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MILITARY SPECIFICATION  
 INSTALLATION AND TEST OF ELECTRONIC EQUIPMENT  
 IN AIRCRAFT, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 This specification covers the general requirements for the installation and test of electronic equipment in piloted aircraft.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-C-172	Cases; Bases, Mounting; and Mounts, Vibration (For Use With Electronic Equipment in Aircraft)
MIL-C-1000	Drawings, Engineering and Associated Lists
MIL-B-5087	Bonding, Electrical and Lightning Protection, for Aerospace Systems
MIL-W-5088	Wiring, Aircraft, Installation of
MIL-E-5400	Electronic Equipment, Airborne, General Specification For
MIL-E-6051	Electromagnetic Compatibility Requirements, Systems
MIL-C-6781	Control Panel: Aircraft Equipment, Rack or Console Mounted
MIL-E-7080	Electrical Equipment, Aircraft, Selection and Installation of
MIL-F-7179	Finishes and Coatings, General Specification For Protection of Aircraft and Aircraft Parts
MIL-N-7513	Nomenclature Assignment, Contractors Method for Obtaining
MIL-R-7705	Radomes, General Specification For
MIL-C-7762	Compasses, Installation of
MIL-P-7788	Plate, Plastic, Lighting
MIL-A-9094	Arrester, Lightning, General Specification for Design of
MIL-S-9129	Static Discharger AN/ASA-3B
MIL-F-15733	Filters, Radio Interference
MIL-F-25173	Fastener, Control Panel, Aircraft Equipment
MIL-M-81288	Mounting Bases, Flexible Plastic Foam

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STANDARDSMilitary

MIL-STD-130	Identification Marking of U. S. Military Equipment
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-454	Standard General Requirements For Electronic Equipment
MIL-STD-877	Antenna Subsystems, Airborne, Criteria for Design and Location of
MIL-STD-882	System Safety Program For Systems and Associated Subsystems and Equipment; Requirements For
MIL-STD-889	Dissimilar Metals
MS21047	Nut, Self-Locking, Plate, Two Lug, Low Height, Steel, 125 KSI FTU, 450 DEG, and 800 DEG. F
MS 21048	Nut Self-Locking, Plate, Two Lug, Low Height, CRES, 125 KSI FTU, 450 DEG
MS 24435	Connector Receptacle, Power Outlet, Electronic Test Equipment
MS 33630	Switch, Toggle, Installation of

PUBLICATIONSMilitary Handbooks

MIL-HDBK-216	RF Transmission Lines and Fittings
MIL-HDBK-660	Fabrication of Rigid Waveguide Assemblies (Sweep Bends and Twists)

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

## 3. REQUIREMENTS

3.1 Applicability of requirements. The electronic equipment installations shall be in accordance with this specification, approved applicable detail equipment installation specifications and drawings, approved equipment handbooks, and other alternate or additional information available to the airframe contractor and approved by the procuring activity.

3.1.1 In case of conflict between the requirements of this specification and the requirements of any detail installation or test specification for electronic equipment, the requirements of the detail specification shall govern.

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3.2 Materials and equipment. Materials and equipment used in the installation of electronic equipment in aircraft shall be of high quality, suitable for the purpose, and shall conform to specifications as are applicable under the contract.

3.2.1 Selection. Materials and equipment shall be in accordance with MIL-E-5400 and other specifications selected in the order of precedence as set forth in MIL-STD-143, except as otherwise specified herein.

3.2.1.1 Standard parts. Standard parts (MS, AN, or JAN) shall be used in the installation of equipment wherever they are suitable for the purpose, and shall be identified on the drawing by their part numbers.

3.2.1.2 Nonstandard parts. Commercial utility parts such as screws, bolts, nuts, cotter pins, etc. may be used, provided they possess suitable properties and are replaceable by standard parts (MS, AN, or JAN) without alteration, and provided the corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is not suitable corresponding part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification. Nonstandard parts shall be submitted for approval as stipulated in requirement 22 of MIL-STD-454.

