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MILITARY HANDBOOK

**ELECTRONIC EQUIPMENT, AIRBORNE
GENERAL GUIDELINES FOR**



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FOREWORD

1. This military handbook 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: Commander, Systems Standardization, Code 4.1.4.2B120-3, Naval Air Warfare Center Aircraft Division, Highway 547, 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 handbook provides guidance for implementing and tailoring guidelines and documents contained in MIL-HDBK-454 Standard General Guidelines for Electronic Equipment, which have applicability in the design and production of electronic equipment for airborne applications. Included in this handbook 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 handbook contains general guidelines for electronic equipment for operation in piloted aircraft and helicopters, missiles, boosters and allied vehicles. Detail electrical and mechanical design, performance and test requirements should be as specified in the detail specification or contract. This handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

1.1.1 Application. This handbook should not be invoked on a blanket basis; however, each guideline should be assessed in terms of need. This handbook is a compendium of general guidelines, the majority of which have been selected from MIL-HDBK-454, for specific applicability to airborne electronic equipment. Individual detail 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 in applying MIL-HDBK-5400 guidelines to the various phases of equipment design, development and production.

1.2 Classification. Suggested classification for design and manufacture of electronic equipment is as follows (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°C (+71°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°C (+71°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°C (+71°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°C (+95°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°C (+125°C intermittent operation).
- 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).

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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 of the equipment.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in Appendix A are not necessarily all of the documents referenced in this handbook but are the ones that are needed to fully understand the information provided by this handbook.

2.2 Applicable issues. Unless otherwise specified, the applicable issues of documents listed in Appendix A are 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 should be the issue specified in the solicitation.

2.3 Copies. Copies of specifications, standards, handbooks, 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 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.

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

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

3.4 Complete operating equipment. Complete operating equipment is defined as 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

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themselves and not require the addition of detail parts, accessories or components to perform a specified operational function.

3.5 Detail specification. For purposes of this handbook, the term "detail 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 specification may be prepared by the Government, the equipment manufacturer for the Government, or the prime vehicle contractor. The preparing activity of the detail specification should utilize the applicable guidance contained in this handbook in the preparation of that specification.

3.6 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.

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

3.8 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.

3.9 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.

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

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

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3.12 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 specification for the purpose of simulating anticipated field service demands as closely as possible.

3.13 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.

3.14 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.

3.15 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.

4. GENERAL GUIDELINES

4.1 This section contains general guidelines 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-HDBK-454 as applicable to airborne electronic equipment.

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

4.1.2 Standard hardware acquisition and reliability program (SHARP). This handbook 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, should be utilized to the maximum extent possible.

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SHARP developed hardware includes standard electronic modules (SEMs), standard enclosure systems (SES), standard power supply systems (SPS), and standard battery systems (SBS). SEMs should 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-HDBK-454 guideline or MIL-HDBK-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> |
|-----|--|--------------|
| 4.2 | General Design and Construction | I |
| 4.3 | Parts Selection | II |
| 4.4 | Materials Selection | III |
| 4.5 | Processes and Finishes | IV |
| 4.6 | Environmental Service Requirements | V |
| | Figure 1 - Operational Requirements Class 1, 1A, 1B | |
| | Figure 2 - Operational Requirements Class 2 | |
| | Figure 3 - Operational Requirements Class 3, 5 | |
| | Figure 4 - Operational Requirements Class 4 | |

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.

4.2.2 Accessibility. Guidance for accessibility to parts, wiring and terminations within equipment is contained in MIL-HDBK-454, Guideline 36.

4.2.3 Anti-jamming. The electronic system or equipment should be designed to obtain the maximum inherent protection against possible interfering signals caused by enemy jamming. The contractor should 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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Table I. General design and construction.

| Subject | MIL-HDBK-5400 Paragraph | MIL-HDBK-454 Guideline |
|--------------------------------------|----------------------------|---------------------------|
| Accessibility | 4.2.2 | 36 |
| Anti-Jamming | 4.2.3 | -- |
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| Corona | 4.2.5 | 45 |
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| Electromagnetic interference control | 4.2.9 | 61 |
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| Enclosures | 4.2.11 | 55 |
| Fabrication | 4.2.12 | -- |
| Grounding, bonding & shielding | 4.2.13 | 74 |
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| Multiplexing | 4.2.20 | -- |
| Nomenclature | 4.2.21 | 34 |
| Orientation | 4.2.22 | -- |
| Panels | 4.2.23 | -- |
| Pressurization | 4.2.24 | -- |
| Reliability | 4.2.25 | 35 |
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| Tools | 4.2.31 | 63 |
| Standard power supplies | 4.2.32 | -- |
| Workmanship | 4.2.33 | 9 |

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

4.2.5 Corona and electrical breakdown prevention. Equipment should be protected against corona and electrical breakdown. Guidance regarding corona and electrical breakdown is given in MIL-HDBK-454, Guideline 45.

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4.2.6 Derating. Guidance for derating of electronic parts and materials should be in given in MIL-HDBK-454, Guideline 18. In addition, 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 should be provided by fuses or circuit breakers. Circuit breakers should 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 should be incorporated in the equipment and should be contained in the same compartment.

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

4.2.8.1 Warm-up time. Warm-up time should be such as to provide the specified performance within a period as specified by the detail specification. Unless otherwise specified, the warm-up time at temperatures down to -54°C should not exceed 2 minutes for equipment essential to flight safety, and should 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 should have electrical interface characteristics compatible with the applicable power system classification of MIL-STD-1399, Section 300.

4.2.9 Electromagnetic interference control. Guidance regarding electromagnetic interference control requirements, tests and test methods is given in MIL-HDBK-454, Guideline 61.

4.2.10 Electrostatic discharge control. Requirements for the establishment and implementation of an electrostatic discharge control program, including its deliverable data requirements, should be tailored for applicability to equipment and specified directly in the contract or detail specification. MIL-HDBK-263 provides guidance for the implementation of an ESD control program. Also, refer to MIL-HDBK-454, Guideline 75, for additional guidance in this area.

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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 should 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. Guidance for the design and construction of other equipment enclosures (e.g., consoles, cabinets, cases), is given in MIL-HDBK-454, Guideline 55, except that performance for mounting bases should 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, should be subject to approval of the acquisition activity. Positive self-locking case mounting fasteners should be used on all mountings. The fasteners chosen should be of a size specified for the weight of the equipment unit.

4.2.12 Fabrication. Boxes, cases, shields and compartment walls should 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 should be in accordance with MIL-B-5087. MIL-HDBK-274 provides guidance information relative to grounding practices for aircraft. Refer to MIL-HDBK-454, Guideline 74, for guidance covering Air Force applications.

4.2.14 Human engineering. Requirements for human engineering should be provided and tailored for applicability to the equipment and specified directly in the contract or detail specification. MIL-STD-1472 provides design criteria which may be selectively applied. Refer to MIL-HDBK-454, Guideline 62, for guidance covering Air Force applications.

4.2.15 Interchangeability. Provisions should be taken to assure for the interchangeability of parts, subassemblies, and assemblies. Information regarding interchangeability is contained in MIL-HDBK-454, Guideline 7.

4.2.15.1 Interchangeability of reordered equipment. For reordered equipment, interchangeability should 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.

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4.2.16 Maintainability. Requirements for the establishment of a maintainability program (maintainability program tasks, quantitative requirements, and verification or demonstration requirements) tailored for applicability to the equipment and program phase, should be specified directly in the contract or detail equipment specification. Other maintainability requirements which may be invoked and cited directly as a basis for contract are contained in MIL-STD-471. MIL-HDBK-472 gives guidance regarding maintainability programs for electronic equipment.

4.2.17 Marking. Guidance for the marking of items is given in MIL-HDBK-454, Guideline 67. Marking should 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 should be provided where space permits. Labels should 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 should be distinctly coded by color or numbers, insofar as practicable. Codes should 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 should not be used where they would be difficult to read or trace. Flat cable conductors may be identified to termination points. The outer conductor of a flat multiconductor cable should be coded continuously for identification and orientation. Hot or cold stamp should be allowed only on insulated wire which will not accept ink. Marking should not be used on wires where the dielectric capability of the wire is reduced by such marking. Wire used for external wiring between units should be coded in accordance with MIL-W-5088.

