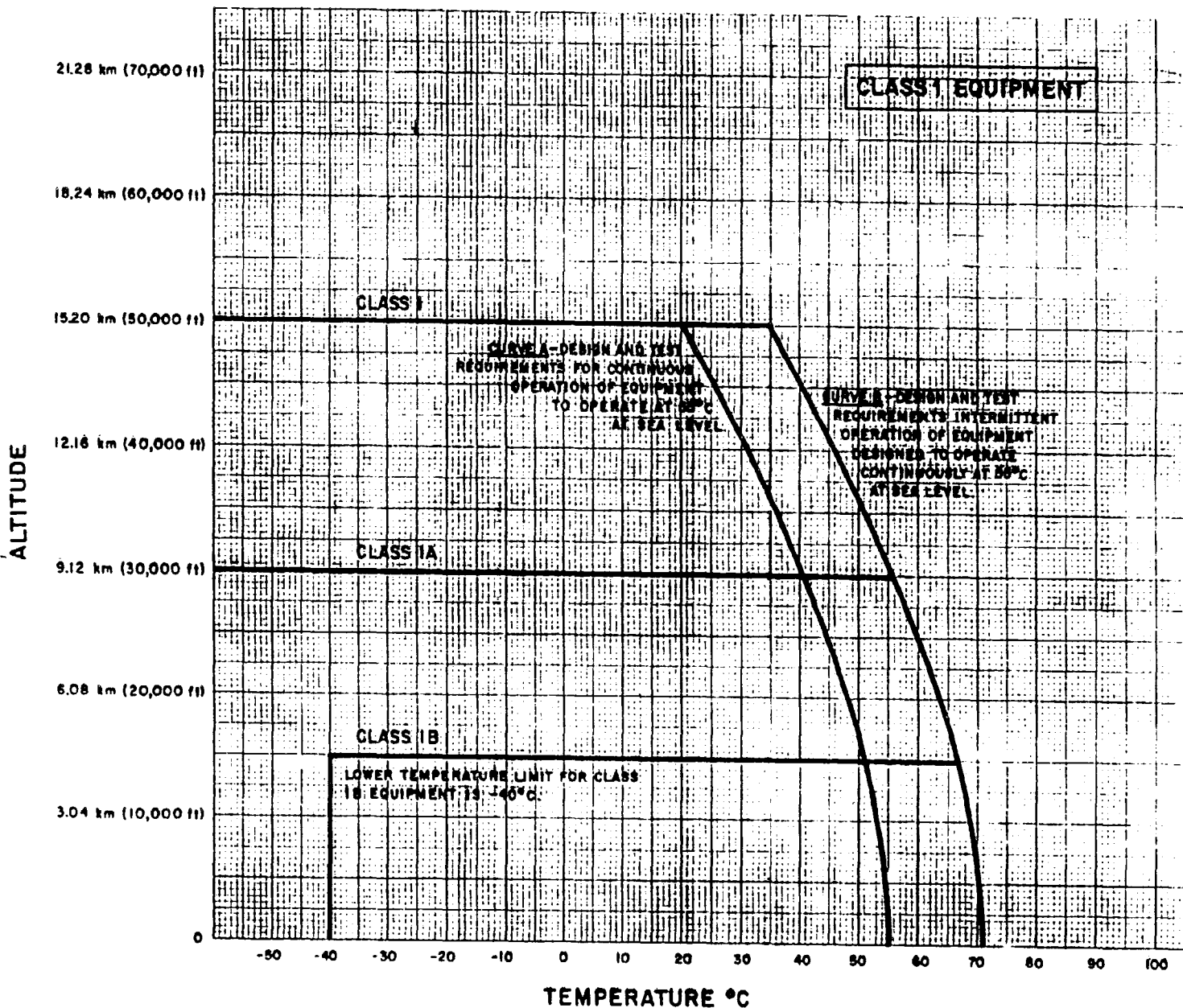


FIGURE 1. Operational requirements for class I airborne electronic equipment (temperature vs altitude).

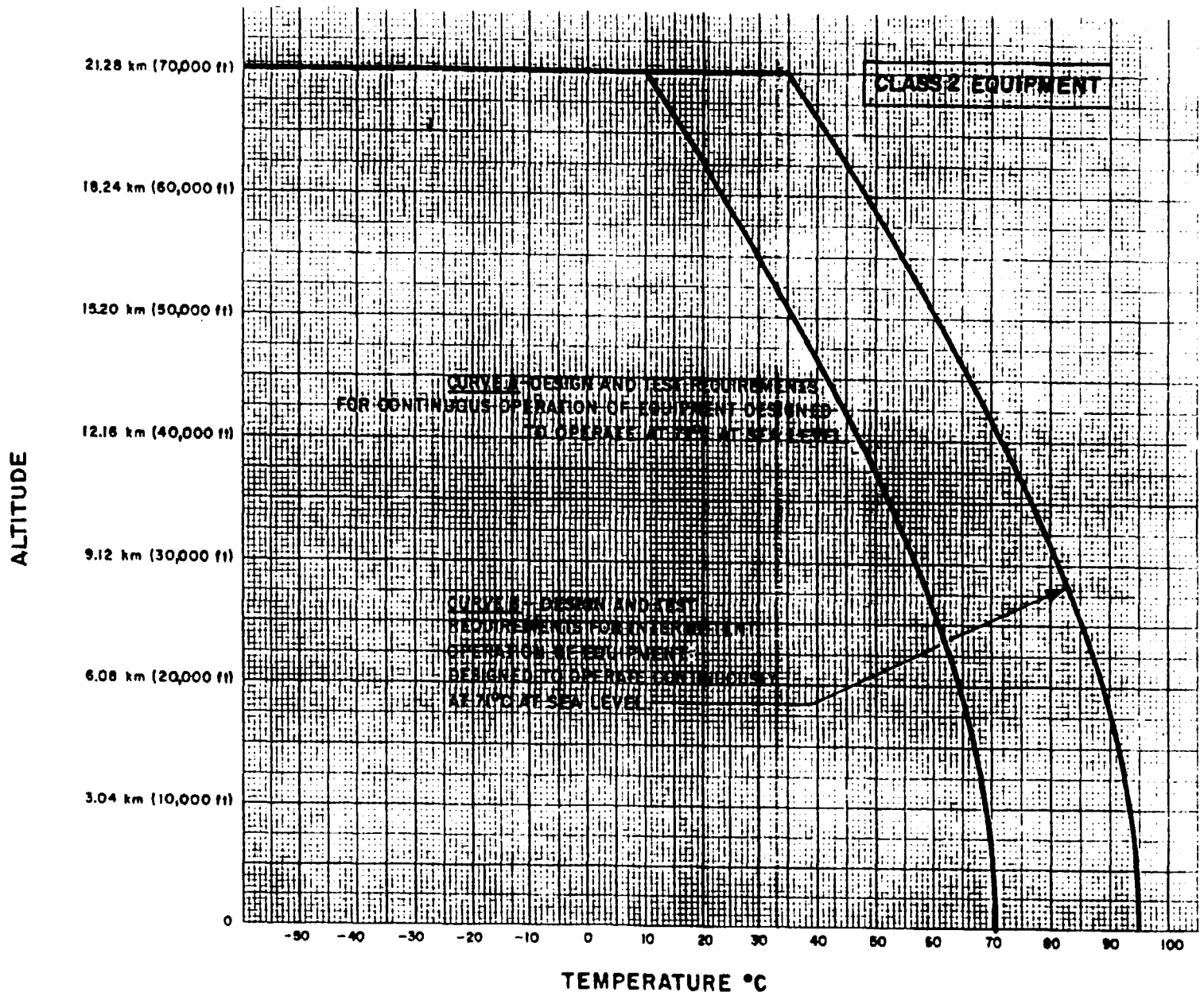


FIGURE 2. Operational requirements for class 2 airborne electronic equipment (temperature vs altitude).

