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(See 6.8)

MILITARY SPECIFICATION

**ELECTRONIC EQUIPMENT, MISSILES, BOOSTERS
AND ALLIED VEHICLES, GENERAL SPECIFICATION FOR**

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 **Scope.** This specification covers the general requirements for electronic equipment for operation in missiles, boosters, and vehicles encountering similar environments including short time exposure to space environments. The detail performance and test requirements for a particular equipment shall be as specified in the detail specification for that equipment.

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

- Class 1** - Equipment designed for 50,000 ft. altitude and continuous sea level operation over the temperature range of -54° to +55° C. (+71° C intermittent operation.)
- Class 1A** - Equipment designed for 30,000 ft. altitude and continuous sea level operation over the temperature range of -54° to +55° C. (+71° C intermittent operation.)
- Class 2** - Equipment designed for 70,000 ft. altitude and continuous sea level operation over the temperature range of -54° to +71° C. (+95° C intermittent operations)

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- Class 3** - Equipment designed for 100,000 ft. altitude and continuous sea level operation over the temperature range of -54° to +95° C. (+125° C intermittent operation.)
- Class 4** - Equipment designed for 100,000 ft. altitude and continuous sea level operation over the temperature range of -54° to +125° C. (+150° C intermittent operation.)
- Class 5** - Equipment designed for altitudes greater than 100,000 ft. 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 The addition of the letter "X" after the class number, e.g., (Class 2X) will identify the equipment as operating in the ambient environment of that class, but requiring cooling, from a source external to the equipment.

2. APPLICABLE DOCUMENTS

- * 2.1 The documents listed in Appendix A in effect on the date of invitation for bids form a part of this specification. Requirements of MIL-STD-454 invoked by this specification are limited to those documents appearing in Appendix A.

DOCUMENTS

- * See Appendix A

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

3. REQUIREMENTS

- * 3.1 Parts, materials and processes. Microelectronic devices shall be given first consideration in design. Parts, materials and processes shall conform to applicable documents listed in Appendix A.
- * 3.1.1 Selection of parts and materials. Parts and materials covered by documents listed in Appendix A are standard and shall be used whenever they are suitable for the purpose. Parts and materials shall be procured from QPL sources when they exist. Nonstandard parts and materials must be equivalent to or better than similar standard parts and materials. When Appendix A fails to provide an

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applicable specification or standard, the contractor shall use other established specifications or standards in the order of precedence set forth in MIL-STD-143. Parts and materials selected from other than Appendix A are not standard, and approval must be obtained prior to their use in equipment. Each vendor source for a non-standard part or material, requires approval.

3.1.1.1 Approval of nonstandard parts and materials. In considering the approval of nonstandard parts and materials, 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 development or service test models to be used for test under service conditions for the evaluation of their suitability and performances.

Category III: Contracts for production models. These contracts will usually include requirements for a prototype (preproduction) model.

* 3.1.1.1.1 Contracts under Category I. Approval of nonstandard parts and materials shall not be required under contracts or orders which fall under Category I.

3.1.1.1.2 Contracts for equipment which fall under Categories II and III. A request for the approval of the use of nonstandard parts and materials including shockmounts and vibration isolators, except for metals and nonelectrical hardware items used for mechanical applications, shall be submitted in accordance with paragraphs 3.1.1.1.4 and 3.1.1.1.5. For a single contract covering like equipments which fall in both Categories II and III, parts approval shall be required only for the parts used in Category II equipments, and any new part sources or new nonstandard parts used in Category III equipments.

3.1.1.1.3 Reordered production equipment. A design review directed toward replacement of nonstandard parts and materials with standard parts and materials shall be performed on contracts for reordered equipment, whether reordered from the original contractor or from a different contractor. Changes must conform to interchangeability requirements. The original part procured from the

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same source, when required by interchangeability or lack of a suitable standard replacement part, may be used without reapproval (see 3.3.1 and 3.3.2).

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

* 3.1.1.1.4 Time schedule of approval requests. The request for approval of nonstandard parts and materials shall be made at the time that the part or material is selected for use in the equipment. The Government retains the right to request changes to the part or material if the performance, description, test data, or inspection of the part or material indicates that the part or material will not perform its intended function. Approval of all nonstandard parts and materials used in the equipment shall be obtained by the contractor prior to delivery of any equipment required by the contract.

3.1.1.1.5 Data to be submitted with nonstandard part requests. The data to be submitted with nonstandard part requests shall be in accordance with MIL-STD-454, Requirement 22, except that the actions of Steps I and II of MIL-STD-749 shall be accomplished simultaneously.

3.1.1.1.6 Samples required for parts and material approvals. Samples of nonstandard parts and materials may be required by the procuring activity. These samples shall be submitted in quantities and to the destination specified by the procuring activity for tests and examination. Sample quantities to be specified will not exceed 1 pound of any lubricant, 12 fuses, and 6 units of any other part, except high voltage power and high power pulse transformers, delay lines, blowers, and power tubes such as magnetrons and klystrons, where two units are sufficient. Sample parts and materials may be tested to destruction by the procuring activity and will not be returned to the contractor. When there is more than one supplier for a part or material, parts or materials from each supplier shall be considered for separate submission.

* 3.1.1.2 Use of military part identifiers. Parts which require QPL approval but which have no qualified vendors shall not be identified with part numbers.

* 3.1.1.3 Choice of parts and materials. Whenever an applicable electronic standard specification provides more than one characteristic or tolerance for an item, the equipment manufacturer shall use in the equipment items of broadest characteristics and of the greatest allowable tolerances that will fulfill the performance requirements of the equipment. When acceptable items of higher than minimum quality are readily available, the utilization of which would not increase the initial or life cycle cost to the procuring activity, they may be used. When maximum physical dimensions of an item are indicated in the applicable specification for the item, all

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new equipment shall be designed to accommodate the maximum physical size specified, in order that all parts having the same type designation will be physically interchangeable in the equipment.

3.1.1.4 Replaceability by standard parts and materials. Whenever permission is granted by the procuring activity for a contractor to use items not in accordance with standard specifications for which approved products exist, only because of nonavailability of standard items, the contractor shall arrange the equipment to permit replacement in the field of the nonstandard by the standard items. The standard item shall be listed in the technical manuals as the preferred replacement.

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

* 3.1.2 Capacitors. All capacitors shall be in accordance with MIL-STD-454, Requirement 2. Except that the use of wet slug and foil type tantalum capacitors requires approval of the procuring activity.

3.1.2.1 Mounting of fixed capacitors. Fixed capacitors shall be securely mounted. They shall not be mounted by their wire leads without providing other mechanical support for the body of the capacitor, except that capacitors whose weight is 1/2 ounce or less may be secured by only their leads if, the total length of both leads measured between the points on the capacitor from which the leads egress and the midpoints of the lead attachment terminals, does not exceed 1 inch. In no case shall the wire leads be less than 1/4 inch for capacitors with axial leads, except for printed circuit applications and in nonrepairable items.

* 3.1.3 Castings. Castings shall be in accordance with MIL-STD-454, Requirement 21.

* 3.1.4 Electrical connectors. Electrical connectors shall be in accordance with MIL-STD-454, Requirement 10.

* 3.1.4.1 Mounting of electric receptacles. Where practical, when receptacles are mounted on a vertical surface the largest polarizing or prime key or keyway of the receptacle shall be at the top center of the shell of the receptacle.

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

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3.1.5 Controls. Controls shall be in accordance with MIL-STD-454, Requirement 28.

3.1.5.1 Knobs and handles. Knobs and handles shall be in accordance with MIL-STD-454, Requirement 12 and Requirement 28.

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

3.1.6 Corrosion resistance. Materials shall be of corrosion-resistant types, or shall be processed to resist corrosion.

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

3.1.6.2 Ferrous alloys. Ferrous alloys shall be in accordance with MIL-STD-454, Requirement 15.

3.1.6.3 Aluminum alloy.

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

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

3.1.6.3.3 Aluminum surfaces, extreme wear resistant. Where bonding or grounding is not necessary, hard anodic finishes conforming to numbers E514, E515, or E516 of MIL-F-14072 may be applied to obtain extreme wear-resistant surfaces under Type II (MIL-F-14072) exposure on desired areas of aluminum alloys not subject to repeated high tensile stresses.