4.2.17.3 Operational program marking. Operationally programmed units should provide a means to identify the software part number and the revision of the software program. Guidance is provided by MIL-HDBK-454, Guideline 67.

4.2.18 Microphonics. Equipment should be designed so that microphonics are not detrimental to equipment performance.

4.2.19 Moisture pockets. Guidance for the treatment and drainage of moisture pockets is given in MIL-HDBK-454, Guideline 31.

4.2.20 Multiplexing. Unless otherwise specified, multiplexing should 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 should be in accordance with MIL-STD-1553. MIL-HDBK-1553 provides guidance information for implementation of MIL-STD-1553.

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4.2.21 Nomenclature assignment. Nomenclature assignment should be in accordance with MIL-STD-196, along with MIL-N-18307 for the Navy, MIL-STD-1812 for the Air Force, and the contract for the Army.

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

4.2.23 Panels.

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

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

4.2.23.3 Ranges of adjustable parts. The electronic circuitry should 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 should 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 should 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 should be met:

- a. The case should withstand a positive or negative 5 psi pressure difference over the applicable pressure range.
- b. The case should be of a type that will permit ready opening and clearing for access to the equipment for repair and maintenance. If practicable, the equipment should be completely operable after removal from the case, and alignment should be unaffected by replacement in the case.
- c. When possible and advantageous, external points should be provided for check without removal from the case.

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- d. A means should 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. A Schrader type 3715 gage, or equivalent should be used to measure the pressure.
- e. Sealing instructions should be placed on one side of the case, if practicable.
- f. Those parts of an equipment, including transmission lines, that are pressurized should 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°C 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 should 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 should be provided.
- g. Unless specified or permitted in the detail specification, pressure should be maintained without the use or need of a pressurization pump. When a pressurization pump is required, redundant barostatic switches, or similar automatic means, should be provided to assure equipment is pressurized during flight, even though it is not being operated. The switch or automatic means should be energized from a common point and should be energized from a common point and should be energized as part of the take-off procedure.
- h. The equipment should maintain pressure to accommodate the maximum operating time; in addition, and where applicable for captive and nonoperating flight, the equipment should maintain operating pressure for periods up to 24 hours. Unless otherwise determined as satisfactory, the loss of pressure should not exceed 5 pounds in a 24-hour period at the altitude and temperature specified in the detail specification.
- i. If required, a desiccant should be provided within the case.
- j. Parts used in pressurized container should meet the guidelines of this handbook, except that the altitude conditions 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) tailored for

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applicability to the equipment and program phase should be specified directly in the contract or detail specification. Other reliability requirements which may be invoked and cited directly as a basis for contract requirements are contained in MIL-STD-1629. MIL-HDBK-217 gives additional guidance regarding reliability programs for electronic equipment.

4.2.26 Repairability. Repairability should 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 should 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 should be tailored for applicability to the equipment and acquisition phase and specified directly in the contract or detail specification.

4.2.27.2 Personnel safety. Guidance provisions for safety of personnel during installation, operation, maintenance and repair is provided in MIL-HDBK-454, Guideline 1.

4.2.28 Test provisions. Test provisions to provide means for monitoring performance, calibration and fault isolation should be directly specified in the detail specification or contract. Refer to MIL-HDBK-454, Guideline 32 for guidance in this area.

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

4.2.28.2 External test points. Protection should 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 should 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) should be tailored for applicability to the equipment and program phase, and specified directly in the contract or detail specification.

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4.2.30 Thermal design. Guidance for thermal design is contained in MIL-HDBK-454, Guideline 52, and MIL-STD-2218.

4.2.30.1 Cooling design data. Cooling design data should be developed as soon as possible after major circuit parameters have been established. Initially, this data should 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 should 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 should be conducted. Refer to MIL-STD-2218 for additional guidance in this area.

4.2.31 Tools.

4.2.31.1 Setscrew wrenches. One wrench for each size and type setscrew head employed for operational adjustments should be securely mounted within the equipment in a readily accessible location. Each wrench should 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, 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 should be furnished by the contractor except that the contractor should not mount tools in the equipment or make space provisions therefore, unless required by the detail 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 should be as specified in MIL-STD-2038. Power supplies conforming to MIL-P-29590 should be of primary consideration for airborne applications.

4.2.33 Workmanship. Guidance for workmanship of mechanical assembly should be applied as given in MIL-HDBK-454, Guideline 9.

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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 should be the primary selection source for standard parts (see 4.3.3). The applicable GFB parts should 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 should be used whenever suitable.

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 should consider the use of the broadest characteristics and greatest allowable tolerances to fulfill the overall requirement. The manufacturer should 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 should 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 the required part or Appendix A does not provide an applicable part standard or specification, the contractor should select a part from other established specifications or standards specified in the contract or by the design activity. 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, including parts approval by the acquisition activity, should be directly specified in the detail specification or contract. Refer to MIL-HDBK-454, Guideline 22 and MIL-HDBK-402 for guidance in this area. A Military Parts Control Advisory Group (MPCAG) review in accordance with the requirements of MIL-STD-965 should be considered.

NOTE: The Parts Control Program requires the approval and listing of all parts in a PPSL unless the requirements have been otherwise tailored.

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TABLE II. Parts selection.

| Subject | MIL-HDBK-5400 Paragraph | MIL-HDBK-454 Guideline |
|---|----------------------------|---------------------------|
| Batteries | 4.3.6 | 27 |
| Bearings | 4.3.7 | 6 |
| Capacitors | 4.3.8 | 2 |
| Circuit breakers | 4.3.9 | 37 |
| Connectors, electrical | 4.3.10 | 10 |
| Controls (knobs, handles, dials) | 4.3.11 | 28 |
| Crystal units (quartz) | 4.3.12 | 38 |
| Fastener hardware | 4.3.13 | 12 |
| Filters, electrical | 4.3.14 | 70 |
| Fuses & fuseholders | 4.3.15 | 39 |
| Gears | 4.3.16 | 48 |
| Hydraulics | 4.3.17 | 49 |
| Lights and associated items | 4.3.18 | 50 |
| Meters, electrical indicating | 4.3.19 | 40 & 51 |
| Microelectronic devices | 4.3.20 | 64 |
| Motors | 4.3.21 | 46 |
| Readouts and displays | 4.3.22 | 68 |
| Relays | 4.3.23 | 57 |
| Resistors | 4.3.24 | 33 |
| Semiconductor devices | 4.3.25 | 30 |
| Servodevices, rotary | 4.3.26 | 56 |
| Sockets, shields and mounting pads | 4.3.27 | 60 |
| Springs | 4.3.28 | 41 |
| Standard electronic modules (SEMs) | 4.3.29 | 73 |
| Switches | 4.3.30 | 58 |
| Terminations | 4.3.31 | 19 |
| Transformers, inductors and coils | 4.3.32 | 14 |
| Tubes, electron | 4.3.33 | 29 |
| Waveguides and related items | 4.3.34 | 53 |
| Wire and cable | 4.3.35 | -- |
| Wire and cable, internal | 4.3.35.1 | 20 & 66 |
| Wiring practices, internal | 4.3.35.2 | 69 |
| Wire and cable external interconnection | 4.3.35.3 | 71 |
| Cable, coaxial (RF) | 4.3.35.5 | 65 |
| Printed wiring | 4.3.35.6 | 17 |

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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 should 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 should 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 should 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 should be performed on contracts for reordered equipment, whether reordered from the original contractor or from a different contractor. Where applicable, the PPSL listing should be utilized for the review function by the MPCAGs. 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 is not required.

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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 should be a "Request for Deviation" in accordance with the applicable configuration management requirements of the contract. The standard/approved item should be listed in technical manuals, parts lists, etc.

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

4.3.5 Substitution of parts. Information regarding the selection and application of substitute parts is given in MIL-HDBK-454, Guideline 72.

4.3.6 Batteries. The use of batteries requires approval of the acquisition activity. Batteries should be selected and applied using guidance given in MIL-HDBK-454, Guideline 27.

4.3.7 Bearings. Bearings should be selected and applied using guidance given in MIL-HDBK-454, Guideline 6.

4.3.8 Capacitors. Capacitors should 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 should not be used.

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

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

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

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4.3.9.2 Position identification. Circuit breakers should 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 should 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 should not vary more than ± 5 percent of the current specified for normal position mounting. Circuit breakers used on flight equipment should operate within the limits of the detail specification when the equipment is in any position or rotation about its three principal axes.