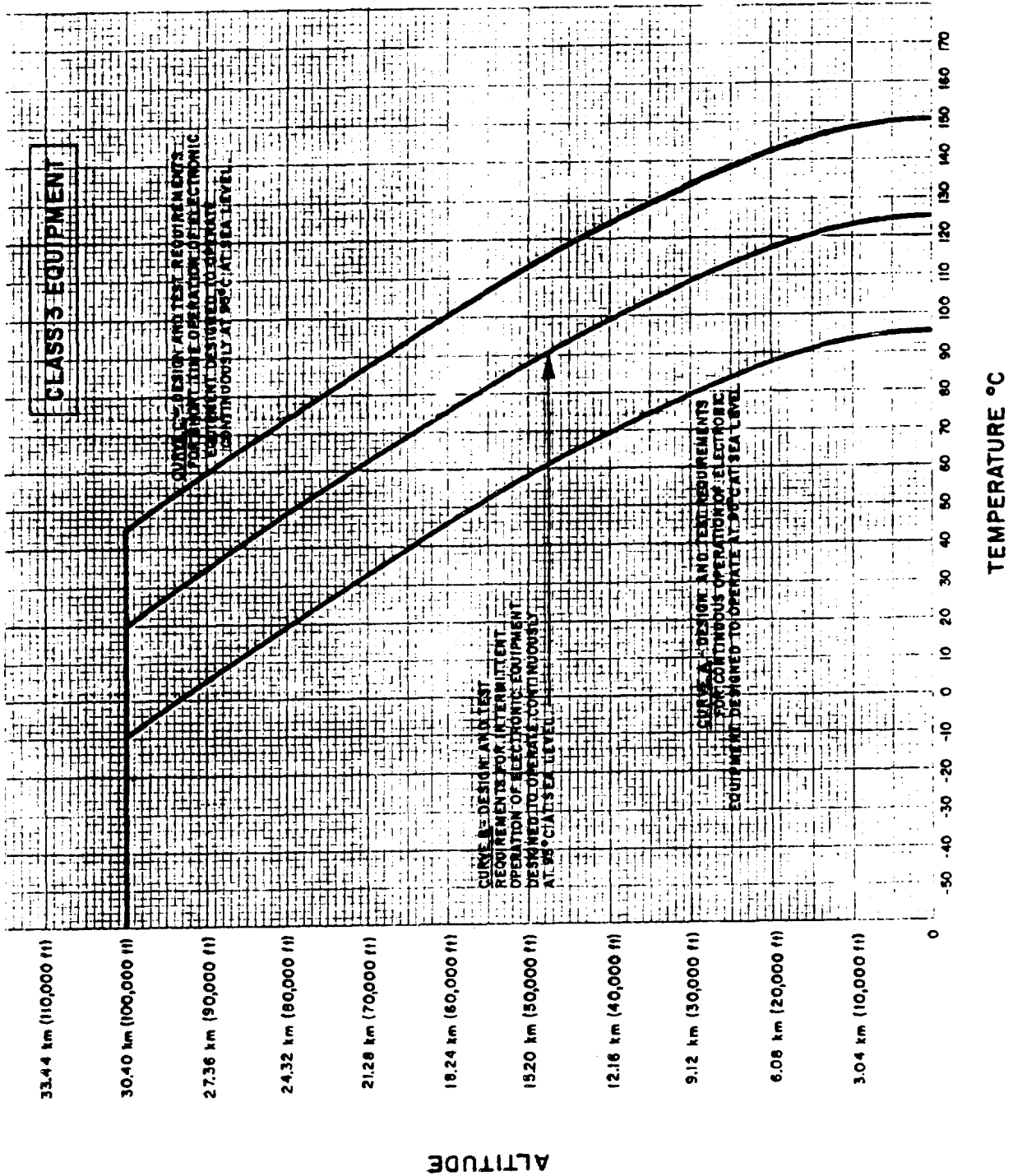


FIGURE 3. Operational requirements for class 3 airborne electronic equipment (temperature vs altitude).

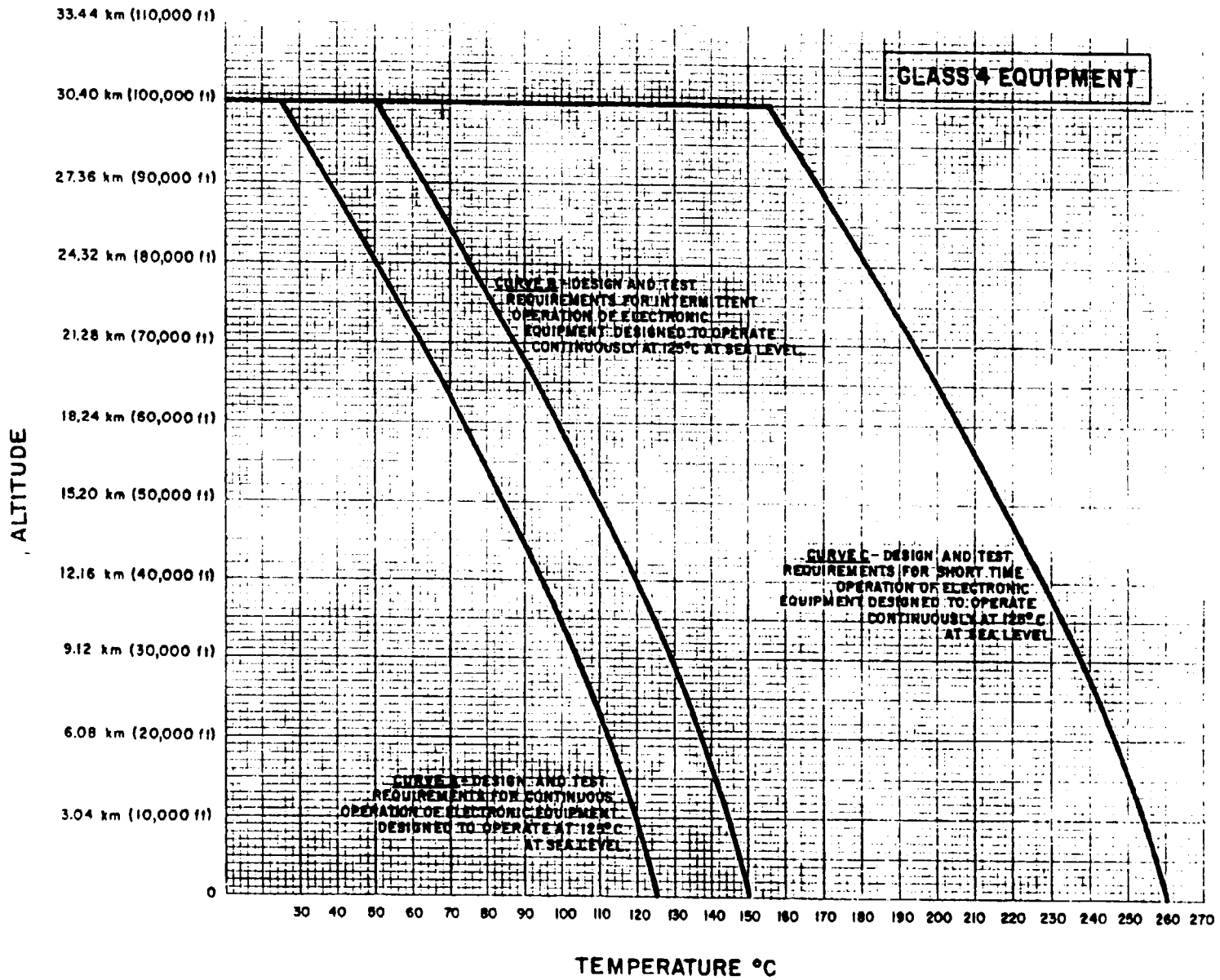


FIGURE 4. Operational requirements for class 4 airborne electronic equipment (temperature vs altitude).

4.6.2.5 Vibration.

4.6.2.5.1 Equipment normally mounted. When normally mounted (with vibration isolators in place, if any), the equipment shall not suffer damage or fail to meet specified performance when subjected to the applicable vibration environment detailed herein or as specified in the detail equipment specification or contract. Selection of the applicable vibration environment (type of excitation, frequency range and energy density level as a function of aircraft and application location) shall be determined using the following criteria.

4.6.2.5.1.1 Equipment designed for installation in propeller aircraft. Equipment of this type shall withstand random excitation over the frequency range of 15 to 500 Hz with energy density levels specified by the appropriate figure and table of MIL-STD-810, Method 514.

4.6.2.5.1.2 Equipment designed for installation in jet aircraft. Equipment of this type shall withstand random excitation over the frequency range of 15 to 2000 Hz with energy density levels specified by the appropriate figure and table of MIL-STD-810, Method 514.

4.6.2.5.1.3 Equipment designed for installation in helicopters. Equipment of this type shall withstand random excitation over the frequency range of 5 to 500 Hz with energy density levels specified by the appropriate figure and table of MIL-STD-810, Method 514. In addition, equipment of this type shall withstand random excitation over the frequency range of 5 to 2000 Hz for the purposes of environmental stress screening (ESS).

4.6.2.5.1.4 Minimum integrity test. Equipment normally mounted on isolators, but with isolators removed, shall be capable of meeting specified performance without suffering equipment damage, when subjected to a minimum integrity test within the vibration levels specified by the applicable figures and tables of MIL-STD-810, Method 514. The minimum integrity test should be applied as a basic test for items which are not designed for any of the other vibration environments cited above. The vibration levels and durations are not based on application environments, but provide reasonable assurance that the equipment will withstand operations and handling during field installation, removal, and repair. The test exposures are based on "typical" electronic boxes and the maximum weight of the test item or subassembly should not exceed approximately 36 kilograms (80 pounds).

4.6.2.6 Shock.

4.6.2.6.1 Equipment. Equipment (with vibration isolators in place, if any) shall not suffer damage or subsequently fail to provide the performance specified in the detail equipment specification when subjected to 18 impact shocks of 20g, consisting of 3 shocks in opposite directions along each 3 mutually perpendicular axes, each shock impulse having a time duration of 6 to 9 milliseconds. The "g" value shall be within ± 10 percent when measured with a 0.2 to 250 Hz filter.

4.6.2.6.2 Mounting base (crash safety). With excursion stops or bumpers in place and with maximum rated load applied in a normal manner, the mounting

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base, individual isolators, or other attaching devices shall withstand at least 12 impact shocks of 40g, consisting of 2 shocks in opposite directions along each of 3 mutually perpendicular axes. Each shock impulse shall have time duration of 6 to 9 milliseconds. The "g" value shall be within ± 10 percent when measured with a 0.2 to 250 Hz filter. Bending and distortion shall be permitted; however, there shall be no failure to the attaching joints, and the equipment or dummy load shall remain in place.

4.6.2.6.3 Bench handling. The equipment shall withstand the shock environment encountered during servicing.

4.6.2.7 Sand and dust. The equipment shall withstand, in both an operating and nonoperating condition, exposure to sand and dust particles as encountered in operational areas of the world.

4.6.2.8 Fungus. The equipment shall withstand, in both an operating and nonoperating condition, exposure to fungus growth as encountered in tropical climates. In no case shall overall spraying of the equipment be necessary to meet this requirement.

4.6.2.9 Salt atmosphere. The equipment shall withstand, in both an operating and nonoperating condition, exposure to salt-sea atmosphere.

4.6.2.10 Explosive conditions. The equipment shall not cause ignition of an ambient-explosive-gaseous mixture with air when operating in such an atmosphere.

5. DETAIL REQUIREMENTS

5.1 Detailed mechanical and electrical design. Specific requirements for individual equipment shall be as specified in the detail equipment specification or contract. The detailed mechanical and electrical design of specific equipment shall be accomplished by the contractor, subject to the requirements of this standard and any detail equipment specification to which it is subsidiary. The requirements of this standard are detailed only to the extent considered necessary to obtain the desired mechanical and electrical characteristics, performance and permanence of the same. The design layout and assembly of the units and their component parts shall be such as to facilitate quantity production and to result in minimum size and weight.