3.2.2 Metals. Metals involved in the installation of electronic equipment and associated wiring shall be of a corrosion-resistant type or shall be suitably protected to resist corrosion and electrolytic action during normal service life. The specific requirements of MIL-B-5087 shall apply to all metals that are part of the bonding path. Finish and coating requirements in accordance with MIL-F-7179 shall not take precedence over MIL-B-5087 unless approved by the procuring activity.

3.2.2.1 Dissimilar metals. When aircraft structures are involved in aircraft installations and dissimilar metals are used, MIL-STD-889 shall apply. MIL-STD-454, requirement 16, shall apply for installations of electrical and electronic equipment.

3.2.3 Nonmetals. Nonmetals used, including plastics, fabrics, and protective finishes, shall, insofar as practicable, be moisture and flame resistant, shall not support fungus growth, or shall be so treated as not to support fungus growth and shall not be adversely affected by aircraft fluids. The specific requirements of MIL-B-5087 shall apply. Nonmetals installed on the exterior of the aircraft shall be coated with a conductive coating of resistance not less than 10 megohms per square unit or more than 50 megohms per square unit.

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3.2.4 Sealing materials. Sealing materials (potting compounds) chosen to seal wire junctions and entrances to connectors, electronic-and-communication-type relays, terminals, and splices shall be in accordance with MIL-STD-454, requirement 47.

3.2.5 Contractor-furnished equipment (CFE)

3.2.5.1 Contractor specifications. Material and equipment conforming to contractor's specification may be used, provided there are no applicable Government specifications and the contractor's specification are approved by the procuring activity. If contractor's specifications are used, the contractor shall, when required by the procuring activity, provide samples for test. Contractor's specification shall use an asterisk (\*) or similar symbol to denote changes, deviations or modifications. The use of contractor's specifications shall not constitute waiver of Government inspection.

3.2.5.2 Contractor modifications. The contractor shall not alter, rework, or modify contractor-furnished equipment built to, and meeting, Government specifications, unless authorized or directed by the procuring activity. When such modifications are authorized, the contractor shall identify the equipment by new nomenclature or part number as approved by the procuring activity.

3.2.5.3 Console control panels. All contractor-furnished control panels shall be designed for mounting in a console arrangement, shall meet the requirements of MIL-C-6781, shall have a plastic lighting plate meeting the requirements of MIL-P-7788, shall be equipped with fasteners meeting the requirements of MIL-F-25173, and shall be electrically bonded in accordance with MIL-B-5087. Human engineering design criteria shall be in accordance with requirement 62 of MIL-STD-454.

3.2.5.3.1 All control panels installed for use by the pilot and, if applicable, the co-pilot shall be grouped together in a console arrangement located for convenient access, with preference given to ease of operation by the pilot. All control panels installed for other crew members shall be grouped in a console arrangement at the crew members position and located for convenient operation.

3.2.6 Government-furnished aircraft equipment (GFAE). Materials and equipment furnished by the Government shall be installed without modification, unless otherwise authorized or directed by the procuring activity. Modifications to GFAE shall be subject to inspection and approval by the procuring activity and shall be suitably identified by an additional nameplate, or other means, to indicate the rework.

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### 3.3 Installation design requirements

#### 3.3.1 Equipment components and parts

3.3.1.1 Cases and mounting bases. Materials, bonding, shielding, and performance requirements of MIL-C-172 shall apply to all cases. Mounting bases shall conform to MIL-C-172 or MIL-M-81288, as applicable, except that performance shall be met for the frequencies and amplitude shown in the specific curve of figure 3 of MIL-E-5400 for the applicable equipment. Mounts and vibration isolators, whether integral or not, shall be subject to the approval of the procuring activity. Self-locking fasteners shall be used. Foam mounts may be used only if specified in the equipment specification.