4.3.10 Connectors, electrical. Electrical connectors should be selected and applied in accordance with MIL-STD-1353. Additional selection and application guidance is given in MIL-HDBK-454, Guideline 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 should 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. However, when necessary, the master keyway should be forward if designated.

4.3.10.2 Adjacent locations. MIL-W-5088 gives requirements for the spacing of electrical connectors used in adjacent locations.

4.3.10.3 Jacks. Microphone jacks should be type M641/5-1 and headset jacks should 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 should be selected and applied in accordance with MIL-K-25049. Handles should be selected and applied in accordance with MIL-H-8810. Multiturn counter control dials should be selected and applied in accordance with MIL-D-28728. Additional application information is specified in MIL-HDBK-454, Guideline 28.

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

4.3.13 Fastener hardware. MIL-HDBK-454, Guideline 12 gives information regarding applicable fastener specifications, mounting methods and techniques.

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

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

4.3.16 Gears. Gears should 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 should 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 should be as follows:

4.3.17.1 Aircraft. The design and installation of hydraulic systems for aircraft should 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 should be as specified directly in the detail specification or contract.

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

4.3.18 Lights and associated items.

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

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

4.3.18.3 Instrument lights. Instrument lighting should 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 should be in accordance with MIL-L-5057.

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

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4.3.18.5 Visual display and legend lights. Visual display and legend lights should 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 should apply.

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

4.3.20 Microelectronic devices. Microelectronic devices, including hybrids, should be selected and applied using guidance given in MIL-HDBK-454, Guideline 64. Devices selected should 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) should be in accordance with MIL-M-7969, except that motors used with a miniature blower for cooling electronic equipment should be in accordance with MIL-B-23071.

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

4.3.22 Readouts and displays.

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

4.3.22.2 Displays. Light emitting diode (LED) displays should 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 should be selected and applied in accordance with MIL-STD-1346. Hermetically sealed types only should be used. Reed relays should be in accordance with MIL-R-83516, and require acquisition activity approval for use in airborne electronic equipment.

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

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4.3.25 Semiconductor devices. Semiconductor devices should be selected and applied in accordance with MIL-STD-701. Information concerning the order of precedence and restrictions in the selection of semiconductor devices is given in MIL-HDBK-454, Guideline 30.

4.3.26 Servodevices, rotary. Guidance concerning the selection and application of rotary servodevices is given in MIL-HDBK-454, Guideline 56.

4.3.27 Sockets, shields and mounting pads.

4.3.27.1 Sockets. Sockets for plug-in electronic parts should be of the single unit type and should 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 should 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 should conform to A-A-55485.

4.3.28 Springs. Springs and spring material should be selected and applied in accordance with MIL-HDBK-454, Guideline 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 should be utilized to the maximum extent possible. SEMs should be designed in accordance with MIL-STD-1389. SEMs should be applied 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 should be selected and applied in accordance with MIL-STD-1132.

4.3.30.1 Mounting.

4.3.30.1.1 Rotary switches. Rotary switches with thru-panel shafts should 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, should be provided to prevent rotation of the switch body.

4.3.30.1.2 Toggle switches. The mounting of toggle switches should be such that the handle of the switch operates in a vertical direction. The "off" position should 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.

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4.3.31 Terminations. The selection of stud terminals, lug terminals, feed-thru terminals, binding posts, terminal boards, terminal junction systems and splices should 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 should not be greater than three. Multisection turret, bifurcated, or multi-hole lug terminals should have not more than three wires per section, tongue, or hole. In no case should the total cross sectional area of the terminated wires exceed the cross sectional area capacity of the terminal or lug. If a greater number of wires is required than those specified herein, approval of the acquisition activity should 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 should 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 should be connected to any one terminal of a board covered by MS27212. Accessories such as stud connectors, straddle plates, jumpers and terminal board lugs should be counted as lugs for this purpose.

4.3.31.3 Number of wires in a connector contact. In order to facilitate contact insertion and removal and wire sealing, only one wire should be terminated in a crimp contact in an electrical connector.

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

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

4.3.34 Waveguides and related items. Guidance concerning the selection and application of waveguides and related items is given in MIL-HDBK-454, Guideline 53.

4.3.35 Wire and cable. Wire and cable having polyvinyl chloride (PVC) or FEP/polyimide (Kapton) insulating material should 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. Further information concerning restrictions of other wire types is given in MIL-HDBK-454, Guideline 20. Multiconductor cables conforming to MIL-C-7078

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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-HDBK-454, Guideline 66.

4.3.35.2 Wiring practices, internal. Internal wiring practices and wiring devices should conform to MIL-HDBK-454, Guideline 69. Use of organizational architectures, i.e., OIM (Organized wire, Integration boards, Mass termination), is strongly encouraged.

4.3.35.3 Wire and cable, external interconnection. Wires conforming to MIL-W-22759 and MIL-W-81044, as identified in MIL-W-5088, Appendix A, and cables conforming to 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-HDBK-454, Guideline 71 and MIL-W-5088, as applicable.

4.3.35.4 External wiring practices. The use of organized wiring systems (OWS) architecture and wiring practices specified in MIL-W-5088 is strongly encouraged to facilitate reliability, maintainability, and reduction of weight.

4.3.35.5 Cable, coaxial (RF). Coaxial cables (RF) should selected using the requirements of MIL-C-17, MIL-L-3890, MIL-C-22931, or MIL-C-23806.

4.3.35.6 Printed wiring. Printed wiring boards, assemblies, cards and associated hardware should be in accordance with MIL-STD-1861. Printed wiring boards should be connected into the equipment by means of connectors. Printed wiring boards utilizing the conductor pattern as the direct contact with the mating connector should 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-HDBK-454 guidelines, 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 should 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.

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TABLE III. Materials selection.

| Subject | MIL-HDBK-5400 Requirement | MIL-HDBK-454 Guideline |
|---|---------------------------|------------------------|
| Adhesives | 4.4.5 | 23 |
| Arc resistant materials | 4.4.6 | 26 |
| Conformal coating | 4.4.7 | -- |
| Dissimilar metals | 4.4.8 | -- |
| Encapsulation and embedment materials | 4.4.9 | -- |
| Fibrous materials, organic | 4.4.10 | 44 |
| Flammability of materials | 4.4.11 | 3 |
| Fungus inert materials | 4.4.12 | 4 |
| Insulators, insulating and dielectric materials | 4.4.13 | 11 |
| Lubricants | 4.4.14 | 43 |
| Metals, corrosion resistant | 4.4.15 | -- |

4.4.2 Polyvinyl chloride (PVC) materials. Polyvinyl chloride (PVC) materials should 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 should be used whenever they are suitable for the purpose. Materials should 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 should select a material from other established specifications or standards in accordance with the order of preference set forth in the contract. 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.

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

4.4.5 Adhesives. The guidelines contained in MIL-HDBK-454, Guideline 23 should be used when selecting and applying adhesives. The use of adhesives in electrical applications requires the approval of the acquisition activity.

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4.4.6 Arc-resistant materials. Arc-resistant materials should be selected and applied using the guidance given in MIL-HDBK-454, Guideline 26.

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

4.4.8 Dissimilar metals. Selection and protection of dissimilar metal combinations should be in accordance with MIL-STD-889. The use of dissimilar metals should 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 should be of a nonreversion type and should 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 should be capable of filling all voids and air spaces in and around the items being encased. Refer to MIL-HDBK-454, Guideline 47 for additional guidance information.

4.4.10 Fibrous material, organic. Organic fibrous material should be selected and applied using guidance given in MIL-HDBK-454, Guideline 44.

4.4.11 Flammability of materials. Materials used in military equipment should, 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 should not be achieved by use of nonpermanent additives to the basic material. Refer to MIL-HDBK-454, Guideline 3 for additional 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 should be accomplished using the guidance provided in MIL-HDBK-454, Guideline 4.

4.4.13 Insulators, insulating and dielectric materials. The selection and application of insulators, insulating and dielectric materials should be made using the guidance provided in MIL-HDBK-454, Guideline 11.

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

4.4.15 Metals, corrosion resistant. Metals should be corrosion resistant or should be coated or metallurgically processed to resist corrosion. Materials and processes for metallic parts should conform to

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applicable requirements of MIL-STD-889 and MIL-STD-1516. Coatings should be selected from MIL-STD-1516.