5.2 Technical data. The requirements for the preparation and management of technical data during the various equipment design, development and production phases shall be selected and tailored from MIL-T-31000 and specified in the contract. MIL-T-31000 defines the various types of drawings, associated lists and reports, along with the applicable Data Item Descriptions (DIDs) for listing in the Contract Data Requirements List (CDRL, DD Form 1423).

5.3 Quality assurance.

5.3.1 Responsibility for tests and inspections. The contractor is responsible for the performance of all tests and inspections as specified herein and in the detail equipment specification or contract.

5.3.2 Government verification. All quality and safety assurance operations performed by the contractor will be subject to Government verification at any time. Verification will consist of (a) surveillance of the operations to determine that practice, methods, and procedures of the quality and safety program requirements are being properly applied, (b) Government product inspection to measure quality and safety of product to be offered for acceptance, and (c) Government inspection of delivered items to assure compliance with the detail equipment specification or contract.

5.3.3 Failure criteria. Unless otherwise specified in the detail equipment specification or contract, the equipment, or portions thereof, shall be considered to have failed the prescribed tests and inspections when any of the following conditions occur:

- a. Equipment fails to meet the specified performance parameters, or fails within specified limits.
- b. Structural failure or distortion.
- c. Any condition that results in hazard to personnel or equipment safety.
- d. Process control deficiencies.
- e. Inspection and test procedure deficiencies.
- f. Improper labeling, handling and packaging.

5.3.4 Problem/failure reporting and corrective action. Problem/failure reporting and corrective action of any failure occurring as a result of tests performed during incoming inspection shall be in accordance with MIL-STD-785. The contractor shall also determine and report the yield or percentage of failures that occurred for each level of hardware. For correction, consideration should be paid to GIDEP data utilization in MIL-STD-1556.

5.3.5 Design qualification tests. Design qualification testing shall be performed prior to commitment to production. The requirements for design qualification of the equipment shall be tailored from Task 301 of MIL-STD-781 and specified in the contract. The requirement for environmental stress screening (ESS), Task 401 of MIL-STD-781, shall also be applied in conjunction with Task 301. These tasks identify the details to be specified by the acquisition activity and the applicable Data Item Descriptions (DIDs) for incorporation into the CDRL (DD Form 1423).

5.3.6 First article tests. The first article tests shall be performed in conjunction with production contracts only. The requirement for the performance of first article tests shall be specified in the detail equipment specification or contract. First article tests are those tests to be performed on one (1) or more equipments (as required by the detail specification or contract) representative of production equipment to be supplied on contract or order.

5.3.6.1 Scope of tests. The requirement for first article tests shall include all tests deemed necessary by the acquiring activity to determine that the equipment meets all of the requirements specified in the detail equipment specification or contract. These tests shall include environmental tests in accordance with the test methods and procedures of MIL-STD-810. Electro-magnetic interference tests and test methods shall be in accordance with MIL-STD-461.

5.3.7 Quality conformance tests. The requirement for the performance of quality conformance tests shall be specified in the detail equipment specification or contract. Quality conformance tests are those tests deemed necessary to determine that the equipments submitted for acceptance under the contract are equivalent in performance and construction to the approved first article equipment. Quality conformance tests shall consist of the following:

- a. Individual tests to be performed on each equipment submitted for acceptance under the contract. These tests should include environmental stress screening (ESS) or burn-in.
- b. Production reliability acceptance tests in accordance with Task 302 of MIL-STD-781. Task 302 identifies those details to be specified by the acquisition activity, including test plan, sampling plan, environmental test conditions, performance requirements, and the applicable Data Item Descriptions (DIDs) for incorporation into the CDRL (DD Form 1423).

5.4 Preparation for delivery. Requirements for packaging, packing and marking for shipment of equipment shall be submitted in the detail equipment specification or contract.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. This standard is intended as a general design guide for use in the development and preparation of detail equipment specifications and contracts for airborne electronic equipment to specify those requirements applicable to the specific equipment.

6.2 Details for inclusion in equipment specifications and contracts. Since this standard covers only general requirements, the detail equipment specification (as prepared either by the Government, the equipment manufacturer for the Government, or the prime vehicle contractor) or contract must specify actual requirements from the multiple choices, tailoring, or exceptions available in the following paragraphs:

- a. Classification requirements (see 1.2, 1.2.1).
- b. Tailoring requirements (see 1.2 and Appendix B).
- c. Warmup time (see 4.2.8.1).
- d. Electromagnetic interference characteristics (see 4.2.9).
- e. Electrostatic discharge control program (see 4.2.10).
- f. Human engineering requirements (see 4.2.14).
- g. Maintainability program requirements (see 4.2.16).
- h. Equipment orientation (see 4.2.22).
- i. Pressure and altitude requirements for specifying air leakage (see 4.2.24(g) and (h)).
- j. Reliability program requirements (see 4.2.25).
- k. Repairability requirements (see 4.2.26).
- l. System safety program requirements (see 4.2.27.1).
- m. Testability program requirements (see 4.2.29).

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- n. Thermal design requirements (see 4.2.30 and 4.2.30.1).
- o. Special tools (see 4.2.31.2).
- p. Parts control program requirements and GFB (see 4.3.1 thru 4.3.3).
- q. Samples for nonstandard parts and material approval, if required.
- r. Nonstandard material approval (see 4.4.4.1).
- s. Environmental test methods, procedures, limits, etc. (see 4.6 thru 4.6.10).
- t. Detail equipment design (see 5.1).
- u. Technical data (see 5.2).
- v. Equipment design qualification tests (see 5.3.5).
- w. First article tests and sample (see 5.3.6, 5.3.6.1).
- x. Accessory material and data to perform tests, if required.
- y. Quality conformance requirements and tests (see 5.3.7).
- z. Packaging requirements (see 5.4).

6.3 Use of helium. Helium should not be used as a pressurizing gas in sealed units containing electron tubes. When it is necessary to use helium for leak detection purposes, exposure should be limited to the time necessary for the test, followed by thorough purging.

6.4 Publications. In the design of electronic equipment, consideration should be given to the information contained in the following publications:

- a. Handbook, Preferred Circuits Navy Aeronautical Electronic
NAVAIR-16-1-519, Volume 2 Equipment.

6.5 Subject term (keyword) listing.

Classification
Design and construction
Environmental requirements
Material selection
Military standard
Parts selection
Processes and finishes
Tailoring requirements

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Custodians:

Army - CR
Navy - AS
Air Force - 11

Preparing activity:
Navy - AS

(Project GDRQ-0102)

Reviewer activities:

Army - MI, AR, AV
Navy - EC
Air Force - 15, 17, 99
DLA - ES

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APPENDIX A

APPLICABLE DOCUMENTS

10. SCOPE

10.1 Scope. THIS APPENDIX IS A MANDATORY PART OF THIS STANDARD. THE INFORMATION CONTAINED HEREIN IS INTENDED FOR COMPLIANCE.

10.2 This appendix lists specifications, standards, handbooks and other publications selected for their applicability in the design and construction of airborne electronic equipment. Those parts and materials covered by documents listed in this appendix will be considered standard items. When part selection standards are referenced, the documents listed in the selection standard have the same status as those listed directly in this appendix and the parts they cover are also considered standard (unless otherwise restricted or banned for airborne applications).

10.3 Selection of documents for nonstandard parts and materials. When Appendix A does not provide a document suitable for the design requirement, selection of specifications and standards for nonstandard parts and materials shall be made in accordance with the order of preference contained in MIL-STD-970, unless otherwise specified herein or in referenced MIL-STD-454 requirements.

20. APPLICABLE DOCUMENTS

20.1 The documents listed in this appendix are applicable to the extent specified directly herein or in the referenced MIL-STD-454 requirements.

20.2 Applicable issues. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation. Later revisions, amendments and documents superseding those listed in Appendix A may be used when preferred by the contractor. When a later issue is used, all applicable requirements of the later revision shall be used.

20.3 Copies. Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the DODSSP Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Addresses for ordering copies of non-government documents are listed on the following page.

30. APPLICATION OF SELECTED DOCUMENTS

30.1 It is not the intent that all documents listed in this appendix apply to all contracts, or that those that do apply necessarily apply in full. Before proceeding with the application of any document, all contractual specifications and requirements should be reviewed by the contractor, and the extent of applicability to the specific equipment design be determined.