#### 3.3.1.2 Switches

3.3.1.2.1 Toggle, push-button, rotary, lever-lock switches. Toggle, push-button, rotary, and lever-lock switches shall be selected and applied in accordance with requirement 58 of MIL-STD-454. Toggle switches shall be installed in accordance with MS 33630. All toggle switches shall be accessible in flight, except those used for ground operation only.

3.3.1.2.2 R-f coaxial switches. R-f coaxial switches shall be in accordance with requirement 58 of MIL-STD-454 as applicable. MIL-HDBK-216 may be used for guidance. R-f coaxial switches to be installed in nonenvironmentally shielded applications shall be moisture resistant.

3.3.1.2.3 Switch installation requirements. Care shall be exercised in grouping and locating switches to prevent improper selection and inadvertent operation. Consideration shall be given to providing space on each switch panel containing four or more switches for subsequent installation of two spare switches. The space for spare switches shall be determined by the equipment and circuit data available on the date of the aircraft mockup inspection.

3.3.1.3 Relays. All relays shall conform to requirement 57 of MIL-STD-454. For airborne electronic equipment (per MIL-E-5400) applications, only hermetically sealed relays shall be used. For aircraft electrical equipment (per MIL-E-7080) applications below 50,000 feet altitude, non-hermetic sealed relays may be used.

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3.3.1.3.1 Relay applications. Relays shall be used for the control of circuits that are at such a distance from the switching source that a greater safety factor or lower weight is achieved. Relays shall also be utilized to provide adequate switching capacity when manual control switches of the proper size or rating are not available, or to provide proper sequence of operation not readily obtainable by manual control switches.

3.3.1.3.2 Relay installation. Relays shall be so installed that tightening of the bus or cable to the terminals will not cause damaging strain on the relay. Relays shall be so orientated that there is no effect upon the operation of the relay when the specified conditions of shock and vibration are encountered in service. Relay installation shall be such that the terminals can be readily inspected or the relay easily removed for testing and replacement.

3.3.1.3.2.1 Plug-in relays shall be so properly secured (e. g., a hold-down clamp or equivalent means) that they will not work loose from sockets.

3.3.1.3.2.2 Where metal-cased relays are mounted on insulated materials (e.g., as in fiberglass boxes), a case grounding connection shall be made. (Reference requirement 1 of MIL-STD-454 and RFI requirements of MIL-B-5087.)

3.3.1.4 Resistors. Resistors shall conform to requirement 33 of MIL-STD-454.

3.3.1.4.1 Resistor mounting. Resistors shall be securely mounted in such a manner as to allow for expansion with temperature changes. Resistors weighing one-half ounce or more shall not be supported by the leads alone but shall have mechanical support for the body. Resistors under one-half ounce shall have the lead to the mounting terminal at least  $\frac{1}{4}$  inch long and shall not exceed 1 inch.

3.3.1.5 Power receptacles. Test equipment receptacle(s) shall be installed to provide d-c power or a-c power, or both, in accordance with MS24435. The receptacle(s) shall be so located that no more than 8 feet of power cord shall be required for the applicable aerospace ground equipment (AGE) to reach any installed unit.

3.3.1.5.1 Receptacle installations. When more than one power receptacle of the same type is required at the same position in the aircraft by the equipment installation data, the contractor may install the minimum number of receptacles commensurate with the maintenance requirements provided:

a. The wire sizes and circuit protector ratings comply with maximum test power requirements.

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- b. Frequency regulation is adequate for each equipment
- c. The location of receptacle with respect to applicable equipments conforms with requirements of applicable drawings
- d. The receptacle is completely identified.

3.3.1.5.1.1 Receptacle location. When a junction box for electronic equipment is located near enough to applicable equipment to meet the requirements of drawings calling for test power receptacle(s), the receptacle (s) shall be installed in a wall of the junction box.