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3.1.6.4 Cadmium plated parts. Cadmium plated parts shall be in accordance with MIL-STD-454, Requirement 15. Standard MS or AN parts will not require refinishing.

- * 3.1.6.4.1 Color of Type II treated parts. Unless otherwise specified, colored chromates as they normally occur in processing shall be used.
- * 3.1.6.5 Magnesium and magnesium alloys. Magnesium and magnesium alloys shall not be used except when approved or specified by the procuring activity. The request for use of magnesium and its alloys shall include the total environment exposure, the weight reduction and other advantages achieved, the proposed surface treatment, and the application details.
- 3.1.6.6 Zinc and zinc-plated parts. Zinc parts and zinc-plated parts shall be given a dichromate treatment in accordance with QQ-Z-325, Type II, Class 2.
- 3.1.7 Dissimilar metals. Selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-454, Requirement 16.
- * 3.1.8 Finishes. Unless contained in a hermetically sealed unit part finishes (including hardware items of equipment not covered by subsidiary specifications) shall be resistant to corrosion. Finishes shall be capable of withstanding a 48 hour Salt Spray (Fog) test in accordance with ASTM B-117 without showing signs of corrosion beyond those established for the particular part, material, or finish specification. Where applicable, these parts shall have finishes providing suitable rates of heat transfer. Parts which are lubricated in equipment may be tested in a lubricated condition. Lusterless finishes shall be used on all surfaces visible to operating personnel. Where cleaning operations on metal parts are not specified in detail, they shall be in accordance with MIL-S-5002. It is not the intent that parts procured to the specifications listed in Appendix A must be refinished.
 - 3.1.8.1 Fasteners and assembly screws. Exposed surfaces of external fasteners and assembly screws which are manipulated, loosened, or removed in the normal processes of servicing and installing the equipment shall be finished preferably in a noncorrosive black or bright finish, so as to provide strong contrast with the color of the surface upon which they appear. Other external fasteners and assembly screws used for securing the internal parts to the chassis shall be similar in color to the surface upon which they appear.
 - 3.1.8.2 Other standard finishes. Type I finishes in accordance with MIL-F-14072 are approved as alternates to any differing requirements specified under the paragraphs on finishes, except that colors specified shall be used.
 - 3.1.9 Fastener hardware. Fastener hardware shall be in accordance with MIL-STD-454, Requirement 12.

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* 3.1.10 Fungus-inert materials. Fungus inert materials in accordance with MIL-STD-454, Requirement 4, shall be used.

3.1.11 Insulating materials, electrical. Insulators, insulating, and dielectric materials shall be in accordance with MIL-STD-454, Requirement 11.

3.1.12 Arc-resistant materials. Arc-resistant materials shall be in accordance with MIL-STD-454, Requirement 26.

3.1.13 Flammable materials. Flammable materials shall be in accordance with MIL-STD-454, Requirement 3.

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

3.1.14.1 Engineering design changes. To identify properly deviations in articles of equipment resulting from engineering change proposals prepared by the contractor and approved by the procuring activity, marking in one of the following categories shall be assigned for use on each major or minor assembly in which the change has been incorporated:

- a. A change in the type designation of the article as included in a nameplate or other marking.
- b. The use of a modification symbol imprinted or affixed adjacent to, but never on or to the right of the name-plate. A series of modification symbols shall be used for successive minor engineering changes not justifying a change in type designation.

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

3.1.14.3 Panel markings. The visible surface adjacent to panel facilities, such as controls, indicators, jacks, and sockets shall be marked with a suitable word, phrase, or abbreviation thereof, indicating the use or purpose of the part. These markings shall provide good legibility and shall be of contrasting color. Abbreviations shall be in accordance with MIL-STD-783. Continuously variable operating controls shall be provided with markings which will permit the operator to set the control easily and correctly to a predetermined point. Controls which require the use of special test equipment and are not to be adjusted without such test equipment, do not require marking indicating the use or purpose of the part on the panel adjacent thereto.

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* 3.1.14.4 Reference designations. Reference designations shall be in accordance with ANSI Y32.16.

3.1.14.5 Wire coding. Wires used for internal wiring shall be coded in accordance with MIL-STD-454, Requirement 20. Hot and cold stamping shall be allowed only on insulated wire which will not accept ink. Marking shall not be used on wires where the dielectric capability of the wire is reduced by such marking. Wires used for external wiring between units shall be coded in accordance with MIL-W-8160 (see 3.1.29).

3.1.15 Meters, electrical indicating and accessories. Electrical indicating meters and accessories shall be in accordance with MIL-STD-454, Requirement 51. External meter shunts shall be in accordance with MIL-STD-454, Requirement 40. Meters other than those in accordance with MIL-M-10304, color schemes W, B, Y, F and P, require procuring activity approval.

3.1.16 Relays. Relays shall be in accordance with MIL-STD-454, Requirement 57. Relays other than hermetically sealed types shall not be used.

3.1.17 Resistors. The selection and use of resistors shall conform to MIL-STD-454, Requirement 33.

3.1.17.1 External voltmeter resistors. External voltmeter resistors shall be in accordance with MIL-R-39005.

3.1.17.2 Tapped resistors. The use of fixed and variable resistors having fixed taps requires procuring activity approval.

3.1.17.3 Mounting of resistors. Resistors shall be securely mounted in such manner as to allow for expansion with temperature changes. They shall not be mounted by their wire leads without providing other mechanical support for the body of the resistor, except that resistors whose weight is 1/2 ounce or less may be secured by only their leads if, the total length of both leads measured between the points on the resistor from which the leads egress and the midpoints of the lead attachment terminals, does not exceed 1.0 inch. In no case shall the wire leads be less than 1/4 inch, except for printed circuit applications and in nonrepairable items.

3.1.18 Soldering. Soldering shall be in accordance with MIL-STD-454, Requirement 5.

3.1.18.1 Mechanical assemblies. Unless specifically approved by the procuring activity, no assembly shall depend solely on soft solder for mechanical strength, except for variable capacitor plates and sections and other relatively light parts that are of accepted commercial design and that have, by actual use proved to be generally suitable for use in electronic equipment.

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3.1.19 Springs. Springs shall conform to MIL-STD-454, Requirement 41.

3.1.20 Switches. Switches shall be in accordance with MIL-STD-454, Requirement 58. Insulation materials used in switches shall be arc-resistant in accordance with MIL-STD-454, Requirement 26.

3.1.20.1 Power switches. Power switches shall conform to the electrical, environmental, and applicable mechanical requirements of MIL-S-3950. If used, provision shall be made to prevent operation of missile equipment with switch in wrong position.

3.1.20.2 Rotary switches.

* 3.1.20.2.1 Indexing mechanism. Rotary switches shall have a positive mechanical index, locating each contact position. When operated normally, the switch indexing mechanism shall prevent the movable contact from coming to rest between contact positions.

* 3.1.20.2.2 Materials. Materials used in the construction of rotary switches shall be as follows:

- a. Contacts shall be silver alloy or silver plated, and shall be self-cleaning. Contacts using other metals are subject to approval of the procuring activity.
- b. Shafts shall be aluminum or corrosion-resistant material.
- c. Metal parts, other than contacts and shafts, shall be made of corrosion-resistant material, except that bushing and bearing assemblies may be brass suitably treated to prevent corrosion.

* 3.1.20.2.3 Mounting. Rotary switches with thru panel shafts shall be designed for mounting to a panel by means of a single bushing concentric with the shaft and threaded .375-32 UNF-2A. A positive mechanical means, in addition to lock washers, shall be provided to prevent rotation of the switch body.