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Industry Association Addresses. Addresses for obtaining copies of non-government industry association documents are as follows:

AGMA	American Gear Manufacturers Association 1901 North Fort Meyer Drive Suite 1000 Arlington, VA 22209
AMS	SAE 400 Commonwealth Drive Warrendale, PA 15096
ANSI	American National Standards Institute 11 West 42nd Street New York, NY 10036
ASM	American Society for Metals Metals Park, OH 44073
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWS	American Welding Society 550 NW LeJeune Road P.O. Box 351040 Miami, FL 33135
EIA	Electronic Industries Association 2001 Pennsylvania Avenue, N.W. Washington, DC 20006
IEEE	Institute of Electrical and Electronics Engineers 820 Second Avenue New York, NY 10017
IPC	Institute for Interconnecting and Packaging Electronic Circuits 7380 North Lincoln Avenue Lincolnwood, IL 60646
NAS	National Standards Association 1200 Quince Orchard Boulevard Gaithersburg, MD 20878
NFPA	National Fire Protection Association Battery march Park Quincy, MA 02269
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062

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FEDERAL SPECIFICATIONS

F-F-300	Filter, Air Conditioning, Viscous-Impingement and Dry Types, Cleanable
L-P-516	Plastic Sheet and Plastic Rod, Thermosetting, Cast
L-S-300	Sheeting and Tape, Reflecting, Nonexposed Lens, Adhesive Backing
V-T-285	Thread, Polyester
V-T-295	Thread, Nylon
FF-B-171	Bearings, Ball, Annular (General Purpose)
FF-B-185	Bearings, Roller, Cylindrical; and Bearings, Roller, Self-Aligning
FF-B-187	Bearing, Roller, Tapered
FF-B-195	Bearings, Sleeve (Bronze, Plain or Flanged)
FF-B-575	Bolts, Hexagon and Square
FF-N-836	Nut, Square, Hexagon, Cap, Slotted, Castle Knurled, Welding and Single Ball Seat
FF-R-556	Rivet, Solid, Small; Rivet, Split, Small; Rivet Tubular, Small; Flat Washer (Burr); and Cap, Rivet, General Purpose
FF-S-85	Screw, Cap, Slotted and Hexagon-Head
FF-S-86	Screw, Cap, Socket-Head
FF-S-92	Screw, Machine; Slotted, Cross Recessed or Hexagon Head
FF-S-200	Setscrews; Hexagon Socket and Spline Socket, Headless
FF-S-210	Setscrews, Square Head and Slotted Headless
FF-W-84	Washers, Lock (Spring)
FF-W-92	Washer, Metal, Flat (Plain)
FF-W-100	Washer, Lock, Tooth

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HH-I-553	Insulation Tape, Electrical (Rubber, Natural and Synthetic)
QQ-N-290	Nickel Plating (Electrodeposited)
QQ-P-416	Plating, Cadmium (Electrodeposited)
QQ-S-766	Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip
QQ-W-321	Wire, Copper Alloy
TT-S-1732	Sealing Compound, Pipe Joint and Thread, Lead Free, General Purpose
VV-L-800	Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low-Temperature)
VV-P-236	Petrolatum, Technical
ZZ-R-765	Rubber, Silicone
CCC-C-428	Cloth, Duck, Cotton; Fire, Water, Weather and Mildew-Resistant
MMM-A-121	Adhesive, Bonding, Vulcanized Synthetic Rubber to Steel
MMM-A-130	Adhesive, Contact
MMM-A-132	Adhesive, Heat Resistant, Airframe Structural, Metal to Metal
MMM-A-134	Adhesive, Epoxy Resin, Metal to Metal Structural Bonding
MMM-A-138	Adhesive, Metal to Wood, Structural
MMM-A-181	Adhesive, Phenol, Resorcinol, or Melamine Base
MMM-A-189	Adhesive, Synthetic-Rubber, Thermoplastic, General Purpose
MMM-A-1617	Adhesive, Rubber Base, General Purpose
MMM-A-1931	Adhesive, Epoxy, Silver Filled, Conductive

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MILITARY SPECIFICATIONS

MIL-I-10	Insulating Compound, Electrical, Ceramic, Class L
MIL-M-14	Molding Plastics and Molded Plastic Parts, Thermosetting
MIL-C-17	Cable, Radio Frequency, Flexible and Semirigid, General Specification for
MIL-P-79	Plastic Rod and Tube, Thermosetting, Laminated
MIL-S-61	Shunts, Instrument, External, 50 Millivolt (Lightweight Type)
MIL-T-152	Treatment, Moisture and Fungus Resistant, of Communications, Electronic and Associated Electrical Equipment
MIL-C-172	Cases, Bases, Mounting and Mounts, Vibration (For Use With Electronic Equipment in Aircraft)
MIL-V-173	Varnish, Moisture and Fungus Resistant (For Treatment of Communications, Electronic and Associated Equipment)
MIL-W-530	Webbing, Textile, Cotton, General Purpose, Natural or in Colors
MIL-C-572	Cords, Yarns and Monofilaments, Organic Synthetic Fiber
MIL-I-631	Insulation, Electrical, Synthetic-Resin Composition, Nonrigid
MIL-J-641	Jack, Telephone, General Specification for
MIL-P-642	Plug, Telephone and Accessory Screws, General Specification for
MIL-T-713	Twine, Fibrous: Impregnated, Lacing and Tying
MIL-P-997	Plastic Material, Maninated, Thermosetting, Electrical Insulation, Sheets, Glass Cloth, Silicone Resin
MIL-S-1222	Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts
MIL-I-1361	Instrument Auxiliaries, Electrical Measuring: Shunts, Resistors and Transformers

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MIL-L-2105	Lubricating Oil, Gear, Multi-Purpose
MIL-L-3150	Lubricating Oil, Preservative, Medium
MIL-I-3158	Insulation Tape, Electrical Glass-Fiber (Resin Filled); and Cord, Fibrous-Glass
MIL-I-3190	Insulation Sleeving, Electrical, Flexible, Coated, General
MIL-T-3530	Thread and Twine, Mildew Resistant or Water Repellant Treated
MIL-L-3661	Lampholders, Indicator Lights, Indicator-Light Housings, and Indicator-Light Lenses, General Specification for
MIL-I-3825	Insulation Tape, Electrical, Self-Fusing: For Use in Electronics, Communications and Allied Equipment
MIL-L-3890	Lines, Radio Frequency Transmission (Coaxial, Air Dielectric)
MIL-L-3918	Lubricating Oil, Instrument, Jewel Bearing
MIL-A-3920	Adhesive, Optical, Thermosetting
MIL-B-3990	Bearing, Roller, Needle, Airframe, Anti-Friction, Inch
MIL-W-4088	Webbings, Textile, Woven Nylon
MIL-S-5002	Surface Treatments and Inorganic Coatings for Metal Surfaces
MIL-L-5057	Lights, Instrument, Individual, General Specification for
MIL-B-5087	Bonding, Electrical and Lightning Protection, for Aerospace Systems
MIL-W-5088	Wiring, Aerospace Vehicle
MIL-H-5440	Hydraulic Systems, Aircraft, Types I and II, Design, Installation and Data Requirements for
MIL-A-5540	Adhesive, Polychloroprene
MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys

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MIL-F-5591	Fasteners, Panel; Nonstructural
MIL-R-5674	Rivets, Structural, Aluminum Alloy, Titanium Columbium Alloy, General Specification for
MIL-B-5687	Bearing, Sleeve, Washers, Thrust, Sintered, Metal Powder Oil Impregnated, General Specification for
MIL-L-6085	Lubricating Oil, Instrument, Aircraft, Low Volatility
MIL-L-6086	Lubricating Oil, Gear, Petroleum Base
MIL-L-6363	Lamps, Incandescent, Aircraft Service, General Requirements
MIL-C-6781	Control Panel, Aircraft Equipment, Rack or Console Mounted
MIL-B-6812	Bolts, Aircraft
MIL-W-6858	Welding, Resistance, Spot and Seam
MIL-C-7078	Cable, Electric, Aerospace, Vehicle, General Specification for
MIL-I-7444	Insulation Sleeving, Electrical, Flexible
MIL-N-7513	Nomenclature Assignment, Contractors Method for Obtaining
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series; General Specification for
MIL-P-7788	Panels, Information, Integrally Illuminated
MIL-B-7838	Bolt, Internal Wrenching, 160 KSI FTU
MIL-M-7793	Meter, Time Totalizing
MIL-B-7883	Brazing of Steels, Copper, Copper Alloys, Nickel Alloys, Aluminum and Aluminum Alloys
MIL-R-7885	Rivets; Blind, Structural, Pull-Stem and Chemically Expanded
MIL-T-7928	Terminals, Lug and Splice, Crimp-Style, Copper

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MIL-S-7947	Steel, Sheet and Strip (1095) Aircraft Quality
MIL-L-7961	Lights, Indicators, Press to Test
MIL-M-7969	Motor, Alternating Current, 400 Cycle, 115/200-Volt System, Aircraft, General Specification for
MIL-S-8516	Sealing Compound, Polysulfide Rubber, Electric Connectors and Electric Systems, Chemically Cured
MIL-A-8576	Adhesive, Acrylic Base, for Acrylic Plastic
MIL-M-8609	Motors, Direct Current, 28 Volt System, Aircraft, General Specification for
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-H-8810	Handles, Control, Aircraft
MIL-R-8814	Rivets, Blind, Nonstructural Type
MIL-B-8831	Bolt, Tensile, Steel, 180 KSI FTU, 450°F, External Wrenching, Flanged Head
MIL-S-8879	Screw Threads, Controlled Radius Root With Increased Minor Diameter, General Specification for
MIL-H-8891	Hydraulic Systems, Manned Flight Vehicles, Type III, Design, Installation, and Data Requirements for
MIL-W-8939	Welding, Resistance, Electronic Circuit Modules
MIL-B-8942	Bearings, Plain, TFE Lined, Self-Aligning
MIL-B-8943	Bearings, Journal-Plain and Flanged, TFE Lined
MIL-B-8948	Bearing, Plain Rod End, TFE Lined, Self-Aligning
MIL-C-9074	Cloth, Laminated, Sateen, Rubberized
MIL-M-10304	Meters, Electrical Indicating, Panel Type, Ruggedized, General Specification for
MIL-C-10544	Connector, Plug and Receptacle (Electrical, Audio, Waterproof, Ten Contact, Polarized)