3.3.1.5.1.2 Receptacle identification. Each power receptacle shall be identified as "POWER RECEPTACLE". In addition thereto, the identification shall include the following: Types (In volt-amperes) of electrical power and amount provided by the receptacle and frequency range, if alternating-current power is provided, as in the following examples:

28V DC	115V 1 PHASE
280 VA	380-420 REG
	300 VA

3.3.1.6 Wire, cables, and connectors. The selection of wires and cables shall be as specified in the contract. The selection of electrical connectors shall be in accordance with requirement 10 of MIL-STD-454.

3.3.1.6.1 Installation of wiring, cables, connectors, and junction boxes. Interconnecting wiring, cables, and connectors shall be installed in accordance with the individual equipment interconnecting wiring diagram or cable assembly, or both, and in accordance with MIL-W-5088 and MIL-B-5087, providing electromagnetic compatibility is not compromised. In case of discrepancy between MIL-B-5088, MIL-B-5087, MIL-E-6051 and requirements of applicable drawings furnished by the procuring activity, the requirements of the drawings shall govern.

3.3.1.6.1.1 Cable installation

3.3.1.6.1.1.1 Cables shall not be routed through the equipment mounting bases and shall be so supported as not to interfere with the operation of vibration isolators.

3.3.1.6.1.1.2 Cables shall be cut with sufficient length to facilitate service replacement of connectors in accordance with MIL-W-5088.

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3.3.1.6.1.2 Connector installation. Approved connectors shall be installed where cables are routed through structural members requiring a disconnect for pressurization or to facilitate production assembly. Extra contacts in these connectors shall be provided in accordance with the requirements of MIL-E-5400.

3.3.1.6.1.3 Junction boxes. Radio and radar junction boxes shall be provided to include, as far as practical, all components, wire terminations, and circuit protection devices necessary for the interconnection and installation of the radio and radar equipment. The functions included in each junction box shall be segregated in a logical manner in accordance with the specific requirements of MIL-B-5087, MIL-W-5088, and MIL-E-6051. Each junction box shall be accessible for inflight or ground maintenance. Controls or circuits unrelated to the radio and radar equipment shall not be included in these junction boxes.

3.3.1.6.2 R-f transmission lines

3.3.1.6.2.1 Coaxial cables. Coaxial cables shall be the type specified on applicable wiring diagrams or approved by the procuring activity. The attenuation characteristics of the coaxial cable and associated connectors from any equipment to its antenna shall not exceed 3dB. Maximum consideration shall be given to the attenuation characteristics in the selection of coaxial cables and associated connectors from any equipment to its antenna. High temperature coaxial cables shall be installed in locations where the ambient temperature will exceed +180<sup>o</sup>F (+82<sup>o</sup>C). (Engineering information on these cable and associated connectors is outlined in MIL-HDBK-216.) Cables that are subject to damage due to extreme cold conditions shall not be utilized in any location where flexure will occur during normal operation. Cables assembled by the aircraft manufacturer shall be prepared in accordance with drawings approved by the procuring activity and shall be tested for continuity, insulation, high potential, and correct connections before and after installation.

3.3.1.6.2.1.1 Coaxial routing. Coaxial cable routing shall be as direct as possible avoiding unnecessary bends and shall be designed to permit easy replacement of the cables without requiring the removal of fixed skin sections or major items of fixed equipment. Cables routed through nonpressurized bulkheads or other nonpressurized structure members shall be protected by grommets or shall be anchored securely by suitable cable clamps to avoid chafing. The cable clamps shall be of a size to provide a snug fit without deforming the cable and shall be located at each end of all bends.

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3.3.1.6.2.2 Coaxial connectors and adapters. All radio-frequency connectors, except bayonet-locking types, located in positions inaccessible during flight, shall be safety-wired in accordance with applicable drawings. The use of right-angle adapters and connectors shall be held to the absolute minimum to avoid the resulting signal losses and to reduce the susceptibility to moisture effects. Where cables cannot be routed to avoid a termination bend radius less than six times the diameter of the cable, approved right angle plugs or adapters may be installed unless the detail equipment installation specification or drawings prohibits their use. Right angle plugs are preferred over right angle adapters since they reduce the number of r-f discontinuities and required fittings from 3 to 2 at the junction. Information relative to these plugs may be obtained from the procuring activity.