4.5 Processes and finishes. Processes and finishes, except painting, should be in accordance with Table IV and, where applicable, using the guidance of the referenced MIL-HDBK-454 guideline or supplemental paragraph herein. Welding and brazing should 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 should 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 should 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 should 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, should 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 MIL-F-14072, Type II 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 should 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.

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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 |
| Soldering, component mounting, etc. - electrical/electronic assembly | 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 MIL-HDBK-454, 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 MIL-HDBK-454, 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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4.5.3 Zinc and zinc-plated parts. Zinc and zinc-plated parts should 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) should be resistant to corrosion. Finishes should be capable of withstanding a 48-hour Salt Spray (Fog) test in accordance with MIL-STD-810, Method 509, Procedure I, without showing signs of corrosion beyond those established for the particular part, material or finish specification. Where applicable, these parts should have finishes providing suitable rates of heat lubricated condition. Lusterless finishes should be used on all surfaces visible to operating personnel. Where cleaning operations on metal parts are not specified in detail, they should 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 should be Lusterless Black, Color No. 37038, in accordance with FED-STD-595. Unless otherwise specified, finish of all other equipment should 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 should 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 should be finished using the guidance provided in 4.5.4.1. Other external fasteners and assembly screws used for securing the internal parts to the chassis should 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 should be used.

4.6 Environmental service guidelines.

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

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must be tailored for the selection of appropriate test procedure, test duration, variations, limits, tolerances, etc., and invoked directly in the detail specification or contract. The services of an environmental specialist may be required to effectively tailor and apply MIL-STD-810 into the detail 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 specification or contract for the proper performance of these tests.

| <u>Test</u> | <u>Method No.</u> |
|-------------------------|-------------------|
| Low Temperature | 502 |
| High Temperature | 501 |
| Altitude (Low Pressure) | 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 should be designed and constructed that no fixed part or assembly becomes 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 specification during operation or after storage in ambient conditions, as follows:

4.6.2.1 Temperature. The equipment should 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 should be capable of operating 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 should be capable of withstanding long periods of exposure to the temperature extremes and shock as listed in table V.

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TABLE V. Environmental conditions.

| Equipment operating | | | | | | | | | | Equipment nonoperating | |
|---|------------------------|--------------------------|------------------------|------------------------------------|------------------------------------|------------------------------------|---------------------------------|---|--------------------------------|-------------------------------|--|
| Temperature extremes for the chamber (without external cooling provisions) | | | | | Combined temperature-altitude | | | Temperature Shock | Temperature Extremes | Temperature Shock | |
| Equipment class | Column 1 continuous | Column 2 intermittent | Column 3 short-time | Column 4 | Column 5 | Column 6 | Column 7 | Equipment operating and nonoperating Altitude | | | |
| Class 1 | -54°C +55°C | 30 min. +71°C | ... | Defined by curve A, figure 1 | Defined by curve B, figure 1 | ... | Column VII -54°C to +71°C | Sea level (30.0 in. Hg.) (3.4 in. Hg.) 50,000 ft. | Column IX -57°C to +85°C | Column X -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.

2/ Classes 1A and 1B equipment should withstand a nonoperating altitude of 40,000 feet (5.5 in. Hg.) for altitude above 100,000 ft.; the equipment's surrounding environment should not exceed 71°C and means should be available for rejection of heat into the surroundings by conduction, radiation or some other means.

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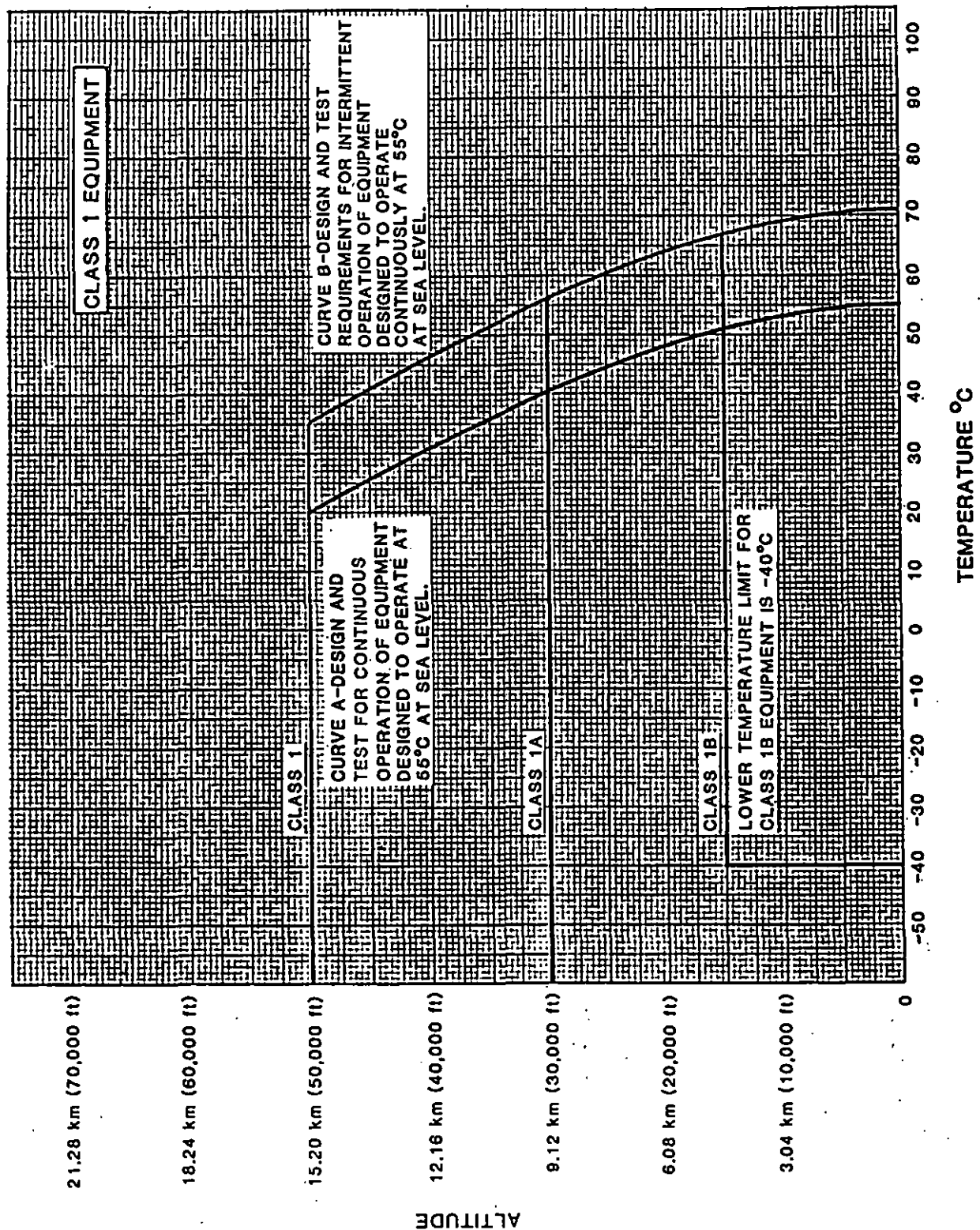


FIGURE 1. Operational guidelines for class 1 airborne electronic equipment (temperature vs altitude).