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MIL-T-10727	Tin Plating: Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals
MIL-C-12520	Connector, Plug and Receptacle (Electrical, Waterproof), and Accessories, General Specification for
MIL-S-12883	Socket and Accessories for Plug-In Electronic Components, General Specification for
MIL-T-13020	Tape, Rubber, Unvulcanized, Splicing and Molding (Tapes TL-317/U and TL-318/U)
MIL-M-13231	Marking of Electronic Items
MIL-S-13282	Silver and Silver Alloy
MIL-B-13506	Bearing, Sleeve (Steel Backed)
MIL-S-13572	Spring, Helical, Compression and Extension
MIL-F-14072	Finishes for Ground Electronic Equipment
MIL-P-15024	Plate, Tags and Bands for Identification of Equipment
MIL-P-15037	Plastic Sheet, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin
MIL-P-15047	Plastic Sheets, Laminated, Thermosetting, Nylon Fabric Base, Phenolic-Resin
DOD-B-15072	Batteries, Storage, Lead-Acid, Portable, General Specification for (Metric)
MIL-I-15126	Insulation Tape, Electrical, Pressure Sensitive Adhesive and Pressure Sensitive Thermosetting Adhesive
MIL-T-15659	Terminal, Lug, Solder, Copper and Phosphor Bronze
MIL-L-15719	Lubricating Grease (High-Temperature, Electric Motor, Ball and Roller Bearings)
MIL-F-16552	Filter, Air Environmental Control System, Cleanable, Impingement (High Velocity Type)
MIL-I-16923	Insulating Compound, Electrical, Embedding

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MIL-I-17205	Insulation Cloth and Tape, Electrical, Glass Fiber, Varnished
MIL-B-17380	Bearing, Roller, Thrust
MIL-H-17672	Hydraulic Fluid, Petroleum, Inhibited
MIL-P-18177	Plastic Sheet, Laminated, Thermosetting, Glass Fiber Base, Epoxy-Resin
MIL-F-18240	Fastener, Externally Threaded 250°F, Self-Locking, Element for
MIL-N-18307	Nomenclature and Identification for Electronic, Aeronautical and Aeronautical Support Equipment, Including Ground Support Equipment
MIL-I-18746	Insulation Tape, Nonadhering, Glass Fabric, Polytetrafluoroethylene Coated
MIL-P-19161	Plastic Sheet, Laminated, Glass Cloth Polytetrafluoroethylene Resin
MIL-I-19166	Insulation Tape, Electrical, High-Temperature, Glass Fiber, Pressure Sensitive
MIL-C-19311	Copper-Chromium Alloy Forgings, Wrought Rod, Bar and Strip (Copper Alloy Numbers 182, 184 and 185)
MIL-S-19500	Semiconductor Devices, General Specification for
MIL-I-22076	Insulation Tubing, Electrical, Non-Rigid, Vinyl, Very Low Temperature Grade
MIL-I-22129	Insulation Tubing, Electrical, Polytetrafluoroethylene Resin, Nonrigid
MIL-T-22361	Thread Compound, Antiseize, Zinc Dust-Petrolatum
MIL-S-22432	Servomotors, General Specification
MIL-S-22473	Sealing, Locking and Retaining Compounds: (Single-Component),
MIL-W-22759	Wire, Electric, Fluoropolymer-Insulated, Copper or Copper Alloy
MIL-S-22820	Servomotor-Tachometer Generator AC, General Specification for

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MIL-T-22821	Tachometer Generator AC, General Specification for
MIL-C-22931	Cable, Radio Frequency, Semirigid, Coaxial, Semi-Air Dielectric, General Specification for
MIL-R-22978	Fastener, Rotary, Quick-Operating, High Strength
MIL-I-23053	Insulation Sleeving, Electrical, Heat Shrinkable, General Specification for
MIL-B-23071	Blowers, Miniature, for Cooling Electronic Equipment, General Specification for
MIL-S-23190	Straps, Clamps, and Mounting Hardware, Plastic and Metal for Cable Harness Tying and Support
MIL-I-23264	Insulators, Ceramic, Electrical and Electronic, General Specification for
MIL-L-23398	Lubricant, Solid Film, Air Cured, Corrosion Inhibiting, NATO Code Number S-749
MIL-S-23586	Sealing Compound, Electrical, Silicone Rubber, Accelerator Required
MIL-I-23594	Insulation Tape, Electrical; High Temperature Polytetrafluoroethylene, Pressure-Sensitive
MIL-T-23648	Thermistor (Thermally Sensitive Resistor), Insulated, General Specification for
MIL-C-23806	Cable, Radio Frequency, Coaxial, Semirigid, Foam Dielectric, General Specification for
MIL-G-23827	Grease, Aircraft and Instrument, Gear and Actuator Screw
MIL-M-24041	Molding and Potting Compound, Chemically Cured, Polyurethane (Polyether Based)
MIL-I-24092	Insulating Varnish, Electrical, Impregnating, Solvent Containing
MIL-G-24139	Grease, Multi-Purpose, Quiet Service
MIL-A-24179	Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-I-24204	Insulation, Electrical, High Temperature, Bonded, Synthetic Fiber Paper

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MIL-G-24211	Gaskets, Waveguide Flange, General Specification for
MIL-R-24243	Rivet, Blind, Nonstructural, Retained Mandrel, Open-End, Domed Head, Aluminum Alloy, Carbon Steel
MIL-S-24251	Shield, Retainer (Bases), and Adapters, Electron Tube, Heat Dissipating, General Specification for
MIL-M-24325	Molding Material, Plastic, Epoxy Compounds, Thermosetting
MIL-I-24391	Insulation Tape, Electrical, Plastic, Pressure Sensitive
DOD-G-24508	Grease, High Performance, Multi-Purpose (Metric)
MIL-N-25027	Nut, Self-Locking, 250°F, 450°F and 800°F
MIL-K-25049	Knobs, Control, Electronic Equipment, General Specification for
MIL-A-25463	Adhesive, Film Form, Metallic Structural Sandwich Construction
MIL-I-25467	Lighting, Integral, Aircraft Instrument, General Specification for
MIL-H-25475	Hydraulic Systems, Missile, Design, Installation, Tests, and Data Requirements, General Requirements for
MIL-P-25518	Plastic Material, Silicone Resin, Glass Fiber Base, Low-Pressure Laminated
MIL-C-26074	Coatings, Electroless Nickel, Requirements for
MIL-L-27160	Lighting, Instrument, Integral White, General Specification for
MIL-W-27265	Webbing, Textile, Woven Nylon, Impregnated
MIL-R-27384	Rivet, Blind, Drive Type
MIL-C-27500	Cable, Electrical, Shielded and Unshielded, Aerospace
MIL-D-28728	Dial, Control, Multi-Turn Counters, General Specification for
MIL-M-28787	Modules, Standard Electronic, General Specification for

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MIL-R-28803	Readouts, Segmented, General Specification for
MIL-P-29590	Power Supplies, Airborne, Electronic, General Specification for
MIL-T-31000	Technical Data Packages, General Specification for
MIL-M-38510	Microcircuits, General Specification for
MIL-M-38527	Mounting Pads, Electrical-Electronic Component, General Specification for
MIL-H-38534	Hybrid Microcircuits, General Specification for
MIL-I-38535	Integrated Circuits (Microcircuits) Manufacturing, General Specification for
MIL-C-39006/22	Capacitor, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum (Polarized, Sintered Slug), 85°C (Voltage Derated to 125°C), Established Reliability, Style CLR79
MIL-C-39006/25	Capacitor, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum (Polarized, Sintered Slug) (Extended Range), 85°C (Voltage Derated to 125°C), Established Reliability, Style CLR81
MIL-T-43435	Tape, Lacing and Tying
MIL-G-45204	Gold Plating, Electrodeposited
MIL-L-46010	Lubricant, Cleaner and Preservative
MIL-S-46049	Strip, Metal, Carbon Steel, Cold Rolled, Hardened and Tempered, Spring Quality
MIL-A-46050	Adhesive, Cyanoacrylate, Rapid Room-Temperature Curing, Solventless
MIL-I-46058	Insulating Compound, Electrical (for Coating Printed Circuit Assemblies)
MIL-P-46112	Plastic Sheet and Strip, Polyimide
MIL-A-46146	Adhesive-Sealants, Silicone, RTV, Non-Corrosive (For Use With Sensitive Metals and Equipment)
MIL-S-46163	Sealing, Lubricating and Wicking Compounds: Thread Locking, Anaerobic, Single Component

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MIL-I-46852	Insulation Tape, Electrical, Self-Adhering, Unsupported Silicone Rubber
MIL-H-46855	Human Engineering Requirement for Military Systems, Equipment and Facilities
MIL-A-47315	Adhesive, Polyurethane
MIL-A-47318	Adhesive, Copolymer Polyurethane
MIL-A-48611	Adhesive System, Epoxy-Elastomeric, for Glass-To-Metal
MIL-B-49030	Batteries, Dry (Alkaline)
MIL-B-49430	Batteries, Non-Rechargeable, Nickel Cadmium, Sealed
MIL-B-49436	Batteries, Rechargeable, Nickel-Cadmium, Sealed
MIL-I-49456	Insulation Sheet, Electrical, Silicone Rubber, Thermally Conductive, Fiberglass Reinforced
MIL-B-49458	Batteries, Non-Rechargeable, Lithium Manganese Dioxide
MIL-R-50781	Resolver, Electrical, Linear, General Specification for
MIL-A-52194	Adhesive, Epoxy (for Bonding Glass Reinforced Polyester)
MIL-S-55041	Switches, Waveguide, General Specification for
MIL-C-55116	Connectors, Miniature, Audio, Five-Pin and Six-Pin, General Specification for
MIL-B-55130	Batteries, Rechargeable, Nickel-Cadmium, Sealed
MIL-T-55156	Terminals, Lug, Splices, Conductor; Screw Type, General Specification for
MIL-T-55164	Terminal Boards, Molded, Barrier, Screw Type, and Associated Terminal Board Lugs, General Specification for
MIL-C-55181	Connectors, Plug and Receptacle, Intermediate Power (Electrical) (Waterproof) Type MW, General Specification for
MIL-O-55310	Oscillators, Crystal, General Specification for