3.3.1.6.2.3 Waveguides. Waveguides and waveguide accessories shall be selected in accordance with requirement 53 of MIL-STD-454. All parts shall be related, fabricated, and installed in accordance with MIL-HDBK-216 and MIL-HDBK-660.

3.3.1.7 Antennas. The design, location, and installation of antennas shall conform to the requirements of MIL-STD-877.

3.3.1.8 Radomes. The design, construction, and tests of radomes shall conform to the requirements of MIL-R-7705 and MIL-B-5087.

3.3.1.9 Presentation devices. Cathode-ray indicators and similar presentation devices shall be installed in front of the operator to provide maximum readability and ease of adjustment at all times during operation. When more than one presentation device is to be located in one operating position, a priority for choice location will be established by the procuring activity.

### 3.3.2 Equipment protection

3.3.2.1 Moisture pockets, walls, traps, and the like, in which water and condensed moisture can collect when the equipment is in normal operating position shall be eliminated or properly drained.

3.3.2.2 Protection shall be provided against water or aircraft fluid leakage and condensation onto the equipment, excessive heat, and combustible vapors and fluids.

3.3.2.3 Protection shall be provided against physical damage, such as may be caused by abrasion, crew movements, inadvertent operation of controls, loading and shifting of cargo, loading of armament and munitions, and ejection of shell cases, clips, and sonobuoys.

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3.3.2.4 The equipment shall be so installed as not to cause damage to, or be damaged by, other equipment, wiring, or plumbing.

3.3.3 Circuit protection. Circuit protection shall be in accordance with requirements 8, 37, and 39 of MIL-STD-454. Installation of circuit protective devices shall be in accordance with MIL-E-7080.

3.3.4 Equipment mounting provisions. Mounting provisions shall exhibit strength and rigidity commensurate with the requirements of the airframe design and the physical characteristics of the equipment. These requirements shall meet the electrical bonding requirements of MIL-B-5087.

3.3.4.1 Mounting hardware. Only machine screws or bolts shall be used for mounting electronic equipment. Whenever the under-surface of the mounting is inaccessible, plate nuts in accordance with MS 21047 or MS21048, or equivalent to be approved by the procuring activity, shall be used.

3.3.4.1.1 Strength of installation hardware. Mounting screws or bolts shall be of sufficient strength to sustain the units under the maximum acceleration expected in the aircraft, under all normal and emergency conditions, and to withstand such incidental abuse as can be expected under all service conditions. The installation hardware located in compartments occupied by crew members or other personnel shall withstand impact shocks of 30g having a time duration of  $11 \pm 1$  millisecond or a static load of 20g in the three major axial directions of the aircraft.

3.3.4.2 Strength of supporting hardware. Supporting members, brackets, racks, and cable clamps drilled as specified or required for mounting the equipment on the aircraft structure shall meet the strength requirements of 3.3.4.1.1.

3.3.4.3 Mounting position. Units shall not be mounted or installed in any manner other than that for which the units or the mountings are designed. In cases where the units or the mountings are to be installed at angles greater than 10 degrees from the designed angle in the normal flight attitude of the aircraft, the contractor shall request approval of the procuring activity. The use of contractor-furnished fixed mounts as an alternate to Government-furnished mounts may be permitted subject to prior approval of the procuring activity; said approval to be based on substantiating data to be submitted by the contractor.

3.3.5 Accessibility of electronics. The electronics installations shall be so designed that those equipment adjustments, test points, inspection points, destructors, equipment fuses, circuit breakers, meters, etc., that are necessary for determining proper operation of electronic equipment, shall be readily and safely accessible. Accessibility of electronics shall be in accordance with requirement 36 of MIL-STD-454.