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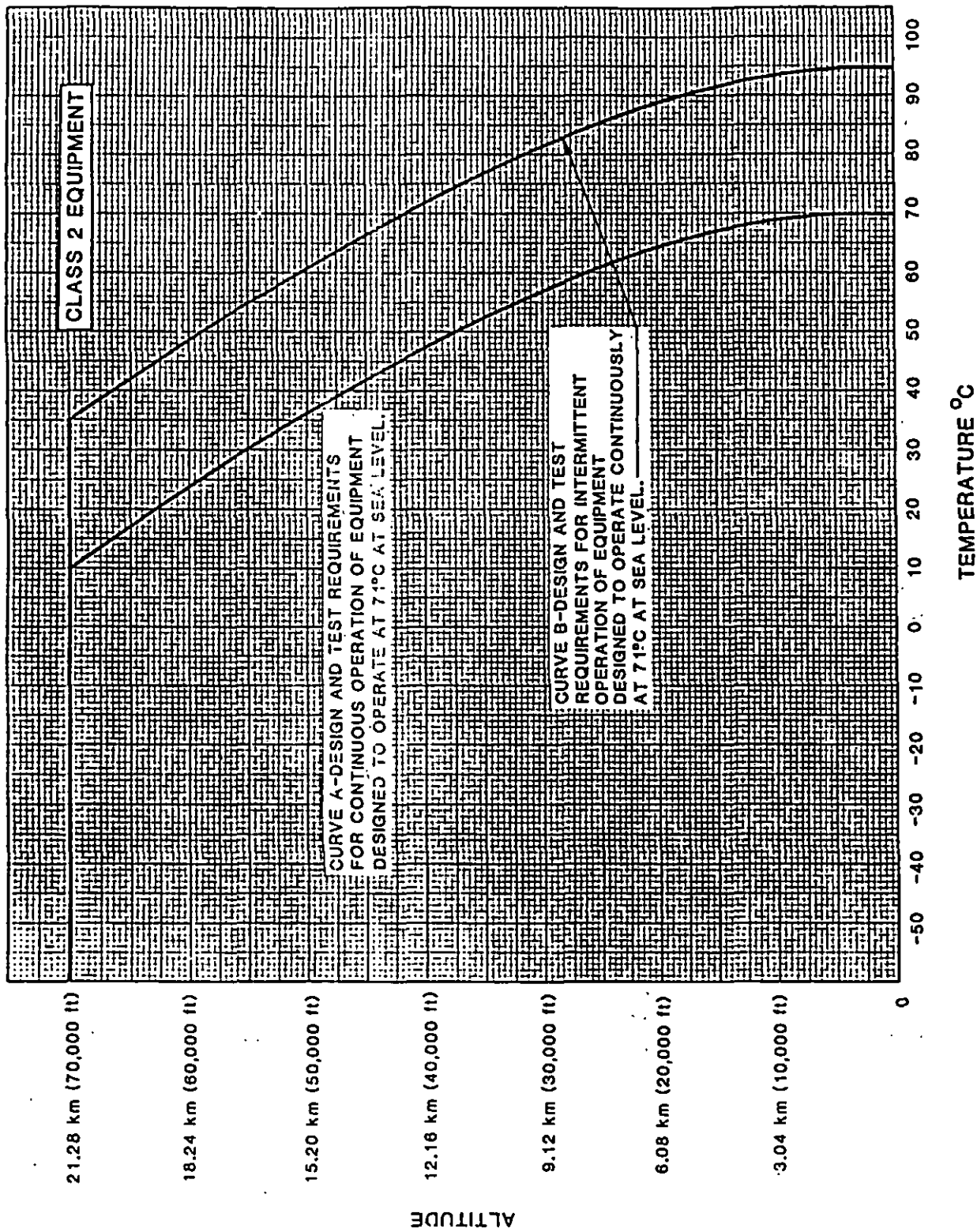


FIGURE 2. Operational guidelines for class 2 airborne electronic equipment (temperature vs altitude).

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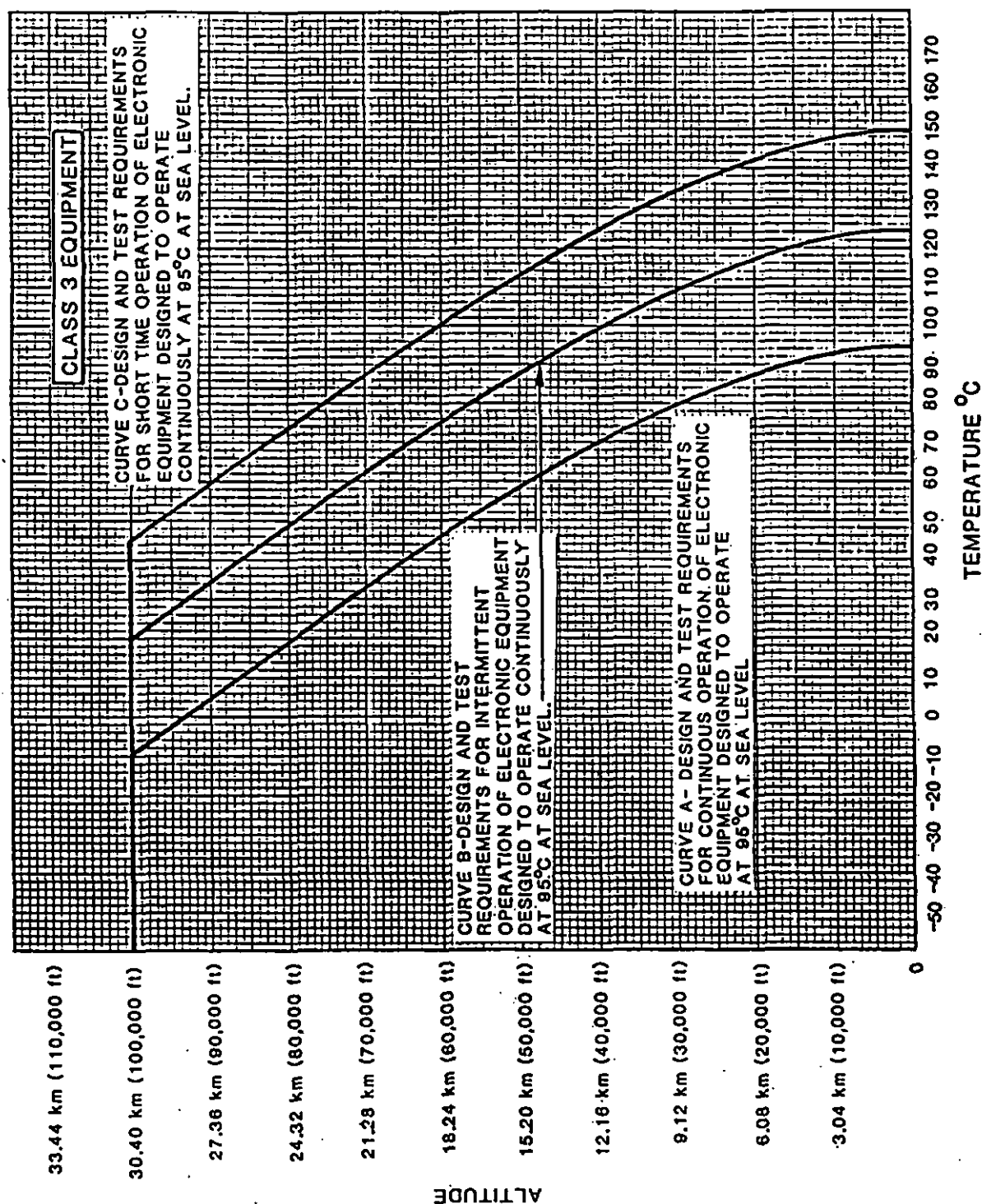


FIGURE 3. Operational guidelines for class 3 airborne electronic equipment (temperature vs altitude).