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MIL-A-55339	Adapters, Connector, Coaxial, Radio Frequency (Between Series and Within Series)
MIL-T-55631	Transformers, Intermediate Frequency, Radio Frequency and Discriminator, General Specification for
MIL-C-81021	Copper-Beryllium Alloy (Copper Alloy Numbers C17500 and C17510), Strip
MIL-W-81044	Wire, Electric, Crosslinked Polyalkene, Crosslinked Alkane-imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-A-81236	Adhesive, Epoxy Resin With Polyamide Curing Agent
MIL-A-81253	Adhesive, Modified Epoxy Resin With Polyamine Curing Agent
MIL-M-81288	Mounting Bases, Flexible Plastic Foam
MIL-G-81322	Grease, Aircraft, General Purpose, Wide Temperature Range
MIL-L-81329	Lubricant, Solid Film, Extreme Environment, NATO Code Number S-1737
MIL-E-81512	Encoder, Shaft Position to Digital, Contact Type, Altitude Reporting, General Specification for
MIL-I-81550	Insulating Compound, Electrical, Embedding, Reversion Resistant Silicone
MIL-B-81744	Barrier Coating Solution, Lubricant Migration Deterring
MIL-S-81746	Servtorqs, General Specification for
MIL-B-81757	Batteries and Cells, Storage, Nickel-Cadmium, Aircraft, General Specification for
MIL-I-81765	Insulating Components, Molded, Electrical, Heat Shrinkable, General Specification for
MIL-C-81774	Control Panel, Aircraft, General Requirements for
MIL-B-81793	Bearing, Ball, Annular, for Instruments and Precision Rotating Components
MIL-B-81934	Bearing, Sleeve, Plain and Flanged, Self-Lubricating, General Specification for

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MIL-B-81936	Bearing, Plain, Self-Aligning (BeCu, CRES Race)
MIL-S-81963	Servo Components, Precision Instrument, Rotating, Common Requirements and Tests, General Specification for
MIL-A-83377	Adhesive Bonding (Structural) for Aerospace and Other Systems, Requirements for
MIL-S-83502	Sockets, Plug-In Electronic Components, Round Style, General Specification for
MIL-C-83503	Connectors, Electrical, Flat Cable, and/or Printed Wiring Board, Nonenvironmental, General Specification for
MIL-R-83516	Relays, Reed, Dry, General Specification for
MIL-T-83721	Transformer, Variable, Power, General Specification for
MIL-T-83727	Transolvers, General Specification for
MIL-S-83731	Switch, Toggle, Unsealed and Sealed Toggle, General Specification for
MIL-S-83734	Sockets, Plug-In Electronic Components, Dual-in-Line (DIPs) and Single-in-Line (SIPs), General Specification for
MIL-B-83769	Batteries, Storage, Lead-Acid, General Specification for
MIL-I-85080	Insulation Sleeving, Electrical, Shrinkable Without Heat, General Specification for
MIL-E-85082	Encoders, Shaft Angle to Digital, General Specification for
MIL-R-85725	Rack, Integrated Avionics, Forced Air Cooled, General Specification for
MIL-E-85726	Enclosure, Standard Avionics, Forced Air cooling, General Specification
MIL-L-85762	Lighting, Aircraft, Interior, Night Vision Imaging System, General Specification
MIL-A-87135	Adhesives, Non-Conductive, for Electronics Application

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MIL-D-87157 Displays, Diode, Light Eitting, Solid State, General Specification for

FEDERAL STANDARDS

FED-STD-H28 Screw-Thread Standard for Federal Services

FED-STD-595 Colors Used in Government Procurement

MILITARY STANDARDS

MIL-STD-12 Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents

MIL-STD-22 Welded Joint Design

MIL-STD-108 Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment

MIL-STD-130 Identification Marking of U.S. Military Property

MIL-STD-155 Joint Photographic Type Designation System

MIL-STD-195 Marking of Connections for Electrical Assemblies

MIL-STD-196 Joint Electronics Type Designation System

MIL-STD-198 Capacitors, Selection and Use of

MIL-STD-199 Resistors, Selection and Use of

MIL-STD-200 Electron Tubes, Selection of

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts

MIL-STD-248 Welding and Brazing Procedure and Performance Qualification

MIL-STD-276 Impregnation of Porous Nonferrous Metal Castings

MIL-STD-280 Definitions of Item Levels, Item Exchangeability, Models, and Related Terms

MIL-STD-411 Aircrew Station Signals

MIL-STD-415 Test Provisions for Electronic Systems and Associated Equipment, Design Criteria for

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MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-469	Radar Engineering Design Requirements, Electromagnetic Compatibility
MIL-STD-470	Maintainability Program for Systems and Equipment
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation
MIL-STD-480	Configuration Control - Engineering Changes, Deviations and Waivers
MIL-STD-681	Identification Coding and Application of Hook-Up and Lead Wire
MIL-STD-683	Crystal Units (Quartz) and Crystal Holders (Enclosures), Selection of
MIL-STD-701	Lists of Standard Semiconductor Devices
MIL-STD-704	Aircraft Electric Power Characteristics
MIL-STD-710	Synchros, 60 and 400 Hz, Selection and Application of
MIL-STD-721	Definitions of Terms for Reliability and Maintainability
MIL-STD-756	Reliability Modeling and Prediction
MIL-STD-781	Reliability Design Qualification and Product Acceptance Tests: Exponential Distribution
MIL-STD-783	Legends for Use in Aircrew Stations and on Airborne Equipment
MIL-STD-785	Reliability Program for Systems and Equipment Development and Production
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-838	Lubrication of Military Equipment
MIL-STD-882	System Safety, Program Requirements

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MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-889	Dissimilar Metals
MIL-STD-965	Parts Control Program
MIL-STD-970	Standards and Specifications, Order of Preference for Selection of
MIL-STD-983	Substitution List for Microcircuits
MIL-STD-1130	Connections, Electrical, Solderless, Wrapped
MIL-STD-1132	Switches and Associated Hardware, Selection and Use of
MIL-STD-1189	Bar Code Symbology Standard
MIL-STD-1277	Splices, Terminals, Terminal Boards, Binding Posts, Terminal Junction Systems, Wire Caps; Electrical
MIL-STD-1279	Meters, Electrical Indicating, Selection and Use of
MIL-STD-1285	Marking of Electrical and Electronic Parts
MIL-STD-1286	Transformers, Inductors, and Coils, Selection and Use of
MIL-STD-1327	Flanges, Coaxial and Waveguide; and Coupling Assemblies, Selection of
MIL-STD-1328	Couplers, Directional, Selection of
MIL-STD-1329	Switches, RF Coaxial, Selection of
MIL-STD-1334	Process for Barrier Coating of Anti-Friction Bearings
MIL-STD-1346	Relays, Selection and Application
MIL-STD-1352	Attenuators, Fixed and Variable, Selection of
MIL-STD-1353	Electrical Connectors, Plug-In Sockets and Associated Hardware, Selection and Use of
MIL-STD-1358	Waveguides, Rectangular, Ridge and Circular, Selection of
MIL-STD-1360	Fuses, Fuseholders and Associated Hardware, Selection and Use of

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MIL-STD-1378	Requirements for Employing Standard Electronic Modules
MIL-STD-1389	Design Requirements for Standard Electronic Modules
MIL-STD-1390	Level of Repair
MIL-STD-1395	Filters and Networks, Selection and Use of
MIL-STD-1399, Section 300	Interface Standard for Shipboard Systems, Electric Power, Alternating Current
MIL-STD-1451	Resolvers, Electrical, Selection of
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-1498	Circuit Breakers, Selection and Use of
MIL-STD-1516	Unified Code for Coatings and Finishes of DOD Equipment
MIL-STD-1553	Digital Time Division Command/Response Multiplex Data Buss
MIL-STD-1556	Government/Industry Data Exchange Program (GIDEP), Contractor Participation Requirements
MIL-STD-1562	Lists of Standard Microcircuits
MIL-STD-1595	Qualification of Aircraft, Missile and Aerospace Fusion Welders
MIL-STD-1629	Procedures for Performing a Failure Mode, Effects and Criticality Analysis
MIL-STD-1636	Adapters, Coaxial to Waveguide, Selection of
MIL-STD-1637	Dummy Loads, Electrical, Waveguide, Coaxial, and Stripline, Selection of
MIL-STD-1638	Waveguide Assemblies, Rigid and Flexible, Selection of
MIL-STD-1639	Power Dividers, Power Combiners, and Power Divider/Combiners, Selection of
MIL-STD-1640	Mixer Stages, Radio Frequency, Selection of
MIL-STD-1646	Servicing Tools for Electric Contacts and Connections, Selection and Use of

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MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
MIL-STD-1788	Avionics Interface Design Standard
MIL-STD-1861	Electrical and Electronic Assemblies, Boards, Cards and Associated Hardware, Selection and Use of
DOD-STD-1866	Soldering Process, General (Non-Electrical)
MIL-STD-2000	Standard Requirements for Soldered Electrical and Electronic Assemblies
MIL-STD-2038	Requirements for Employing Standard Power Supplies
MIL-STD-2113	Radio Frequency Circulators and Isolators, Selection of
MIL-STD-2120	Connectors, Electromagnetic Interference (EMI) Filter Contact
MIL-STD-2162	Amplifiers, Radio Frequency and Microwave, Solid State, Selection of
MIL-STD-2165	Testability Program for Electronic Systems and Equipments
MIL-STD-2175	Castings, Classification and Inspection of
MIL-STD-2200	Requirements for Employing Standard Enclosure Systems
MIL-STD-2219	Fusion Welding for Aerospace Applications
MS27212	Terminal Boards, Assembly, Molded-In Stud, Electric
MS33522	Rivets, Blind, Structural, Mechanically Locked and Friction Retainer Spindle (Reliability and Maintainability), Design and Construction Requirements for)
MS33540	Safety Wiring, and Cotter Pinning, General Practices for
MS33557	Nonstructural Rivets for Blind Attachment, Limitations for Design and Usage