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3.3.6 Equipment clearance. Space shall be provided for each component of electronic equipment to insure adequate ventilation, unobstructed shockmount operation, and accessibility for preflight testing, for replacement, and for inflight operation. Space requirements for each component shall be determined by the airframe contractor based upon the following factors:

a. Clearances shall be provided in accordance with installation drawing(s) for the component, and in accordance with the special requirements for accessibility for preflight testing, for replacement, and for inflight operation and for adequate ventilation and cooling as dictated by the basic design of the airplane.

b. Where no approved drawing exists, the airframe contractor shall utilize detail equipment installation specifications, handbooks, mockup equipment, actual equipment, vendor's drawings, and such other sources as are available and are approved by the procuring activity.

3.3.7 Cooling. Cooling shall be provided as necessary to insure that the maximum ambient temperatures specified for the various installed electronic equipments are not exceeded in flight or during ground operation. Provisions shall be made to keep ambient temperatures from exceeding the nonoperating design temperature of the equipment or 185 F whichever is the lesser of the two.

3.3.7.1 Cooling distribution. Cooling medium supplied directly to equipment(s) shall be at the weight flows and temperatures specified in the applicable equipment specification. Plenum chamber and distribution pressure losses affecting weight flow and cooling medium temperature rise in the plenum chamber shall be taken into account when several units are supplied cooling medium from a common plenum.

3.3.7.2 Emergency cooling. When the equipment and equipment compartment cooling system is separate from that used for the occupied compartments, ram air at quantities sufficient to enable adequate cooling of both air and liquid cooled essential equipment shall be provided to complete mission or accomplish "safe return" to base, whichever is required by the weapon system specification, if the cooling system fails.

3.3.8 Pressurization. When more than one electronic equipment requiring either pressurization or dehumidification, or both, is installed in the same airframe, the contractor shall explore the feasibility and practicability of meeting the requirements from a common source. Precaution shall be taken to assure that the loss of one equipment shall not cause the loss of another.

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3.3.9 Personnel safety. The equipment and installation shall be so designed as to protect personnel from electrical shock in accordance with requirement 1 of MIL-STD-454. Ground switching shall be avoided, especially in 115-volt a-c circuits; and connectors shall have no "hot" male pins when separated.

3.3.9.1 All category III or IV hazards as specified in MIL-STD-882 shall be eliminated or controlled by proper redesign or special operating procedures.

3.3.10 Lightning protection and electrical bonding. Lightning protection and electrical bonding of all electronic equipment, associated components and hardware, and tests pertaining thereto, shall be in accordance with MIL-B-5087.

3.3.10.1 Lightning arrestors. Lightning arrestors shall be in accordance with MIL-A-9094.

3.3.10.2 Electrostatic dischargers. Electrostatic dischargers shall be in accordance with MIL-S-9129.

3.3.11 Compass deviation. Components, hardware, and wiring of electronic equipment installations shall not cause magnetic compass deviations in excess of those specified in MIL-C-7762.

3.3.12 Electromagnetic compatibility. The installation and test of electrical and electronic equipment, including switches, relays, electromechanical devices, etc., shall comply with the requirements of MIL-E-6051.

3.3.12.1 Filters. Filters shall be in accordance with the requirements of MIL-F-15733 and shall be installed only when it is demonstrated to the procuring activity that they are necessary to insure compliance with MIL-E-6051.

3.3.12 Shock and vibration. Electronic equipment shall be so installed that it will not be subjected to shock and vibrations exceeding the limits specified in the equipment specification or, when not specified, the limits specified in MIL-E-5400.

3.3.14 Reliability. The reliability principles and techniques specified in requirement 35 of MIL-STD-454 shall apply.

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3.4 Installation performance requirements. When installed the entire electrical and electronic equipment shall provide acceptable performance while operating with all other equipment as appropriate and as defined by the applicable operational mission and functional performance requirements specification.

3.4.1 The performance of the electronic system shall not be compromised by the design, location, or quality of its installation. The equipment installation shall provide for simplicity of operation.