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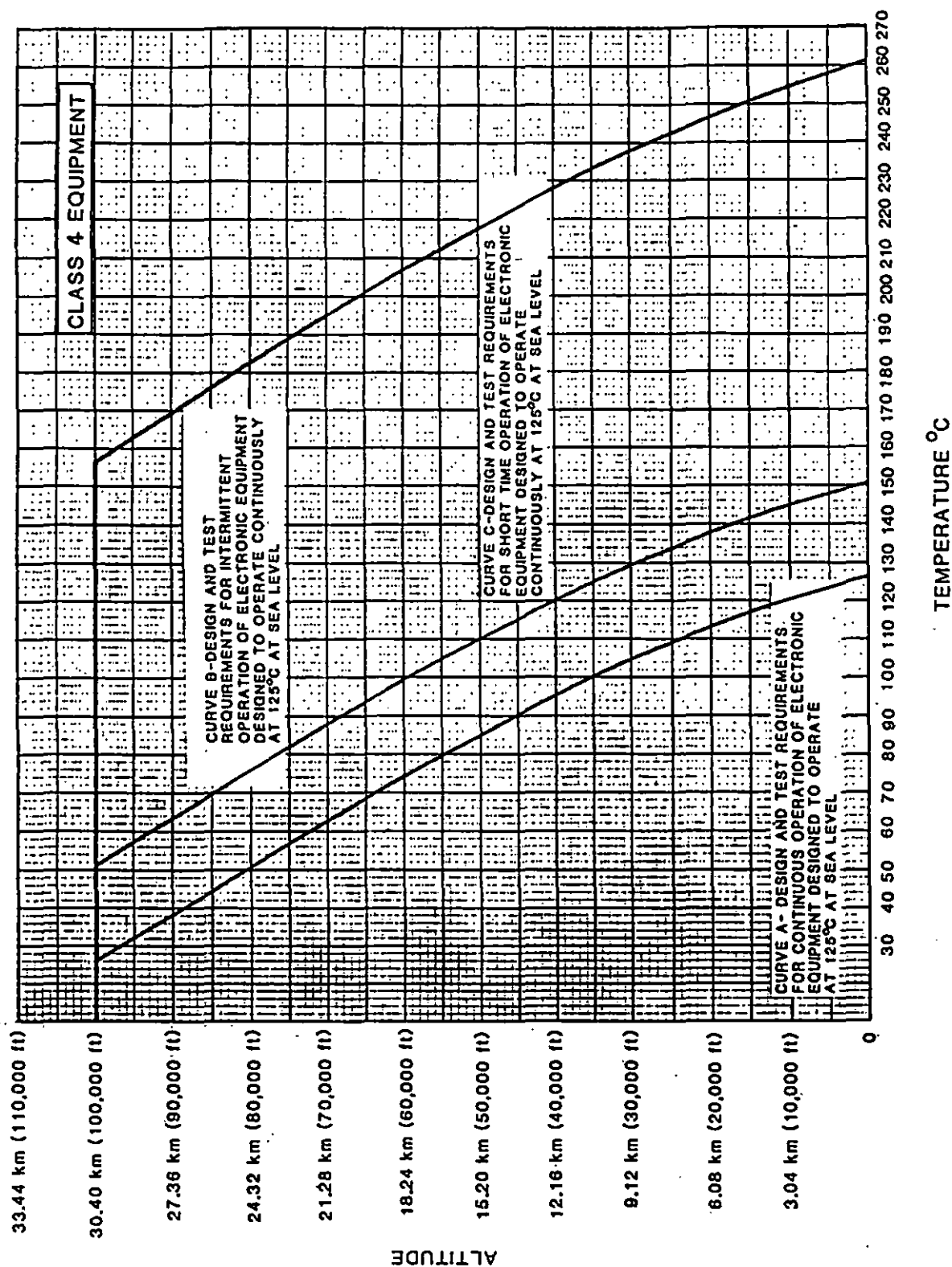


FIGURE 4. Operational guidelines for class 4 airborne electronic equipment (temperature vs altitude).

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4.6.2.2 Altitude. The equipment should 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 should be capable of operating under the applicable temperature-altitude combinations shown on figures 1 through 4, as applicable.

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

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 should not suffer damage or fail to meet specified performance when subjected to the applicable vibration environment detailed herein or as specified in the detail 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) should be determined using the following criteria.

4.6.2.5.1.1 Equipment designed for installation in propeller aircraft. Equipment of this type should 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 should 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 should 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 should 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, should 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

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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) should not suffer damage or subsequently fail to provide the performance specified in the detail 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 should 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 base, individual isolators, or other attaching devices should 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 should have time duration of 6 to 9 milliseconds. The "g" value should be within ± 10 percent when measured with a 0.2 to 250 Hz filter. Bending and distortion should be permitted; however, there should be no failure to the attaching joints, and the equipment or dummy load should remain in place.

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

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

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

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

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5. DETAIL GUIDELINES

5.1 Detailed mechanical and electrical design. Specific requirements for individual equipment should be as specified in the detail specification or contract. The detailed mechanical and electrical design of specific equipment should be accomplished by the contractor, using the guidelines of this handbook and any detail specification to which it is subsidiary. This handbook is 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 should 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 should 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 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 consists of (a) surveillance of the operations to determine that practices, 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 specification or contract.

5.3.3 Failure criteria. Unless otherwise specified in the detail specification or contract, the equipment, or portions thereof, should 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.

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- 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 should be specified in the contract or detail specification. In addition, a report depicting the yield or percentage of failures that occurred for each level of hardware should be specified in the contract or detail specification. For correction and consideration, a Government-Industry Data Exchange Program (GIDEP) should be established and specified in the contract or detail specification.

5.3.5 Design qualification tests. Design qualification testing should be performed prior to commitment to production. The requirements for design qualification of the equipment, to demonstrate that it conforms to specified performance and reliability requirements under specified combined environmental conditions, should be cited in the contract or detail specification. The requirements for environmental stress screening (ESS), to detect and correct latent manufacturing defects before the initiation of reliability accounting tests and applied in conjunction with the design qualification requirements, should be specified in the contract or detail specification. These tasks identify the details to be specified by the acquisition activity and the applicable Data Item Description (DIDs) for incorporation into the CDRL (DD Form 1423). Refer to MIL-STD-2218 for guidance on thermal design verification tests.

5.3.6 First article tests. The first article tests should be performed in conjunction with production contracts only. The requirement for the performance of first article tests should be specified in the detail 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 should include all tests deemed necessary by the acquiring activity to determine that the equipment meets all of the requirements specified in the detail specification or contract. These tests should include environmental tests in accordance with the test methods and procedures of MIL-STD-810. Electro-magnetic interference tests and test methods should be in accordance with MIL-STD-461.

5.3.7 Quality conformance tests. The requirement for the performance of quality conformance tests should be specified in the detail specification or contract. Quality conformance tests are those tests deemed necessary to determine that the equipments submitted for acceptance under the contract are

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equivalent in performance and construction to the approved first article equipment. Quality conformance tests should 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, to determine that production equipment continues to conform to performance and reliability requirements under specific environmental conditions, should be specified in the contract or detail specification. Production reliability acceptance tests identify 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 should be specified in the detail 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 handbook is intended as a general design guide for use in the development and preparation of detail 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 handbook only provides guidance, the detail 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 1.1.2 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).

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- 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).
- 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 4.6.2.10).
- 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.

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

- 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

Custodians:

Army-CR
Navy-AS
Air Force-11

Preparing activity:

Navy - AS

(Project GDRQ-0164)

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 NOT A MANDATORY PART OF THIS HANDBOOK. THE INFORMATION CONTAINED HEREIN IS INTENDED FOR GUIDANCE.

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 should be specified by the contracting or design activity, unless otherwise cited herein or in the referenced MIL-HDBK-454 guidelines.

20. APPLICABLE DOCUMENTS

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

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 should be used.

20.3 Copies. Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the 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.

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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.

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

| | |
|------|--|
| AGMA | American Gear Manufacturers' Association 1500 King Street, Suite 201 Alexandria, VA 22314 |
| AMS | Society of Automotive Engineers, Inc. (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 Miami, FL 33126 |
| EIA | Electronic Industries Association 2500 Wilson Blvd Arlington, VA 22201 |
| IEEE | Institute of Electrical and Electronics Engineers 445 Hoes Lane, P.O. Box 1331 Piscataway, NJ 08855-1331 |
| IPC | Institute for Interconnecting and Packaging Electronic Circuits 7380 North Lincoln Avenue Lincolnwood, IL 60646-1776 |

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|------|---|
| 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 60062-2096 |

FEDERAL SPECIFICATIONS

| | |
|-----------|---|
| A-A-52401 | Bearing, Sleeve (Steel-Backed) |
| A-A-52414 | Bearing, Roller, Thrust |
| A-A-55485 | Pads, Electrical-Electronic Component, General Requirements for |
| L-P-516 | Plastic Sheet and Plastic Rod, Thermosetting, Cast |
| V-T-285 | Thread, Polyester |
| V-T-295 | Thread, Nylon |
| FF-B-171 | Bearings, Ball, Annular (General Purpose) |
| FF-B-187 | Bearing, Roller, Tapered |
| 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 |

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| FF-S-200 | Setscrews; Hexagon Socket and Spline Socket, Headless |
| FF-S-210 | Setscrews, Square Head (Inch) and Slotted Headless (Inch & Metric) |
| FF-W-84 | Washers, Lock (Spring) |
| FF-W-92 | Washer, Flat (Plain) |
| FF-W-100 | Washer, Lock (Tooth) |
| QQ-C-320 | Chromium Plating (Electrodeposited) |
| QQ-N-290 | Nickel Plating (Electrodeposited) |
| QQ-P-416 | Plating, Cadmium (Electrodeposited) |
| 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 |