3.1.21 Terminals. Terminals shall be in accordance with MIL-STD-454, Requirement 19.

* 3.1.22 Threaded parts. Threaded parts shall be in accordance with MIL-STD-454, Requirement 12. The use of metric threads shall be coordinated with the procuring activity and shall require approval prior to use.

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3.1.23 Tools (special). The requirement for special tools shall be in accordance with MIL-STD-454, Requirement 63, except that the contractor shall not mount such tools in the equipment or make space provisions therefore unless required by the detail specification or contract.

3.1.24 Transformers and inductors. Transformers and inductors shall be in accordance with MIL-STD-454, Requirement 14. All audio and power transformers and inductors require procuring activity approval.

* 3.1.25 Semiconductor devices and electron tubes. Semiconductor devices are preferred to electron tube. Semiconductor devices shall be in accordance with MIL-STD-454, Requirement 30. Electron tubes shall be in accordance with MIL-STD-454, Requirement 29.

3.1.26 Structural welding. Structural welding shall be in accordance with MIL-STD-454, Requirement 13.

3.1.27 Wire (hook-up). Hook-up wire shall be in accordance with MIL-STD-454, Requirement 20. The size of wire leads supplied integral with parts shall be controlled by the specification for these parts.

* 3.1.28 Wiring (internal). Internal wiring shall be in accordance with MIL-STD-454, Requirements 1 and 69.

* 3.1.28.1 Printed wiring. Printed wiring shall be in accordance with MIL-STD-454, Requirement 17. Printed wiring boards shall be connected into the equipment by means of connectors. Printed wiring boards utilizing the conductor pattern as the direct contact with the mating connector shall not be used.

* 3.1.29 Wiring (external). Provisions shall be made for external wiring in accordance with MIL-STD-454, Requirement 71, and MIL-W-5088 as applicable.

3.1.30 Wood. Wood shall not be used.

3.1.31 Microelectronic devices. Microelectronic devices shall be in accordance with MIL-STD-454, Requirement 64. Devices selected shall be soldered or welded into the circuit.

* 3.1.32 Parts to meet reliability requirements. When the contract or equipment specification includes a reliability requirement that is based on a previous calculation and demonstration of the equipment reliability, the parts shall be equal to or more reliable than those used in the demonstration equipment.

3.1.33 Bearings. Bearings shall be in accordance with MIL-STD-454, Requirement 6.

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3.1.34 Derating. Derating of electronic parts and materials shall be in accordance with MIL-STD-454, Requirement 18.

3.1.35 Adhesives. Adhesives shall be in accordance with MIL-STD-454, Requirement 23. The use of adhesives in electrical applications requires the approval of the procuring activity.

3.1.36 Batteries. The use of batteries shall be in accordance with MIL-STD-454, Requirement 27.

3.1.37 Motors, dynamotors, rotary power converters, and motor generators. Motors, dynamotors, rotary power converters, and motor generators shall be in accordance with MIL-STD-454, Requirement 46.

3.1.38 Electrical overload protection. Electrical overload protection shall be in accordance with MIL-STD-454, Requirement 8, Class 3.

3.1.38.1 Circuit breakers. When used for electrical overload protection, circuit breakers shall be in accordance with MIL-STD-454, Requirement 37.

3.1.39 Lubrication. Lubrication shall be in accordance with MIL-STD-454, Requirement 43.

3.1.40 Organic fibrous material. The use of organic fibrous materials shall be in accordance with MIL-STD-454, Requirement 44.

* 3.1.41 Encapsulation and embedment. Encapsulation and embedment shall be in accordance with MIL-STD-454, Requirement 47.

3.1.41.1 Conformal coating. Conformal coating, when used, shall be reversion resistant and hydrolytically stable.

3.1.42 Waveguides and related equipment. Waveguides and related equipment shall be in accordance with MIL-STD-454, Requirement 53.

3.1.43 Quartz crystals. The selection and application of quartz crystals shall be in accordance with MIL-STD-454, Requirement 38.

3.1.44 Rotary servo devices. Rotary servo devices shall be in accordance with MIL-STD-454, Requirement 56.

3.1.45 Sockets, shields, and clamps. Sockets, shields, and clamps shall be in accordance with MIL-STD-454, Requirement 60.

3.1.46 Brazing. Brazing shall be in accordance with MIL-STD-454, Requirement 59.

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3.1.47 Indicator lights. Indicator lights shall be in accordance with MIL-STD-454, Requirement 50.

3.1.48 Hydraulics. Hydraulics shall be in accordance with MIL-STD-454, Requirement 49.

3.1.49 Gears and cams. Gears and cams shall be in accordance with MIL-STD-454, Requirement 48.

3.1.50 Tuning dials. Tuning dials shall be in accordance with MIL-STD-454, Requirement 42.

3.1.51 Coaxial cable (RF). Coaxial cable (RF) shall be in accordance with MIL-STD-454, Requirement 65.

* 3.1.52 Multiconductor cable. Multiconductor cable within the equipment shall be in accordance with MIL-STD-454, Requirement 66.

3.1.53 Readouts. Readouts shall be in accordance with MIL-STD-454, Requirement 68.

3.1.54 Electrical filters. Electrical filters shall be in accordance with MIL-STD-454, Requirement 70.

3.2 Design and construction.

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

3.2.1.1 Mechanized production (including printed circuits). When designing new equipment, contractors shall include, when possible, circuits that have been or can be reproduced by mechanized or semimechanized production facilities consistent with the state of the art. The procuring activity shall be kept informed of the type of circuits selected and the type of facility required to produce such circuits. The following factors applicable to this type of construction shall govern.

3.2.1.1.1 Nonrepairable subassemblies. Subassemblies of high reliability or relatively low cost shall be constructed as nonrepairable.

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3.2.1.1.2 Circuit approval (nonrepairable subassemblies). The contractor shall inform the procuring activity of those circuits which he proposes as non-repairable subassemblies, and shall obtain approval therefor.

3.2.1.1.3 Larger assemblies and expensive repairable stages shall be constructed of standard or approved nonstandard parts or subassemblies as indicated above, and shall be capable of replacement either by subassembly or detail part, as applicable.

* 3.2.1.1.4 Approval requests. In the construction of nonrepairable subassemblies, detail parts need not be submitted for approval. Approval requests shall include data as specified in 3.1.1.1.5 with each individual nonrepairable subassembly considered as a single nonstandard part. The approval request shall include the electrical schematic, and information describing tests, performance, environmental capabilities, and mechanical details.

3.2.1.1.5 In the selection and layout of circuits, the contractor shall attempt to use circuits and methods of construction which may permit use of the same subassemblies in other equipment having similar circuits and functions.

3.2.1.1.6 Types of construction. The following types of construction are considered to be classed in the mechanized or semimechanized category, and shall be considered:

- a. Subassemblies using printed circuits, upon which the parts are printed or mechanically placed and electrically connected.
- b. Construction in which several ceramic or filled plastic wafers are placed one above the other and components printed or mounted thereon.
- c. Three-dimensional, or folded-type construction, in which the parts are mechanically placed and electrically connected.
- d. Microcircuits using deposited or printed techniques, including circuits employing combinations of these processes and discrete parts.

3.2.1.1.7 In order to permit flexibility in the arrangement or assembly of modules and subassemblies, interconnecting leads involving circuits considered susceptible of radiated interference or capable of radiating interference shall be shielded and of low-impedance design. All other connections (such as power) shall be well shielded or bypassed internally to prevent radiation or pickup of extraneous fields.

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3.2.1.1.8 Welds, resistance, electrical interconnections. Electrical interconnection resistance welds shall be in accordance with MIL-STD-454, Requirement 24.

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

3.2.3 Thermal design. Cooling provisions and thermal design shall be in accordance with MIL-STD-454, Requirement 52, except that the marking requirements shall not apply.