3.4.2 Unless the contractor submits for the approval of the procuring activity a proposal with substantiating test data that limits be exceeded in a particular case, the electronic equipment shall be so mounted, installed, and located as not to be subject to conditions exceeding the limits specified in the applicable equipment specifications and installation data.

3.5 Identification. Unless classified, the type designation portion of the nomenclature (e.g., AN/APS-00) for major components of electronic equipment shall be affixed to adjacent structure to identify the location of the components. Letter size and method of affixing shall be accomplished within such practical limits as determined by the contractor.

3.5.1 Identification of contractor-furnished components. The contractor shall submit to the procuring activity a list of contractor-furnished electronic equipment components, of the types listed below, that do not have Government designations or nomenclature, with a brief description of the function of the component, requesting determination as to which of the items will require AN nomenclature. In those cases where AN nomenclature is desired by the procuring activity, the contractor shall request assignment of AN nomenclature in accordance with MIL-N-7513 and nameplate approval in accordance with MIL-STD-130:

- a. Control panels in accordance with MIL-C-6781
- b. Antennas
- c. Coaxial switches
- d. Marriage units containing electronic parts
- e. Special mountings
- f. Indicating devices.

Components not covered by AN nomenclature shall be clearly identified and plainly marked in a manner suitable to facilitate supply and maintenance procedures.

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3.6 Workmanship. Details of workmanship shall be in accordance with requirement 9 of MIL-STD-454.

3.7 Drawings and photographs. When specifically required by contract, drawings and photographs shall be prepared by the contractor, within the category and form to meet the intended use, as specified in MIL-D-1000.

#### 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 and testing required in connection with the installation of electronic equipment in aircraft shall be classified as follows:

- a. Bench tests (see 4.2.1)
- b. Preflight tests (see 4.2.2)
- c. Flight tests (see 4.2.3)
- d. Engineering approval tests (category I) (see 4.2.4).

#### 4.2 Tests

4.2.1 Bench tests. Prior to installation in aircraft, each piece of electronic equipment shall be bench tested at the installation point to determine that the equipment has not been damaged nor the performance and operation affected in shipping and handling or during the interchange of components, and to establish that their controls function properly and that basic operating characteristics are within prescribed limits.

4.2.2 Preflight tests. Completed installations of electronic equipment shall be tested and adjusted as required to establish that the equipment has been properly installed and that basic performance requirements are met. Preflight tests shall consist of such tests and adjustments in accordance with approved procedures to insure all cabling is satisfactory,

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primary power is adequate, and antenna installations are without physical defects, and to insure equipment operation above the minimum standard for acceptance. When necessary, stringent requirements shall be established to minimize adjustments of installed equipment to improve the interchangeability and reduce maintenance time.

#### 4.2.3 Flight tests

4.2.3.1 Production flight tests. These tests shall be conducted on each aircraft to establish that the entire electronic system is functioning properly. Production flight tests shall check all individual equipments and systems using an abbreviated version of the Engineering approval flight tests. In general, such tests will not require quantitative checking of antenna patterns, electromagnetic compatibility, equipment ambient temperatures, maximum ranges, etc., unless such items prove in the Engineering approval flight tests to be marginal or difficult to control in the production aircraft.

4.2.4 Engineering approval tests (category I). Engineering approval tests, consisting of both ground and flight tests, as applicable, shall demonstrate that the installed equipment will perform in a manner commensurate with the operational, mission safety, and functional requirements, including flight line checkout. These tests shall include systems electromechanical compatibility, electrical bonding and radiation hazard, interference levels, antenna and radome performance, equipment ambient temperature levels, and system stability, maintainability, and reliability. When acceptable limits have not been established by the procuring activity, limits shall be proposed by the contractor and submitted for approval to the procuring activity. Examples of specific data to be acquired are ranges at various relative bearings of the communication, navigation, and identification equipment, radar search and tracking ranges, equipment accuracies, etc. Normally, engineering approval tests shall be conducted on the first production aircraft and other selected aircraft as stipulated by the procuring activity.