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| 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 |

MILITARY SPECIFICATIONS

| | |
|-----------|---|
| MIL-I-10 | Insulating Compound, Electrical, Ceramic, Class L |
| MIL-M-14 | Molding Compounds, Thermosetting |
| MIL-C-17 | Cable, Radio Frequency, Flexible and Semirigid, General Specification for |
| 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 |

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| 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 |
| MIL-L-2105 | Lubricating Oil, Gear, Multi-Purpose (Metric) |
| 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 Specification for |
| 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 | Bearings, Roller, Needle, Airframe, Anti-Friction, Inch |
| MIL-W-4088 | Webbings, Textile, Woven Nylon |
| MIL-S-5002 | Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems |
| 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 |

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| MIL-H-5440 | Hydraulic Systems, Aircraft, Design and Installation Requirements for |
| MIL-A-5540 | Adhesive, Polychloroprene |
| MIL-C-5541 | Chemical Conversion Coatings on Aluminum and Aluminum Alloys |
| MIL-F-5591 | Fasteners, Panel; Nonstructural |
| MIL-R-5674 | Rivets, Structural, Aluminum Alloy, Titanium Columbium Alloy, General Specification for |
| MIL-B-5687 | Bearings, 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-I-6363 | Lamps, Incandescent, Aircraft Service, General Specification for |
| 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-I-7444 | Insulation Sleeving, Electrical, Flexible |
| MIL-S-7742 | Screw Threads, Standard, Optimum Selected Series; General Specification for |
| MIL-P-7788 | Panels, Information, Integrally Illuminated |
| MIL-M-7793 | Meter, Time Totalizing |
| MIL-B-7838 | Bolt, Internal Wrenching, 160 KSI FTU |

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| MIL-B-7883 | Brazing of Steels, Copper, Copper Alloys, Nickel Alloys, Aluminum and Aluminum Alloys |
| MIL-R-7885 | Rivets; Blind, Structural, Mechanically Locked Spindle and Friction Locked Spindle, General Specification for |
| MIL-T-7928 | Terminal, Lug Splices Conductor, Crimp Style, Copper, General Specification for |
| 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, 180 KSI FTU and 108 KSI FSU, 450°F, Protruding and Flush Head, General Specification for |
| 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, General Specification 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 |

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| 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 | Connectors, Plug and Receptacle (Electrical, Audio, Waterproof, Ten Contact, Polarized) |
| 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 Alloys |
| MIL-S-13572 | Spring, Helical, Compression and Extension |
| MIL-F-14072 | Finishes for Ground Based Electronic Equipment |
| MIL-P-15024 | Plates, Tags and Bands for Identification of Equipment |
| 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) |

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| MIL-I-16923 | Insulating Compound, Electrical, Embedding |
| MIL-I-17205 | Insulation Cloth and Tape, Electrical, Glass Fiber, Varnished |
| MIL-H-17672 | Hydraulic Fluid, Petroleum, Inhibited |
| MIL-F-18240 | Fastener, Element, Self-Locking, Threaded Fastener, 250°F |
| 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-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 |
| MIL-T-22821 | Tachometer Generator, AC, General Specification for |

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| MIL-C-22931 | Cable, Radio Frequency, Semirigid, Coaxial, Semi-Air Dielectric, General Specification for |
| MIL-F-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 |
| MIL-I-24092 | Insulating Varnishes and Solventless Resins for Application by the Dip Process |
| MIL-G-24139 | Grease, Multi-Purpose, Water Resistant |
| 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, General Specification for |
| MIL-S-24251 | Shields, Retainer (Bases), and Adapters, Electron Tube, Heat Dissipating, General Specification for |
| MIL-I-24391 | Insulation Tape, Electrical, Plastic, Pressure Sensitive |
| DOD-G-24508 | Grease, High Performance, Multi-Purpose (Metric) |
| MIL-I-24768/1 | Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin (GME) |
| MIL-I-24768/2 | Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Epoxy-Resin (GEE) |
| MIL-I-24768/3 | Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Epoxy-Resin (GEB) |
| MIL-I-24768/7 | Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Polytetrafluoroethylene-Resin (GTE) |
| MIL-I-24768/8 | Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin (GMG) |
| MIL-I-24768/9 | Insulation, Plastic, Laminated, Thermosetting, Nylon-Fabric-Base, Phenolic-Resin (NPG) |
| MIL-I-24768/10 | Insulation, Plastic, Laminated, Thermosetting, Paper-Base, Phenolic-Resin (PBE) |
| MIL-I-24768/11 | Insulation, Plastic, Laminated, Thermosetting, Paper-Base, Phenolic-Resin (PBG) |
| MIL-I-24768/12 | Insulation, Plastic, Laminated, Thermosetting, Paper-Base, Phenolic-Resin (PBM) |
| MIL-I-24768/13 | Insulation, Plastic, Laminated, Thermosetting, Cotton-Fabric-Base, Phenolic-Resin (FBE) |
| MIL-I-24768/14 | Insulation, Plastic, Laminated, Thermosetting, Cotton-Fabric-Base, Phenolic-Resin (FBG) |
| MIL-I-24768/16 | Insulation, Plastic, Laminated, Thermosetting, Cotton-Fabric-Base, Phenolic-Resin (FBM) |

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| MIL-I-24768/17 | Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Silicone-Resin (GSG) |
| 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-L-25467 | Lighting, Integral, Aircraft Instrument, General Specification for |
| MIL-P-25518 | Plastic Material, Silicone Resin, Glass Fiber Base, Low-Pressure Laminated |
| 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, Power, Electrical and Cable Special Purpose, Shielded and Unshielded, Electrical, General Specification for |
| MIL-D-28728 | Dial, Control, Multi-Turn Counters, General Specification for |
| MIL-M-28787 | Modules, Standard Electronic, General Specification for |
| MIL-D-28803 | Display Optoelectric, Readouts, Blacklighted 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 (Inactive) |

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| MIL-PRF-38534 | Hybrid Microcircuits, General Specification for |
| MIL-PRF-38535 | Integrated Circuits (Microcircuits) Manufacturing, General Specification for |
| MIL-C-39006/22 | Capacitors, Fixed, Electrolytic (Nonsolid Electrolyte) Tantalum (Polarized, Sintered Slug), 85°C (Voltage Derated to 125°C), Established Reliability, Style CLR79 |
| MIL-C-39006/25 | Capacitors, 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, Solid Film, Heat Cured, Corrosion Inhibiting |
| 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 |
| MIL-I-46852 | Insulation Tape, Electrical, Self-Adhering, Unsupported Silicone Rubber |
| MIL-A-47315 | Adhesive, Polyurethane |

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| 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, Lithium Sulfur Dioxide |
| 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 and Stud Types, and Associated Accessories, General Specification for |
| MIL-C-55181 | Connectors, Plug and Receptacle, Intermediate Power (Electrical, Waterproof) Type MW, General Specification for |
| MIL-O-55310 | Oscillator, Crystal Controlled, General Specification for |
| MIL-A-55339 | Adapters, Connector, Coaxial, Radio Frequency (Between Series and Within Series), General Specification for |
| 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 |

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| 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, 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 Detering |
| 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 | Bearings, Ball, Annular, for Instruments and Precision Rotating Components |
| MIL-B-81934 | Bearings, Sleeve, Plain and Flanged, Self-Lubricating, General Specification for |
| MIL-B-81936 | Bearing, Plain, Self-Aligning (BeCu Ball, CRES Race), General Specification for |
| 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 |

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| 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 | Transformers, Variable, Power, 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 Packages (DIPS) and Single-in-Line Packages (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 Cooled, General Specification for |
| MIL-L-85762 | Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible, General Specification for |
| MIL-A-87135 | Adhesives, Non-Conductive, for Electronics Application |
| MIL-D-87157 | Displays, Diode, Light Emitting, Solid State, General Specification for |

FEDERAL STANDARDS

| | |
|-------------|---|
| FED-STD-H28 | Screw-Thread Standards for Federal Services |
| FED-STD-595 | Colors Used in Government Procurement |

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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-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 Metal Castings and Powdered Metal Components |
| MIL-STD-280 | Definitions of Item Levels, Item Exchangeability, Models, and Related Terms |
| MIL-STD-411 | Aircrew Station Altering Systems |
| MIL-STD-470 | Maintainability Program for Systems and Equipment |
| MIL-STD-471 | Maintainability Verification/Demonstration/Evaluation |
| MIL-STD-681 | Identification Coding and Application of Hook-Up and Lead Wire |
| MIL-STD-683 | Crystal Units (Quartz) and Crystal Holders (Enclosures) and Oscillators, Selection of |

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| MIL-STD-701 | Lists of Standard Semiconductor Devices |
| MIL-STD-704 | Aircraft Electric Power Characteristics |
| MIL-STD-710 | Synchs, 60 and 400 Hz, Selection and Application of |
| MIL-STD-783 | Legends for Use in Aircrew Stations and on Airborne Equipment |
| MIL-STD-810 | Environmental Test Methods and Engineering Guidelines |
| MIL-STD-838 | Lubrication of Military Equipment |
| MIL-STD-883 | Test Methods and Procedures for Microelectronics |
| MIL-STD-889 | Dissimilar Metals |
| MIL-STD-965 | Parts Control Program* |
| 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 | Standard Department of Defense Bar Code Symbology |
| MIL-STD-1277 | Splices, Chips, Terminals, Terminal Boards, Binding Posts, 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-965 is planned for retention and will be redefined as either a standard practice or an acquisition guideline. A final decision is due by January 1996.