* 3.2.3.1 Cooling design performance limit and evaluation data. Cooling design data shall be submitted as soon as possible after major circuit parameters have been established. Initially, this data shall include calculations, drawings, and other information relating to the choice of a particular cooling system configuration. As part of this initial data, the first set of applicable thermal design evaluation data shall be submitted, based on preliminary calculations. The approval of the cooling system will be based upon consideration of this information. At intervals specified in the contract data requirements list (DD Form 1423), a complete report containing revised data will be submitted in triplicate to the procuring activity. These intervals shall be quarterly if not otherwise specified. 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, a thermal evaluation test program shall be conducted. The final report data shall be forwarded to the procuring activity for approval.

3.2.4 Corona prevention. Corona prevention shall be in accordance with MIL-STD-454, Requirement 45.

3.2.5 Explosion-proofing. The equipment shall be made explosion-proof. Equipment or units thereof which do not cause ignition of an ambient explosive gaseous mixture with air, when thoroughly operated in such an atmosphere after having been in such an atmosphere for a period long enough to be permeated by such atmosphere, shall be considered explosion-proof. In general, this condition will be satisfied when parts which are likely to produce sparking or arcing and which are not contained within pressurized containers, are made explosion-proof.

3.2.6 Electromagnetic interference characteristics. Electromagnetic interference control shall be in accordance with MIL-STD-454, Requirement 61.

3.2.7 Anti-jamming. Where applicable, the electronic system or equipment shall be designed to obtain the maximum inherent protection against

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possible interfering signals caused by enemy jamming. The contractor shall solicit and obtain the approval of the procuring activity for the basic anti-jamming concepts before proceeding with the design of the models.

3.2.8 Maintainability. Maintainability shall be in accordance with MIL-STD-454, Requirement 5-1.

3.2.9 Accessibility. Accessibility shall be in accordance with MIL-STD-454, Requirement 36.

3.2.10 Test points and test facilities. Test points and test facilities shall be in accordance with MIL-STD-454, Requirement 32.

3.2.10.1 Operational checkout provisions. The equipment shall be designed to provide for connections at its face for such test equipment as may be required for operational checkout tests. The equipment shall be designed in such manner as to permit use of items of standard service test equipment to accomplish all necessary tests. The latest available list of standard service test equipment shall be obtained by the contractor from the procuring activity. If special test equipment is required, the procuring activity shall be supplied with recommendations therefor.

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

3.2.12 Moisture pockets. Control of moisture pockets shall be in accordance with MIL-STD-454, Requirement 31.

3.2.13 Reliability. The reliability requirements shall be in accordance with MIL-STD-454, Requirement 35.

3.2.14 Orientation. Normal installation position or range of position shall be as specified in the detail equipment specification. The equipment shall operate within specified limits in any position specified in the detail equipment specification. The equipment shall perform in the required manner under conditions of zero gravity.

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

- a. In general, the case shall have sufficient strength to withstand the applicable pressure difference + 5 psi, and at ambient ground level pressure, an inside pressure of 5 psi less than ambient.

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

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- i. If required, a desiccant shall be provided within the case.
- j. Parts used in pressurized container must meet the requirements of this specification, except that the altitude requirements may differ.

3.2.16 Safety (personnel hazard). Provisions for personnel safety shall be in accordance with MIL-STD-454, Requirement 1.

* 3.2.16.1 Safety program. A safety program shall be established by the contractor if required by the detail equipment specification or contract. Safety programs shall conform to MIL-STD-882 (see 6.2).

3.2.17 Service conditions (electrical). Electrical power sources shall be in accordance with MIL-STD-454, Requirement 25, unless otherwise specified in the detail equipment specification.

3.2.17.1 Warmup time. Warmup time shall be such as to provide the specified performance within a period as specified by the detail equipment specification.

* 3.2.18 Service conditions (environmental). The equipment shall be so designed and constructed that no fixed part or assembly shall become loose, no movable part or control be shifted in setting, position, or adjustment, and no degradation be caused in the performance beyond that specified in the individual specification for the particular equipment during operation or after storage in ambient conditions as follows.

3.2.18.1 Temperature. Each class of equipment shall be exposed to the temperature conditions shown in Table I. 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.

3.2.18.1.1 Operating. Each class of equipment shall operate under the conditions and within the ranges listed in columns I, II, III, and VII of Table I.

3.2.18.1.2 Nonoperating. The equipment in a nonoperating condition shall withstand long periods of exposure to the temperature extremes and shock as listed in Table I.

3.2.18.2 Altitude. Each class of equipment shall meet the applicable altitude conditions listed in column VIII of Table I 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.

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3.2.18.3 Temperature-altitude combination. The equipment shall operate under the applicable temperature-altitude combinations shown in Figure 2.

3.2.18.4 Humidity. The electronic equipment shall provide the required performance, including the periods of duty cycles for testing, under conditions of relative humidity up to 100 percent at temperatures up to 50° C, including conditions wherein condensation takes place in and on the equipment.

3.2.18.5 Vibration. The vibration requirements shall be as specified in the detail equipment specification.

3.2.18.6 Shock. When normally mounted, equipment shall not suffer damage or subsequently fail to provide the performance specified in the detail equipment specification when subjected to 18 impact shocks of 15g, consisting of 3 shocks in opposite directions along each of 3 mutually perpendicular axes, each shock impulse having a time duration of 11 ± 1 milliseconds. The "g" value shall be within ± 10 percent when measured with a 0.2 to 250 Hz filter, and the maximum "g" shall occur at approximately 5-1/2 milliseconds.

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

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

3.2.18.8 Fungus. The equipment shall withstand in both an operating and nonoperating condition, exposure to fungus growth as encountered in tropical climates. In no case shall overall spraying of the equipment be necessary to meet this requirement. (See 3.1.10.)

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

3.2.18.10 Explosive conditions. The equipment shall not cause ignition of an ambient-explosive-gaseous mixture with air when operating in such an atmosphere (see 3.2.5).

3.2.19 Human engineering. Human engineering requirements shall be in accordance with MIL-STD-454, Requirement 62.

3.3 Interchangeability. Interchangeability shall be in accordance with MIL-STD-454, Requirement 7.

3.3.1 Interchangeability of reordered equipment. For reordered equipment, interchangeability shall exist between units and all replaceable assemblies,

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subassemblies, and parts of a designated model of any previously manufactured equipment supplied or designated by the procuring activity. Such interchangeability shall be measured against the designated model, manufacturing drawings, or other technical information provided for the purpose. In the event the contract or order does not stipulate whether the model, drawings, or other information shall govern, the designated model shall be used.

3.3.2 Interchangeability conflicts. Should any conflicts arise between any of the requirements of this specification or the detail specification and the requirement for interchangeability, the contractor should immediately inform the procuring service of such conflict. Unless advised otherwise, the interchangeability requirement shall govern.

3.4 Nomenclature assignment. Nomenclature assignment shall be in accordance with MIL-N-18307 for the Navy and MIL-N-7513 for the Air Force.

3.5 Workmanship. Workmanship shall be in accordance with MIL-STD-454, Requirement 9.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspections. The inspection of electronic equipment shall be classified as follows:

- a. First article (preproduction) (4.3)
- b. Quality conformance tests (4.4)

* 4.3 First article (preproduction) tests. First article (preproduction tests shall be performed on one (more than one if required by the detail specification or by contract) equipment representative of the equipment to be supplied under the contract. Tests shall be performed in accordance with the approved test procedures of 4.5. The data obtained by the contractor in performing tests shall be submitted to the procuring activity at the completion of all tests and prior to shipping the equipment to the Government testing facility.

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4.3.1 Accessory material. When the procuring activity requires the shipment of the equipment to a Government facility for tests, the contractor shall submit, in addition to the complete equipment, all extra materials and design and test data necessary to test and evaluate the equipment (4.3.2). The design and test data supplied by the contractor shall indicate the physical and electrical characteristics of the equipment and establish that the equipment conforms to this specification.