4.3 Test procedures. The procedures for making the bench, preflight, and flight tests will, in general, be furnished by the procuring activity in the form of a test specification, equipment handbooks, or letters of instruction. The contractor shall prepare procedures for approval of required tests which are not furnished by the procuring activity. Where tests cannot be accomplished in accordance with approved procedures owing to circumstances beyond the control of the contractor (e.g., lack of GFE test equipment or special GFE ground facilities) the tests shall consist of such alternate procedures as approved by the procuring activity to insure satisfactory equipment operation.

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4.4 Testing of provisions for service-installed equipment. Where contractors are authorized or requested to install provisions for service-installed equipment, the contractor shall make such temporary installations of the equipment in each aircraft that engineering approval, preflight, and flight tests may be accomplished. The contractor shall request the procuring activity to provide the necessary equipment required for the temporary installation.

4.5 Equipment failure. All equipment should arrive at the contractor's plant in fully operable condition, or operable with adjustments, as necessary, in accordance with approved adjustment procedures for the equipment. Equipment arriving at the contractor's plant requiring more than adjustment shall be considered to have arrived in an unsatisfactory condition. The contractor shall render an equipment operable by making minor repairs, as necessary, such as replacement of tubes, crystals, resistors, and easily replaceable subassemblies, and repair of loose or poorly soldered connections. When specified by the procuring activity, the contractor shall also perform such repairs and adjustments of a major nature as may be required for correction of defective equipment.

4.5.1 Equipment failure report. The contractor shall prepare and submit to the procuring activity a report of failure of any equipment which arrives at the contractor's plant in an unsatisfactory condition. The form and frequency of such reports shall be as specified in the Data Requirements List (DD Form 1423).

4.6 Test reports. Results of tests conducted on each equipment shall be recorded by the contractor in a test report. These data shall be retained by the contractor for review by the contractor and by representatives of the procuring activity in connection with studies leading to proposals for simplifying or otherwise improving the test requirements involved. Copies of these test reports will not normally be required for transmission to the procuring activity or to cognizant Government inspector's activities.

## 5. PREPARATION FOR DELIVERY

5.1 This section is not applicable to this specification.

## 6. NOTES

6.1 Intended use. This is a general specification and is intended to require important desirable characteristics of electronic installations which are known to be achievable in the majority of airplane designs of today, and to prohibit serious installation design discrepancies which

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have appeared in aircraft. Since this is a general specification and cannot properly account for the various special problems which appear in new airframe designs, airframe contractors are encouraged to continually review the requirements of this specification, subordinate specifications, and supporting installation and test specifications, with the intent of developing proposals to deviate from specifications whenever such deviation is predicted to yield simplification, greater reliability, better logistics, reduced cost, or improved operations.

6.2 Data requirements. 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. 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 procuring officer.

6.3 Unpacking and mechanical inspection for damage. All equipments furnished by the Government are tested before shipment. Careful handling helps to keep these units in acceptable working condition when reassembled. The equipment should be carefully unpacked and examined for apparent damage and shortages. Any dust and packing material should be removed from all units. When compressed air is used, extreme care should be exercised to avoid damage to the equipment. Units received in an unsatisfactory condition should be reported in accordance with existing instructions.

#### 6.4 Definitions

6.4.1 The term "equipment" as used in this specification may refer to a part, a component, or a complete equipment.

6.4.2 Flame-resistant material. A material which will not support combustion, i.e., will not readily ignite when exposed to flame, and will not burn or char appreciably after a flame is removed from contact.

6.4.3 Moisture-resistant material. A material which will not absorb moisture when subjected to conditions of high humidity for extended periods of time.

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6.4.4 Function (performance). A function specification states (1) the complete performance requirements of the product for the intended use, and (2) the necessary interface and interchangeability characteristics. It covers form, fit, and function.

Custodians:

Air Force - 11  
Navy - AS  
Army - EL

Preparing activity:

Air Force - 11

Reviewers:

Air Force - 82, 84, 85  
Navy  
Army - AV

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