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| MIL-STD-1334 | Process for Barrier Coating of Anti-Friction Bearings |
| MIL-STD-1346 | Relays, Selection and Application of |
| 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 |
| MIL-STD-1378 | Requirements for Employing Standard Electronic Modules |
| MIL-STD-1389 | Design Requirements for Standard Electronic Modules |
| MIL-STD-1390 | Level of Repair Analysis (LORA) |
| MIL-STD-1395 | Filters and Networks, Selection and Use of |
| MIL-STD-1399 | Interface Standard for Shipboard Systems, Section 300 Electric Power, Alternating Current (Metric) |
| 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-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 |

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| 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 |
| MIL-STD-1788 | Avionics Interface Design Standard |
| MIL-STD-1812 | Type Designation, Assignment and Method for Obtaining |
| MIL-STD-1861 | Electrical and Electronic Assemblies, Boards, Cards and Associated Hardware, Selection and Use of |
| DOD-STD-1866 | Soldering Process, General (Non-Electrical) (Metric) |
| 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-2175 | Castings, Classification and Inspection of |
| MIL-STD-2200 | Requirements for Employing Standard Enclosure Systems |
| MIL-STD-2218 | Thermal Design, Analysis, and Test Procedures for Airborne Electronic Equipment |
| MIL-STD-2219 | Fusion Welding for Aerospace Applications |
| MS27212 | Terminal Board Assembly, Molded-In Stud, Electric |
| MS33522 | Rivets, Blind, Structural, Mechanically Locked and Friction Retainer Spindle (Reliability and Maintainability), Design and Construction Requirements for |

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| MS33540 | Safety Wiring and Cotter Pinning, General Practices for |
| MS33557 | Nonstructural Rivets for Blind Attachment, Limitations for Design and Usage |

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 | Encoders, 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) (Metric) |
| 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-454 | General Guidelines for Electronic Equipment |
| MIL-HDBK-419 | Ground, Bonding and Shielding for Electronic Equipments and Facilities |

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| 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 | Materials Joining |
| MIL-HDBK-1553 | Multiplex Application Handbook |
| MIL-HDBK-2000 | Soldering of Electrical and Electronic Assemblies |
| MIL-BUL-103 | List of Standardized Military Drawings (SMDS) |

OTHER GOVERNMENT DOCUMENTS

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

10 CFR 20 Code of Federal Regulations, Title 10, Chapter 1, 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

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

SAE AMS 3638E Plastic Tubing, Electrical Insulation, Irradiated Polyolefin, Pigmented, Semi-Rigid, Heat-Shrinkable 2 to 1 Shrink Ratio

SAE AMS 3653D Tubing, Electrical Insulation, Standard Wall, Extruded Polytetrafluoroethylene (PTFE)

SAE AMS 3654B Tubing, Electrical Insulation, Light Wall, Extruded Polytetrafluoroethylene (PTFE)

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| SAE 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 |
| ASTM A228/A228M | Steel Wire, Music Spring Quality |
| ASTM A313 | Chromium-Nickel Stainless and Heat Resisting Steel Spring Wire |
| ASTM A588/A558M | Steel, Structural, High-Strength Low Alloy Structural, with 50 KSI (345 MPA), Minimum Yield Point to 4 In. (100 MM) Thick |
| ASTM A682 | Steel, Strip, High Carbon, Cold Rolled, Spring Quality, General Requirements for |
| ASTM A684/A684M | Steel, Strip, High Carbon, Cold Rolled, Standard Specification for |
| ASTM B134 | Wire, Brass |
| ASTM B159 | Wire, Phosphor Wire (Metric) |
| 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 B206 | Copper-Nickel-Zinc Alloy (Nickel Silver) Wire and Copper Nickel Alloy Wire (Metric) |
| ASTM B522 | Gold-Silver-Platinum Electrical Contact Alloy |
| ASTM B633 | Electrodeposited Coatings of Zinc on Iron and Steel |
| ASTM D495 | Insulation, Solid Electrical, High Voltage, Low Current, Dry Arc Resistance of |
| ASTM D635 | Plastics, Self-Supporting, in a Horizontal Position, Rate of Burning and/or Extent of Time of, Burning of |
| ASTM D1000 | Pressure-Sensitive Adhesive Coated Tapes Used for Electrical Insulation, Methods of Testing |

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| ASTM D3295 | PTFE Tubing, Specification for |
| ASTM D4956 | Sheeting, Retroreflective, For Traffic Control |
| ASTM F872 | Filter Unit, Air Conditioning, Viscous Impingement Type, Cleanable |
| 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 |
| ANSI N2.1 | Radiation Symbol |
| EIA RS-310-C | Cabinets, Racks, Panels and Associated Equipment |
| IEEE 200 | Electrical and Electronic Parts and Equipments, Reference Designations for |
| IEEE 1076 | Manual, VHDL Language Reference |
| 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 | 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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APPENDIX B

SAMPLE TAILORING GUIDE

10. SCOPE

10.1 Scope. THIS APPENDIX IS NOT A MANDATORY PART OF THIS HANDBOOK. THE INFORMATION CONTAINED HEREIN IS INTENDED FOR GUIDANCE.

10.2 This appendix provides a sample tailoring guide for MIL-HDBK-5400 based on the relationship of tailoring specific guidelines 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-HDBK-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-HDBK-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-HDBK-5400 guidelines 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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| <u>PARAGRAPH</u> | <u>DESCRIPTION</u> | <u>CON</u> | <u>D&V</u> | <u>FSED</u> | <u>PROD</u> |
|------------------|---|------------|----------------|-------------|-------------|
| 4.1.1 | Tailoring of MIL-HDBK-454 guidelines | 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 |
| 4.2.10 | 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 | 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 | G |
| 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 |

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| PARAGRAPH | DESCRIPTION | CON | D&V | FS&D | PROD |
|-----------|--|-----|-----|------|------|
| 4.2.24 | Pressurization | N | N | A | A |
| 4.2.25 | Reliability | N | N | A | A |
| 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 | Set screw 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 of 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 |

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| PARAGRAPH | DESCRIPTION | CON | D&V | FSED | PROD |
|------------|--|-----|-----|------|------|
| 4.3.10 | Connectors, electrical | N | N | A | A |
| 4.3.10.1 | Mounting of electrical receptacles | N | N | N | A |
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INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.
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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

MIL-HDBK-5400

2. DOCUMENT DATE

(YYMMDD)

951130

3. DOCUMENT TITLE

ELECTRONIC EQUIPMENT, AIRBORNE GENERAL GUIDELINES FOR

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE
(Include Area Code)

7. DATE SUBMITTED
(YYMMDD)

(1) Commercial:

(2) DSN:

(If Applicable)

8. PREPARING ACTIVITY

a. NAME
COMMANDER
NAVAL AIR WARFARE CENTER
AIRCRAFT DIVISION

b. TELEPHONE NUMBER (Include Area Code)

(1) Commercial
(908) 323-2970

(2) DSN
624-2970

c. ADDRESS (Include Zip Code)
CODE 4.1.4.28120-3
HIGHWAY 547
LAKEHURST, NJ 08733-5100

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
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