* **4.3.2** Design data and material. The following extra design data and material shall be supplied with this preproduction equipment for tests:

- a. Copies of brief operating instructions.
- b. Copies of a complete schematic diagram reduced to its simplest form, showing the circuits of all assemblies and subassemblies and of detail parts not internal therein individually in schematic form with electrical interconnection indicated.
- c. Copies of a practical wiring diagram of each assembly or of each constructional unit thereof, whichever is practicable, showing the physical location and connections of detail parts and subassemblies with reference symbols and terminal numbers indicated.
- d. Copies of a complete cabling diagram of the complete test equipment.
- e. Copies of outline dimensional sketches of all major and minor assemblies and of any detail external parts, showing projections.
- f. Prior to submission of the preproduction sample equipment, copies of a report by the contractor of his tests on the equipment. Included with this shall be an analysis of all failures which occurred and suggestions for improvements in design which may be incorporated in later productions.
- g. Complete set of interconnecting cables.
- h. One set of spare parts peculiar to the equipment. (Standard parts, such as resistors, capacitors, and tubes in common use which can be obtained through common commercial sources are not required.)

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4.3.3 Scope of tests. First article (preproduction) tests shall include all tests deemed necessary by the procuring activity to determine that the equipment meets all the requirements of this specification and the contract. These tests shall include environmental tests in accordance with the procedures of MIL-T-5422 for the Navy, and MIL-STD-810^{1/} for the Air Force and Army to the limits specified herein or in the detail equipment specification. Interference tests and test methods shall be in accordance with MIL-STD-454, Requirement 61.

4.4 Quality conformance tests. Quality conformance tests shall consist of all tests deemed necessary to determine that the equipment submitted for acceptance under the contract is equivalent in performance and construction to the approved preproduction equipment. Quality conformance tests shall consist of the following:

- a. Individual tests: Individual tests shall be conducted on each equipment submitted for acceptance under the contract.
- b. Sampling tests: Equipment submitted for sampling tests shall be selected by the contractor under the supervision of the Government inspector, shall be representative of current production, and shall first have passed the individual tests. The quantity of sample tests to be performed shall be as specified in the detail specification or the contract.

4.5 Test procedures. The procedures and methods for performing all tests specified herein shall be as stated in the detail equipment specification, or if not stated therein, shall be prepared by the contractor and sent to the procuring activity for approval. In the latter case, the contractor shall have obtained approval from the procuring activity prior to submission of equipment for tests. The right is reserved by the procuring activity to require additional tests to determine compliance with the requirements of this and the detail equipment specification when it is deemed necessary.

4.6 Presubmission testing. No item, part, or complete equipment shall be submitted to the Government inspector by the contractor until it has been previously tested and inspected by the contractor and found to comply to the best of his knowledge and belief with all applicable requirements. With the consent of the contractor and at the discretion of the procuring activity, this prior test and inspection may be participated in or witnessed by the Government inspector with the object of eliminating the necessity of repeating such test and inspection after the equipment has been formally submitted to the Government inspector.

^{1/} For MIL-STD-810, Test methods and procedures will be specified in the detail equipment specification.

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4.7 Rejection and retest. The electronic equipment which has been rejected may be reworked or have parts replaced to correct the defects, and re-submitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Government inspector. Units rejected after retest shall not be resubmitted without the specific approval of the procuring activity.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking. Requirements for packaging, packing, and marking for shipment shall be as specified in the detail equipment specification.

6. NOTES

6.1 Intended use. This specification is intended for use to incorporate, in detail equipment specification, those requirements which are common to electronic equipments for missiles, boosters, and vehicles used for short periods of time in space environments.

* 6.2 Ordering data. Procurement documents should specify:

a. Title, number and date of the detail specification relating to the electronic equipment to be furnished.

b. Class and type of cooling as specified.

c. Data requirements

3.1.1.1.5

4.3.1

4.3.2

The selected data requirements in support of this specification will be reflected in a contractor Data Requirements List (DD Form 1423) attached to the request for proposal, invitation for bid, or the contract as appropriate.

d. Preparation for delivery.

e. Items of 6.7 not covered elsewhere

f. Safety program (3.2.22.1) (Not for Army use)

6.3 Definitions.

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

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6.3.2 Equipment. Equipment is a general term characterizing the broad category of electronic items (such as units, subsystems, and systems).

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

6.3.4 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.

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

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

* 6.3.7 Electronic standard specification. For the purpose of this specification, electronic standard specifications are those listed in Appendix A.

6.3.8 Electronics. The term "electronics" is defined as a system, or equipment, the primary purpose of which is the transmission or reception of intelligence, and 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.

6.3.9 Hermetic sealing. Hermetic sealing is the process by which an item is totally enclosed by a suitable metal structure or case by fusion of metallic or ceramic materials so that no gas or liquid can enter or escape. 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.

6.3.10 Interconnecting cable. Interconnecting cable is an assembly of a definite continuous length of one or more insulated, parallel or twisted electrical conductors having both ends terminated with fittings which provide for connections to components of an electrical circuit.

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6.3.11 Intermittent and short-time operations. Intermittent and short-time operations are the alternating periods of operation for the specified time followed by 15 minutes of nonoperation.

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

6.3.13 Procuring activity. The Military or Federal agency contracting for equipment.

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

6.5 Finishes. Changes necessary to military specifications believed required by 3.1.9 should be brought to the attention of the procuring activity.

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

- a. Handbook, Preferred Circuits, Navy NAVAIR-16-1-519, Aeronautical Electronic Equipment Vol. 2
- b. Electronic Circuits MIL-STD-439

6.7 Detail equipment specifications. Since this specification covers only the general requirements for parts, materials, processes, design and construction, the detail equipment specification, contract, or order should specify actual requirements from the multiple choices or exceptions available in the following paragraphs.

- a. Classification requirements (1.2 and 6.2)
- b. Exterior finish requirements (3.1.8)
- c. Accessibility (3.2.9)
- d. Maintainability (3.2.8)
- e. Orientation (3.2.14)

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- f. Methods of maintaining pressure (3. 2. 15(g))
- g. Altitude requirement in specifying air leakage (3. 2. 15(h))
- h. Service conditions (electrical) (3. 2. 17)
(detailed power requirements)
- i. Warmup time (3. 2. 17. 1)
- j. Vibration (3. 2. 18. 5)
- k. Meters (3. 1. 15)
- l. Thermal design (3. 2. 3)
- m. Electromagnetic interference characteristics (3. 2. 6)

6.8 Supersession data. This issue of MIL-E-8189 supersedes all previous issues of MIL-E-8189 for new designs. Previous issues of MIL-E-8189 remain in effect to cover the procurement of previously designed equipment.

6.9 Changes from previous issue. The margins of this specification have been marked with an asterisk to indicate where changes, from the previous issue have been made. This has been done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content, irrespective of the original notations and relationship to the last previous issue.

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TABLE I
ENVIRONMENTAL CONDITIONS

Equipment class	Equipment operating					Equipment operating and nonoperating		Equipment nonoperating		
	Temperature extremes for the chamber (without external cooling provisions)		Combined temperature-altitude	Temperature shock	Altitude	Temperature extremes	Temperature shock	Temperature extremes	Temperature shock	
	Column I continuous	Column II Intermittent								Column III short-time
Class 1	-54° C +55° C	30 min. +71° C	---	Defined by curve A, figure 2, (sheet 1)	Defined by curve B, figure 2, (sheet 1)	---	-54° C to +71° C	Sea level (30.0 in. Hg.) to 50,000 ft.	-62° C to +85° C	-62° C to +85° C
Class 1A	-54° C +55° C	30 min. +71° C	---	Defined by curve A, figure 2, (sheet 1)	Defined by curve B, figure 2, (sheet 1)	---	-54° C to +71° C	Sea level (30.0 in. Hg.) to 30,000 ft.	-62° C to +85° C	-62° C to +85° C
Class 2	-54° C +71° C	30 min. +95° C	---	Defined by curve A, figure 2, (sheet 2)	Defined by curve B, figure 2, (sheet 2)	---	-54° C to +95° C	Sea level (30.0 in. Hg.) to 70,000 ft.	-62° C to +95° C	-62° C to +95° C
Class 3	-54° C +95° C	30 min. +125° C	10 min. +150° C	Defined by curve A, figure 2, (sheet 3)	Defined by curve B, figure 2, (sheet 3)	Defined by curve C, figure 2, (sheet 3)	-54° C to +125° C	Sea level (30.0 in. Hg.) to 100,000 ft.	-62° C to +125° C	-62° C to +125° C
Class 4	-54° C +125° C	30 min. +150° C	10 min. +260° C	Defined by curve A, figure 2, (sheet 4)	Defined by curve B, figure 2, (sheet 4)	Defined by curve C, figure 2, (sheet 4)	-54° C to +150° C	Sea level (30.0 in. Hg.) to 100,000 ft.	-82° C to +150° C	-62° C to +150° C
Class 5	-54° C +95° C	30 min. +125° C	---	Same as Class 3	---	---	-54° C to +125° C	Sea level (30.0 in. Hg.) to 2,000,000 ft.	-62° C to +125° C	-62° C to +125° C