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MILITARY HANDBOOKS

MIL-HDBK-5	Metallic Materials and Elements for Aerospace Vehicle Structures
MIL-HDBK-216	RF Transmission Lines and Fittings
MIL-HDBK-217	Reliability Prediction of Electronic Equipment
MIL-HDBK-218	Application of Electrical Resolvers
MIL-HDBK-225	Synchros, Descriptions and Operation
MIL-HDBK-231	Encoder, Shaft Angle to Digital
MIL-HDBK-246	Program Managers Guide for the Standard Electronic Modules Program
MIL-HDBK-248	Acquisition Streamlining
MIL-HDBK-251	Reliability/Design, Thermal Applications
MIL-HDBK-253	Guidance for the Design and Test of Systems Protected Against the Effects of Electromagnetic Energy
MIL-HDBK-263	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronics Parts, Assemblies, and Equipment (Excluding Electrically Initiated Explosive Devices)
MIL-HDBK-274	Electrical Grounding for Aircraft Safety
MIL-HDBK-275	Guide for the Selection of Lubricant Fluids and Compounds for Use in Flight Vehicles and Components
MIL-HDBK-402	Guidelines for Implementation of DOD Parts Control Program
MIL-HDBK-419	Ground, Bonding and Shielding for Electronic Equipments
MIL-HDBK-472	Maintainability Prediction
MIL-HDBK-660	Fabrication of Rigid Waveguide Assemblies (Sweep Bends and Twists)
MIL-HDBK-691	Adhesive Bonding
MIL-HDBK-730	Military Standardization Handbook on Materials Joining

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MIL-HDBK-1553 Multiplex Application Handbook
MIL-HDBK-2000 Soldering of Electrical and Electronic Assemblies

OTHER GOVERNMENT DOCUMENTS

MIL-BUL-103 List of Standardized Military Drawings (SMDs)
NAVAIR-16-1-519, Handbook, Preferred Circuits Navy Aeronautical
Vol. 2 Electronic Equipment
10 CFR 20 Code of Federal Regulations, Title 10, Chapter I, Part
20
21 CFR 1000-1050 Code of Federal Regulations, Title 21, Chapter I,
Parts 1000-1050
29 CFR 1910 Code of Federal Regulations, Title 29, Chapter XVII,
Part 1910
NTIA Manual National Telecommunications and Information
Administration Manual of Regulations and Procedures
for Radio Frequency Management
VHSIC Interoperability Standards. Includes specifications for the
TM-bus, ETM bus, Pi bus, and VHSIC Electrical Specification. (Copies
available from Naval Research Laboratory, Code 5305, Washington, DC
20375-5000.)
Tester Independent Support Software System (TISSS) Specifications (Copies
available from TISSS Program Office, RADC/RBR, Griffiss Air Force Base,
NY 13441-5700).

NON-GOVERNMENT DOCUMENTS

AMS 3638E Plastic Tubing, Electrical Insulation, Irradiated
Polyolefin, Pigmented, Semi-Rigid, Heat-Shrinkable 2
to 1 Shrink Ratio
AMS 3653D Tubing, Electrical Insulation, Standard Wall, Extruded
Polytetrafluoroethylene (PTFE)
AMS 3654B Tubing, Electrical Insulation, Light Wall, Extruded
Polytetrafluoroethylene (PTFE)
AMS 3655A Tubing, Electrical Insulation, Thin Wall, Extruded
Polytetrafluoroethylene (PTFE)
ASTM A29/A29M Steel Bars, Carbon and Alloy, Hot Wrought and Cold
Finished, General Requirements for

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ASTM A228/A228M	Steel Wire, Music Spring Quality
ASTM A313	Chromium-Nickel Stainless and Heat Resisting Steel Spring Wire
ASTM A588/A558M	High Strength Low Alloy Structural Steel With 50 KSI Minimum Yield to 4 Inch Thick
ASTM A682	Steel, Strip, High Carbon, Cold Rolled, Spring Quality, General Requirements for
ASTM A684/A684M	Steel, Strip, High Carbon, Cold Rolled
ASTM B194	Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B196/B196M	Copper-Beryllium Alloy Rod and Bar
ASTM B197/B197M	Copper-Beryllium Alloy Wire
ASTM B522	Gold-Silver-Platinum Electrical Contact Alloy, Specification
ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel, Standard Specification for
ASTM D495	Standard Method of Test for High-Voltage, Low-Current Dry Arc Resistance of Solid Electrical Insulation Materials
ASTM D568	Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Vertical Position, Test Method for
ASTM D635	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, Test Method for
ASTM D1000	Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation, Methods of Testing
ASTM D3295	PTFE Tubing, Specification for
ANSI/IPC-D322	Guidelines for Selecting Printed Wiring Board Sizes Using Standard Panel Sizes
ANSI C95.1	Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 KHz to 100 GHz
ANSI C95.2	Radio Frequency Radiation Hazard Warning Symbol

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ANSI N2.1	Radiation Symbol
ANSI Z35.1	Accident Prevention Signs
ANSI Z53.1	Marking Physical Hazards, Safety Color Code for
EIA-297-A	Cable Connectors for Audio Facilities for Radio Broadcasting
EIA RS-310-C	Racks, Panels and Associated Equipment
IEEE 200	Electrical and Electronic Parts and Equipments, Reference Designations for
IEEE 1076	VHSIC Hardware Description Language (VHDL)
NAS498	Bolts, Shear, 95 KSU FSU
NAS547	Fastener, Rotary, Quick-Operating, High Strength
NAS1686	Rivet, Blind, Aluminum Sleeve, Mechanically Locked, Spindle, Bulbed
NAS1687	Rivet, Blind, Monel and Inconel Sleeve, Mechanically Locked Spindle, Bulbed
NFPA 70	National Electrical Code
UL 94	Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
Metals Handbook (Vol I) (ASM)	
American Gear Manufacturers Association (AGMA)	

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SAMPLE TAILORING GUIDE

10. SCOPE

10.1 Scope. THIS APPENDIX PROVIDES GUIDANCE INFORMATION ONLY AND IS NOT INTENDED TO BE INVOKED AS A CONTRACTURAL REQUIREMENT.

10.2 This appendix provides a sample tailoring guide for MIL-STD-5400 based on the relationship of tailoring specific requirements during various development and production phases as defined in MIL-HDBK-248. This guide is not intended to be restrictive as to the methods/factors to be considered for tailoring applications. Examples of other methods/factors concerned with tailoring of MIL-STD-5400 requirements are shown in paragraph 40.

20. APPLICABLE DOCUMENTS (Reference Only)

MIL-HDBK-248 Acquisition Streamlining

30. APPLICATION OF SAMPLE TAILORING GUIDE

30.1 The sample tailoring guide contained herein cross-references indications of tailoring applicability for MIL-STD-5400 requirements to various phases of item development and production as defined in MIL-HDBK-248. Codes and abbreviations used in the sample tailoring guide table are as follows:

Tailoring Requirements

N-	Not applicable this phase
A-	Applicable this phase
T-	Essentially a "tailoring" paragraph
G-	General statement - tailoring not required

Program Phases

CON-	Conceptual (Research)
D&V-	Demonstration & Validation
FSED-	Full Scale Engineering Development
PROD-	Production

30.2 Guide for the extent of tailoring to be effected during program phases.

Conceptual (Research) - Specifications and standards requirements should be tailored and limited to minimum technical design objectives and broad basic performance and functional requirements. Application of "cost driver" requirements should be very limited.

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Demonstration & validation - Specifications and standards requirements should be tailored again to upgrade and more clearly define the technical objectives relating to design, performance and functional demonstration requirements for the prototype item. Consideration of "cost driver" requirements should be expanded.

Full scale engineering development - Specifications and standards requirements should be tailored for maximum compatibility of the ultimate engineering design with the operational system requirements. The application of "cost driver" requirements such as configuration control, quality assurance, reliability, data and documentation, packaging, packing, preservation and transportation should be given special consideration and definition in anticipation of future procurement. Pertinent general military design requirements should be critically tailored for each application. A tailored configuration and product baseline should be established prior to entering the production phase.

Production - Proper application of tailored requirements during the engineering design/prototype phase should preclude the necessity for application of additional military requirements and tailoring during the production phase, except for possible refinement of some requirements.

40. OTHER CONSIDERATIONS FOR TAILORING

40.1 This appendix is limited to guidance for tailoring MIL-STD-5400 requirements to the development and production phases of a program. There are, however, many other factors which can provide the basis for tailoring to modify, limit, combine, or eliminate specific requirements consistent with the minimum level necessary to provide cost effective system performance and program management. Below is a list of some other areas which may provide basis for tailoring of specific requirements relative to those areas of consideration. Refer to MIL-HDBK-248 for additional guidance relative to acquisition streamlining and tailoring of requirements.

- Mission requirements
- Equipment application
- Environmental/test requirements
- Interface requirements with other systems/equipment
- Operational/logistics requirements
- Software and technical data requirements
- Human factors requirements
- Configuration management requirements
- Reliability/maintainability requirements
- Quality assurance requirements
- Packaging, packing, handling, storage and transportation requirements

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MIL-STD-5400 Paragraph Number and Description		CON	D&V	FSED	PROD
4.1	Untitled	G	G	G	G
4.1.1	Tailoring of MIL-STD-454 requirements	G	G	G	G
4.1.2	Standard hardware acquisition and reliability program (SHARP)	N	N	A	A
4.1.3	Requirements, tables and figures	G	G	G	G
4.2	Design and construction	G	G	G	G
4.2.1	Untitled	G	G	G	G
TABLE I	General design and construction				
4.2.2	Accessibility	N	N	A	A
4.2.3	Anti-jamming	N	A	A	A
4.2.4	Castings, metal	N	N	N	A
4.2.5	Corona and electrical breakdown prevention	A	A	A	A
4.2.6	Derating	N	A	A	A
4.2.7	Electrical overload protection	N	N	A	A
4.2.7.1	Resettable circuit protectors	N	N	A	A
4.2.7.2	Spare fuses	N	N	A	A
4.2.8	Electrical power	N	N	A	A
4.2.8.1	Warm-up time	N	N	A	A
4.2.8.2	Untitled	N	N	A	A
4.2.9	Electromagnetic interference control	N	N	A	A
4.2.9.1	Radar equipment	N	N	A	A
4.2.10	Electrostatic discharge control	A	A	A	A
4.2.11	Enclosures	N	N	A	A
4.2.11.1	Standardized avionics enclosures	N	N	A	A
4.2.11.2	Other enclosures	N	N	A	A
4.2.12	Fabrication	N	N	A	A
4.2.13	Grounding, bonding and shielding	A	A	A	A
4.2.14	Human engineering	N	N	A	A
4.2.15	Interchangeability	N	N	N	A
4.2.15.1	Untitled	N	N	N	A
4.2.15.2	Untitled	N	N	N	A
4.2.15.3	Interchangeability of reordered equipment	N	N	N	A
4.2.16	Maintainability	N	N	A	A
4.2.17	Marking	N	N	A	A
4.2.17.1	Labels	N	N	N	A
4.2.17.2	Wire coding for identification	N	N	N	A
4.2.17.3	Operational program marking	N	N	N	A
4.2.18	Microphonics	G	G	G	A
4.2.19	Moisture pockets	N	N	N	A
4.2.20	Multiplexing	N	N	A	A
4.2.21	Nomenclature assignment	N	N	N	A
4.2.22	Orientation	N	N	A	A
4.2.23	Panels	N	A	A	A
4.2.23.1	Control panels	N	A	A	A
4.2.23.2	Electroluminescent panels	N	A	A	A
4.2.23.3	Ranges of adjustable parts	N	A	A	A
4.2.24	Pressurization	N	N	A	A
4.2.25	Reliability	N	N	A	A

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MIL-STD-5400 Paragraph Number and Description		CON	D&V	FSED	PROD
4.2.26	Repairability	N	N	A	A
4.2.27	Safety	G	G	G	G
4.2.27.1	System safety	G	G	G	G
4.2.27.2	Personnel Safety	A	A	A	A
4.2.28	Test provision	N	N	A	A
4.2.28.1	Built-in test devices	N	N	A	A
4.2.28.2	External test points	N	N	A	A
4.2.28.3	Failure effect	N	N	A	A
4.2.29	Testability program	N	N	A	A
4.2.30	Thermal design	N	N	A	A
4.2.30.1	Cooling design data	N	N	A	A
4.2.31	Tools	N	N	N	A
4.2.31.1	Setscrew wrenches	N	N	N	A
4.2.31.2	Special tool	N	N	N	A
4.2.31.3	Furnishing and stowing	N	N	A	A
4.2.32	Standardized power supplies	N	N	A	A
4.2.33	Workmanship	N	N	A	A
4.3	Parts selection	N	A	A	A
4.3.1	Government-furnished baseline (GFB)	N	A	A	A
4.3.1.1	Choice of parts	N	A	A	A
4.3.2	Nonstandard parts	N	A	A	A
4.3.3	Parts control program	N	A	A	A
4.3.4	Approval of parts	N	A	A	A
4.3.4.1	Contracts under category I	T	T	T	T
4.3.4.2	Contracts for equipment which fall under categories II and III	T	T	T	T
4.3.4.3	Reordered production equipment	T	T	T	T
4.3.4.3.1	Continuation of production	T	T	T	T
4.3.4.4	Replacing of approved parts	N	A	A	A
4.3.4.5	Equipment performance	G	G	G	G
TABLE II	Parts selection				
4.3.5	Substitution parts	N	A	A	A
4.3.6	Batteries	N	A	A	A
4.3.7	Bearings	N	N	A	A
4.3.8	Capacitors	N	A	A	A
4.3.8.1	Fixed, tantalum electrolytic	N	A	A	A
4.3.8.2	Aluminum electrolytic	N	A	A	A
4.3.9	Circuit breakers	N	A	A	A
4.3.9.1	Manual operation	N	A	A	A
4.3.9.2	Position identification	N	A	A	A
4.3.9.3	Orientation	N	N	A	A
4.3.10	Connectors, electrical	N	N	A	A
4.3.10.1	Mounting of electrical receptacles	N	N	N	A
4.3.10.2	Adjacent locations	N	N	N	A
4.3.10.3	Jacks	N	A	A	A
4.3.11	Controls (knobs, handles, dials)	N	A	A	A

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MIL-STD-5400 Paragraph Number and Description	CON	D&V	FSED	PROD
4.3.12	N	A	A	A
4.3.13	N	N	A	A
4.3.14	N	A	A	A
4.3.15	N	N	A	A
4.3.16	N	N	A	A
4.3.17	N	N	A	A
4.3.17.1	N	N	A	A
4.3.17.2	N	N	A	A
4.3.17.3	N	N	A	A
4.3.18	N	N	A	A
4.3.18.1	N	A	A	A
4.3.18.2	N	A	A	A
4.3.18.3	N	A	A	A
4.3.18.4	N	A	A	A
4.3.18.5	N	A	A	A
4.3.18.6	N	A	A	A
4.3.19	N	N	A	A
4.3.20	N	A	A	A
4.3.21	N	A	A	A
4.3.21.1	N	A	A	A
4.3.21.2	N	A	A	A
4.3.22	N	A	A	A
4.3.22.1	N	A	A	A
4.3.22.2	N	A	A	A
4.3.23	N	A	A	A
4.3.24	N	A	A	A
4.3.25	N	A	A	A
4.3.26	N	A	A	A
4.3.27	N	N	A	A
4.3.27.1	N	N	A	A
4.3.27.2	N	N	A	A
4.3.27.3	N	N	A	A
4.3.28	N	N	A	A
4.3.29	N	N	A	A
4.3.30	N	N	A	A
4.3.30.1	N	N	A	A
4.3.30.1.1	N	N	A	A
4.3.30.1.2	N	N	A	A
4.3.31	N	N	A	A
4.3.31.1	N	N	A	A
4.3.31.2	N	N	A	A
4.3.32	N	A	A	A
4.3.33	N	A	A	A
4.3.34	N	N	A	A
4.3.35	N	N	A	A
4.3.35.1	N	N	A	A

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MIL-STD-5400 Paragraph Number and Description	CON	D&V	FSED	PROD
4.3.35.2 Wiring practices, internal	N	N	A	A
4.3.35.3 Wire and cable, external interconnection	N	N	A	A
4.3.35.4 Cable, coaxial (RF)	N	N	A	A
4.3.35.5 Printed wiring	N	N	A	A
4.4 Material selection	N	N	A	A
4.4.1 Choice of materials	N	A	A	A
4.4.2 Polyvinyl chloride (PVC) materials	N	A	A	A
4.4.3 Standard materials	N	A	A	A
4.4.4 Nonstandard materials	N	A	A	A
4.4.4.1 Approval of nonstandard materials	N	A	A	A
TABLE III Materials selection				
4.4.5 Adhesives	N	N	A	A
4.4.6 Arc-resistant materials	A	A	A	A
4.4.7 Conformal coating	N	N	A	A
4.4.8 Dissimilar metals	N	N	A	A
4.4.9 Encapsulation and embedment materials	N	N	N	A
4.4.10 Fibrous material, organic	N	N	A	A
4.4.11 Flammability of materials	N	N	A	A
4.4.12 Fungus-inert materials	N	A	A	A
4.4.13 Insulators, insulating and dielectric materials	N	A	A	A
4.4.14 Lubricants	N	N	A	A
4.4.15 Metals, corrosion-resistant	N	N	A	A
4.5 Processes and finishes	G	G	G	G
TABLE IV Processes and finishes				
4.5.1 Protective platings and coating	G	G	G	G
4.5.1.1 Materials	G	G	G	G
4.5.1.2 Aluminum alloy	G	G	G	G
4.5.1.2.1 Surface, general	G	G	G	G
4.5.1.2.2 Surfaces, bonded and grounded	G	G	G	G
4.5.1.2.3 Surfaces, extreme wear-resistant	G	G	G	G
4.5.2 Magnesium and magnesium alloys	G	G	G	G
4.5.3 Zinc and zinc-plated parts	G	G	G	G
4.5.4 Finishes	N	N	A	A
4.5.4.1 Cases and front panels	N	N	A	A
4.5.4.2 Fasteners and assembly screws	N	N	A	A
4.5.4.3 Other standard finishes	G	G	A	A
4.6 Environmental service requirements	N	N	A	A
4.6.1 MIL-STD-810 environmental tests	T	T	T	T
4.6.1.1 Untitled	T	T	T	T
4.6.2 Equipment operational requirements	N	N	A	A
4.6.2.1 Temperature	N	N	A	A
4.6.2.1.1 Operating	N	N	A	A
TABLE V Environmental conditions				
4.6.2.1.2 Nonoperating	N	N	A	A
4.6.2.2 Altitude	N	N	A	A

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4.6.2.4	Humidity	N	N	A	A
4.6.2.5	Vibration	N	N	A	A
4.6.2.5.1	Equipment normally mounted	N	N	A	A
4.6.2.5.1.1	Equipment designed for installation in propeller aircraft	N	N	A	A
4.6.2.5.1.2	Equipment designed for installation in jet aircraft	N	N	A	A
4.6.2.5.1.3	Equipment designed for installation in helicopters	N	N	A	A
4.6.2.5.1.4	Minimum integrity test	N	N	A	A
4.6.2.6	Shock	N	N	A	A
4.6.2.6.1	Equipment	N	N	A	A
4.6.2.6.2	Mounting base (crash safety)	N	N	A	A
4.6.2.6.3	Bench handling	N	N	A	A
4.6.2.7	Sand and dust	N	N	A	A
4.6.2.8	Fungus	N	N	A	A
4.6.2.9	Salt atmosphere	N	N	A	A
4.6.2.10	Explosive conditions	N	N	A	A

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