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

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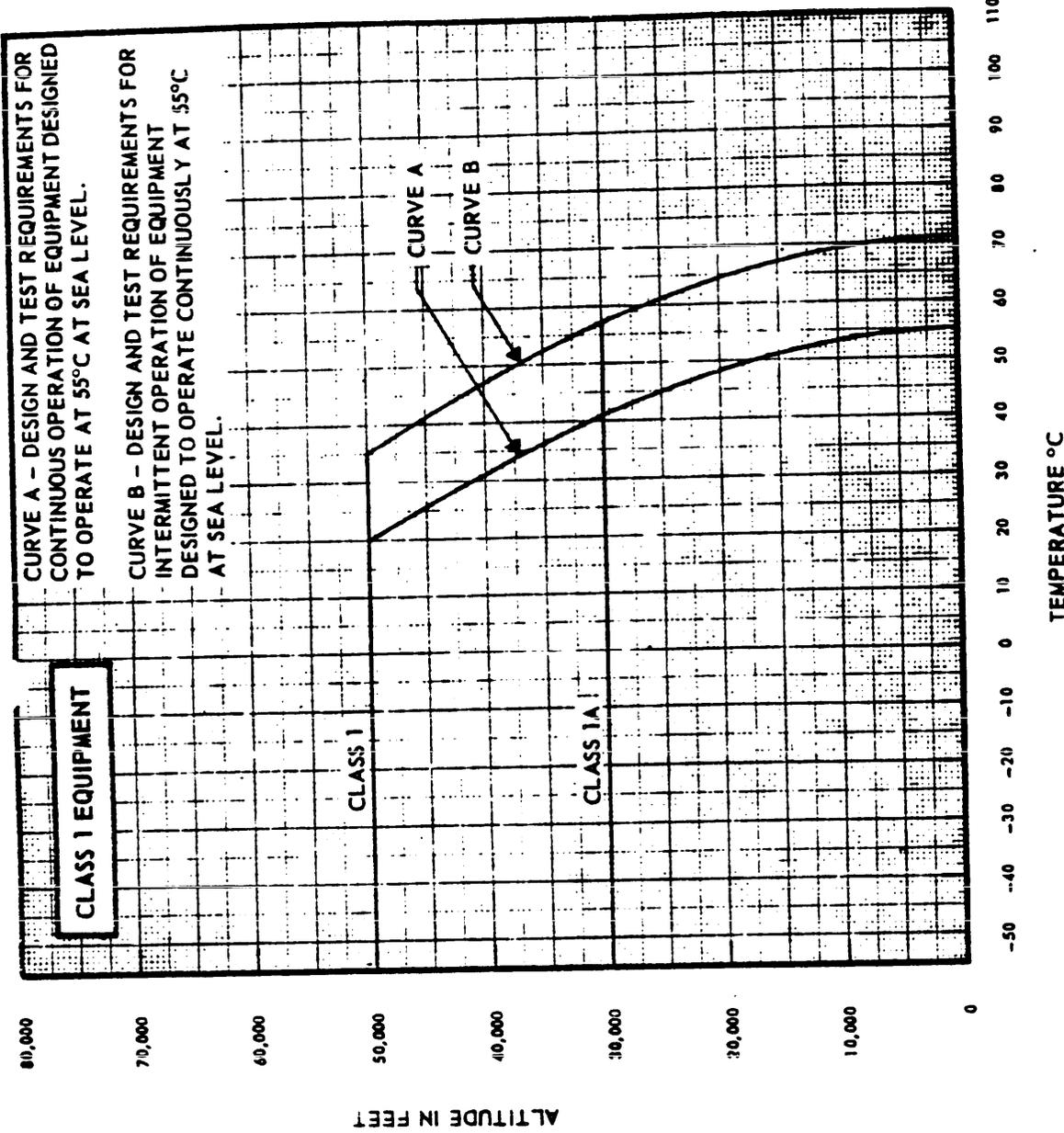


Figure 2 (Sheet 1 of 4). Operational Requirements for Class 1 Electronic Equipment for Missiles, Boosters or Allied Vehicles (Temperature vs. Altitude)

NOTE: Figure 1 of previous issues has been deleted

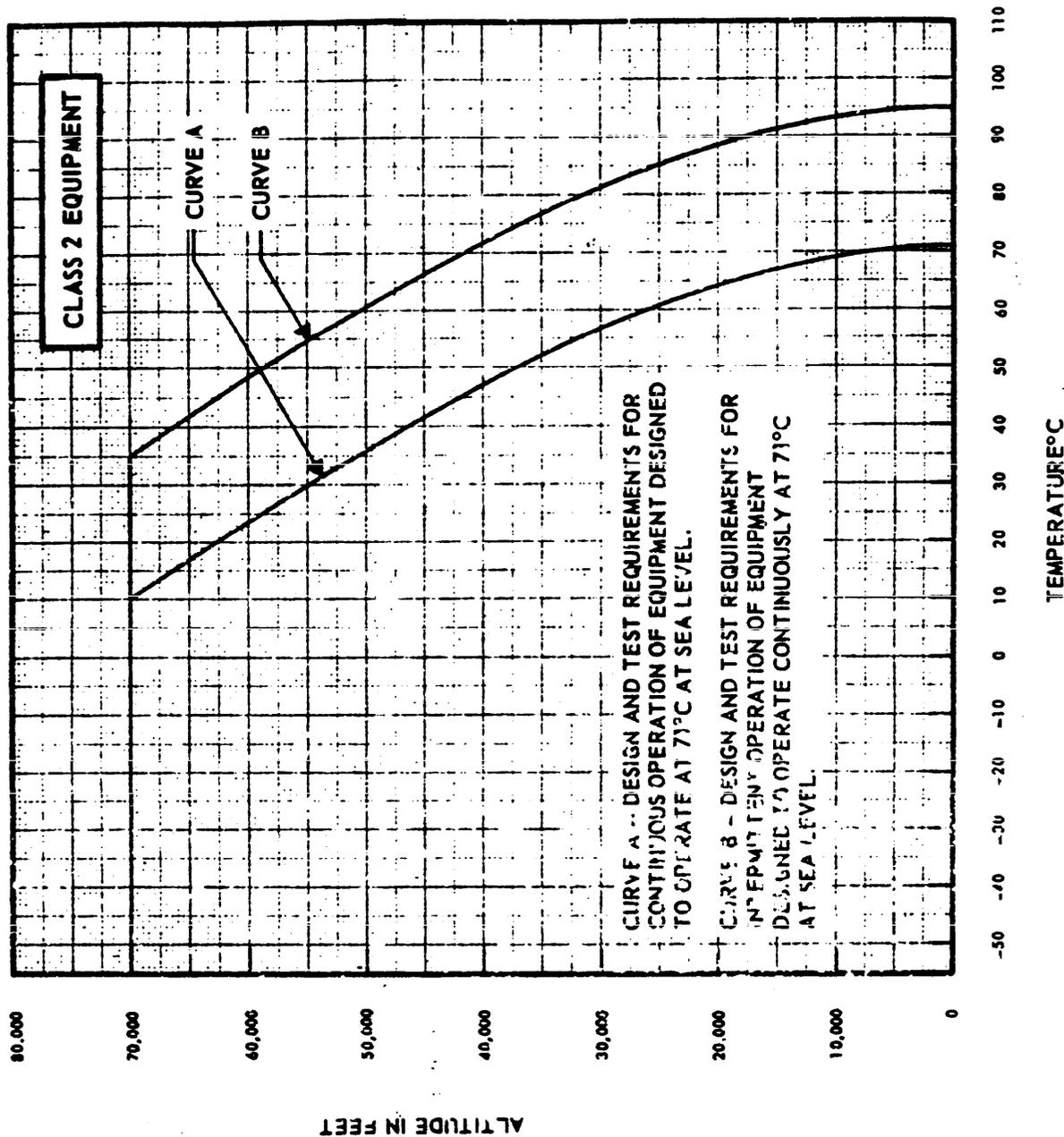


Figure 2 (Sheet 2 of 4). Operational Requirements for Class 2 Electronic Equipment for Missiles, Boosters or Allied Vehicles (Temperature vs. Altitude)

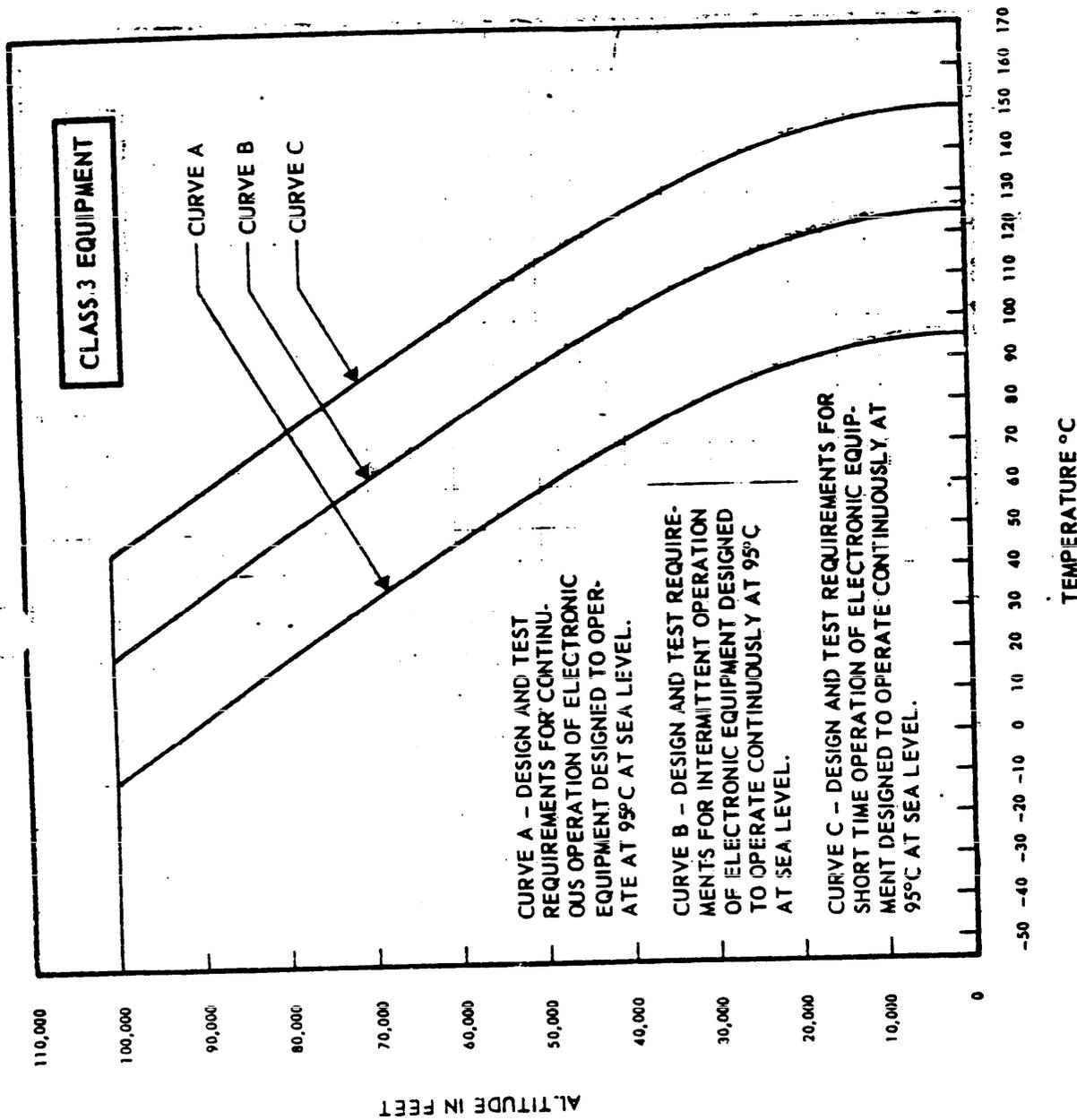


Figure 2 (Sheet 3 of 4). Operational Requirements for Class 3 Electronic Equipment for Missiles, Boosters or Allied Vehicles (Temperature vs. Altitude)

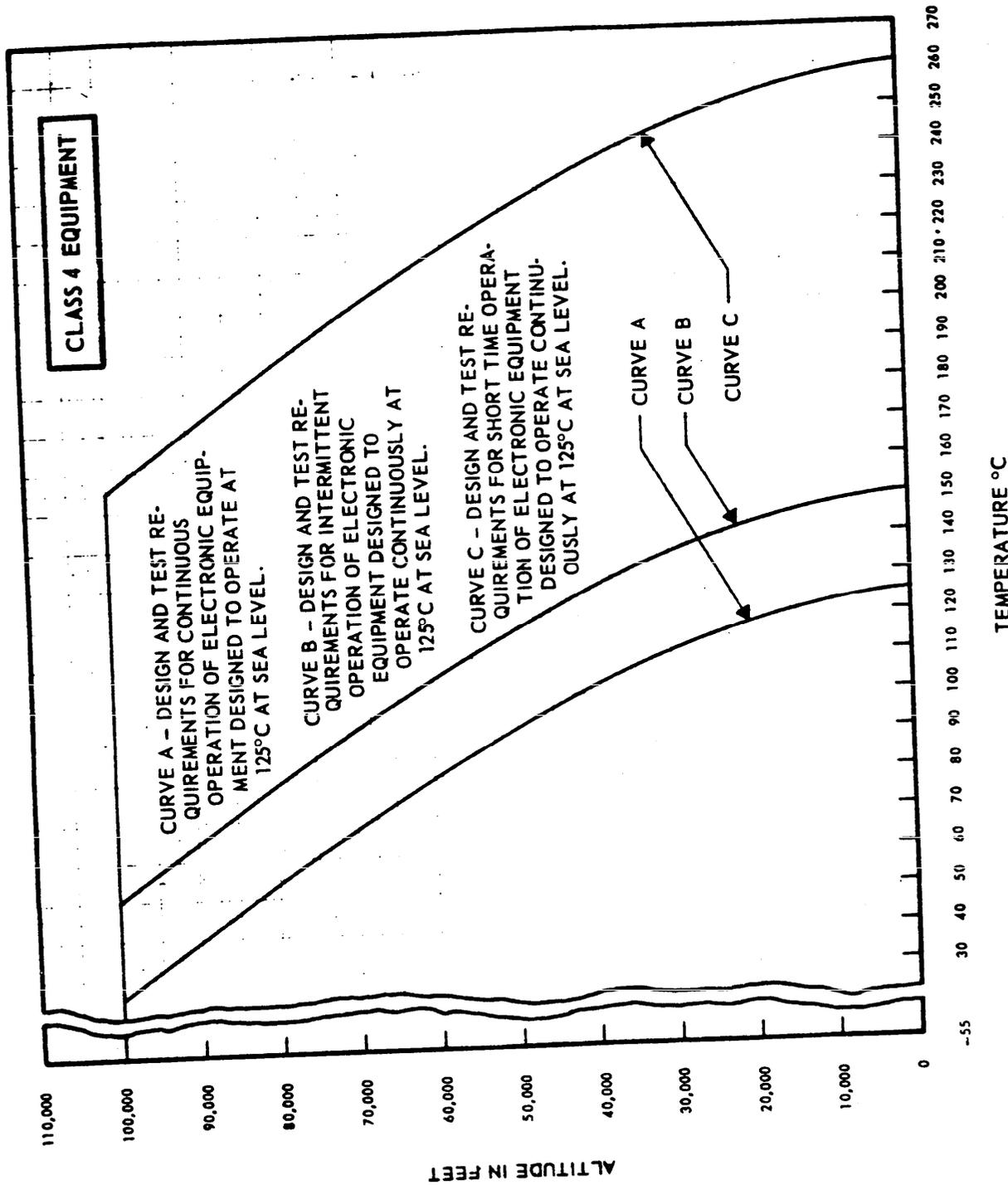


Figure 2 (Sheet 4 of 4). Operational Requirements for Class 4 Electronic Equipment for Missiles, Boosters or Allied Vehicles (Temperature vs. Altitude)

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Custodians:

Army -
Navy - AS
Air Force - 11

Preparing activity:

Navy - AS
Project No. MISC-0A37

Reviewer activities:

Navy - EC

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Appendix A
Supersession Data
(See 30.3)

APPENDIX A

AIRBORNE ELECTRONIC AND ASSOCIATED EQUIPMENT, APPLICABLE DOCUMENTS

10. SCOPE

10.1 Scope. This appendix lists the specifications, standards and publications to be used in the design and construction of airborne electronic equipment.

20. APPLICABLE DOCUMENTS

See Alphabetical and Numerical lists

30. REQUIREMENTS

30.1 Effective issue. The issue of the selected specification, standard or publication that applies is the issue of the selected document in effect on the date of the applicable issue of MIL-E-8189. Later revisions, amendments, Qualified Products Lists, and superseding documents which apply to parts, materials, and technical processes, may be used when preferred by the contractor. When a later issue is used, all the applicable requirements of the later issue shall be used.

30.2 Application of selected documents. Before proceeding with the application of any document listed in this appendix, all specification and contractual requirements must be reviewed by the contractor and the extent of the application determined.

30.3 Supersession. This appendix supersedes all issues of MILITARY/ANA BULLETIN 400 ~~is~~ related to MIL-E-8189, for new designs. Previous issues of MILITARY/ANA BULLETIN 400 remain in effect for the procurement of previously designed equipment.

30.4 Part selection standards. When part selection standards are referenced in this appendix the documents listed in those standards have the same status as being listed in this appendix and the parts they cover are considered standard.

* Indicates the document is new in this issue.

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Appendix A

ALPHABETICAL LIST

<u>Document Title</u>	<u>Document Number</u>	<u>Referenced in MIL-STD-454 Regt. No.</u>
Accident Prevention Signs, Specifications for	ANSI-Z-35.1-1968	1
Adapter, Connector, Coaxial, Radio Frequency, between Series, and within Series, General Specification for	MIL-A-27434	
Adapters, Coaxial to Waveguide, General Specification for	MIL-A-22641	53
Adhesives	MIL-HDBK 691	23
Adhesive, Air-Drying, Silicone Rubber	MIL-A-25457	23
Adhesive Glass to Metal (for Bonding)	MMM-A-131	23
Adhesive, Heat Resistant, Air-Frame Structural Metal to Metal	MMM-A-132	23
Adhesive, Optical, Thermosetting	MIL-A-3920	23
Adhesive, Phenol, Resorcinol, or Melamine Base	MMM-A-181	23
Adhesive, Rubber Base, General Purpose	MMM-A-1617	23
Adhesive, Synthetic Rubber, Thermoplastic General Purpose	MMM-A-189	23
Air Transportability Requirements, General Specification for	MIL-A-8421	
Aluminum Alloy, Bar, Rod, Shapes, Tube and Wire Extruded, and Structural Shapes, General Specification for	QQ-A-200	
Anodic Coatings, for Aluminum and Aluminum Alloys	MIL-A-8625	
Application of Electrical Resolvers	MIL-HDBK 218	56
Attenuator, Fixed Selection of	MIL-STD-1352	53
Batteries, Storage, Sealed, Nickel-Cadmium	MIL-B-55130	27
Battery Dry	MIL-STD-688	27
Bearing, Ball, Annular, Instrument Precision	MIL-B-23063	6
Bearing, Ball Precision, for Instruments and Rotating Components	MIL-B-81793	6
Bearing, Roller, Needle, Air-Frame, Anti-Friction	MIL-B-3990	6
Bearing, Roller, Tapered	FF-B-187	6
Bearing, Sleeve, (Bronze, Plain or Flanged)	FF-B-195	6
Bearings, Ball, Annular (General Purpose)	FF-B-171	6
Bearings, Roller, Cylindrical; and Bearings, Roller, Self-Aligning	FF-B-185	6
Bearings, Sleeve, Washers, Thrust, Sintered, Metal Powder, Oil-Impregnated	MIL-B-5687	6
Blower, Miniature, for Cooling Electronic Equipment (10 to 500 CFM), General Specification for	MIL-B-23071	52

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Appendix A

<u>Document Title</u>	<u>Document Number</u>	<u>Referenced in MIL-STD-454 Reqt. No.</u>
Bolt, Aircraft	MIL-B-6812	12
Bolt, Hexagon and Square	FF-B-575	12
Bolt, Internal Wrenching, 160 KSI Ft _u	MIL-B-7838	12
Bolt, Nut and Stud	MIL-B-857	12
Bolts, Internal Wrenching	NAS496	
Bolts, Shear	NAS498	12
Bonding, Electrical, and Lighting Protection, for Aerospace Systems	MIL-B-5087	1
Brass Leaded and Nonleaded, Flat Products (Plate, Bar, Sheet and Strip)	QQ-B-613	
Brazing of Steels, Copper, Copper Alloys, Nickel Alloys, Aluminum Alloys	MIL-B-7883	59
Cable, Electric, Aerospace Vehicle, General Specification for	MIL-C-7078	66, 71
Cable, Electrical, Special Purpose, General Specification for	MIL-C-915	66, 71
Cable, Radio Frequency, Semi-Rigid, Coaxial, Semi-Air-Dielectric, General Specification for	MIL-C-22931	65
Cable, Special Purpose, Electrical 34, 36, 37, 39, 40, 42, 46, 47 and 52 Conductors	MIL-C-13777	66, 71
Cable, Special Purpose, Electrical Multiconductor	MIL-C-27072	66, 71
Cable and Wire, Electrical (Power and Control, Flexible and Extra Flexible, 300 and 600 Volts)	MIL-C-3432	66, 71
Cables, Radio Frequency, Coaxial, Dual Coaxial, Twin Conductor, and Twin Lead	MIL-C-17	65, 66, 71
Cap, Dust, Plastic, Electric Connectors	MS90376	
^{1/} Capacitor, Selection and Use of	MIL-STD-198	2
Cases, Bases, Mounting, and Mounts, Vibration (for Use With Electronic Equipment in Aircraft)	MIL-C-172	55
Casting, Classification and Inspection	MIL-C-6021	21
Cellular Elastomeric Materials, Fabricated Parts	MIL-C-3133	
Chemicals Films and Chemical Film Materials for Aluminum and Aluminum Alloys	MIL-C-5541	
Chromium Plating (Electrodeposited)	QQ-C-320	
* Circuit Breakers, Selection and Use of	MIL-STD-1498	
Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings	TT-C-490	
Color	FED-STD-NO. 595	

^{1/} Use of certain parts referenced in this military specification require procuring activity approval for use as outlined in MIL-E-8189 and MIL-STD-454.

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Appendix A

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1/ Use of certain parts referenced in this military specification require procuring activity approval for use as outlined in MIL-E-8189 and MIL-STD-454.

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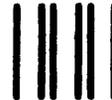
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