

MIL-P-11268L (ER)
28 December 1983
SUPERSEDING
MIL-P-11268K (ARMY)
31 August 1978

MILITARY SPECIFICATION

PARTS, MATERIALS, AND PROCESSES USED IN ELECTRONIC EQUIPMENT

This specification is approved for use by the Electronics Research and Development Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the selection, approval for use, and application of parts, materials, and processes in the design and construction of electronic equipment. A part, material, or process is hereafter referred to as an "item." This specification is intended primarily for use in the establishment of a configuration baseline for the equipment.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue of the Department of Defense Index of Specifications and Standards (DODISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- | | |
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| C-F-202 | - Felt Sheet (Hair) and Felt Roll (Hair). |
| C-F-206 | - Felt Sheet, Cloth, Felt, Wool, Pressed. |
| F-F-300 | - Filter, Air Conditioning, Viscous-Impingement and Dry Types, Cleanable. |
| J-W-1177 | - Wire, Magnet, Electrical. |
| L-P-349 | - Plastic Molding and Extrusion Material, Cellulose Acetate Butyrate. |
| L-P-380 | - Plastic Molding Material, Methacrylate. |

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Electronics Research and Development Command, ATTN: DELET-R-S, Fort Monmouth, New Jersey 07703, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC MISC

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- L-P-383 - Plastic Materials, Polyester Resin, Glass Fiber Base, Low Pressure Laminated.
- L-P-385 - Plastic Molding Material, Polychlorotrifluorethylene.
- L-P-387 - Plastic Sheet, Laminated, Thermosetting (for Designation Plates).
- L-P-389 - Plastic Molding Material, FEP Fluorocarbon, Molding and Extrusion.
- L-P-390 - Plastic Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density).
- L-P-392 - Plastic Molding Material, Acetal, Injection and Extrusion.
- L-P-393 - Plastic Molding Material, Polycarbonate, Injection and Extrusion.
- L-P-394 - Plastic Molding Material, Polypropylene, Injection and Extrusion.
- L-P-395 - Plastic Molding (and Extrusion) Material, Nylon, Glass Fiber Reinforced.
- L-P-396 - Plastic Molding and Extrusion Material, Polystyrene.
- L-P-397 - Plastic Molding Material, Cellulose Acetate.
- L-P-398 - Plastic Molding Material, Styrene-Butadiene.
- L-P-399 - Plastic Molding and Extrusion Material, Styrene-Acrylonitrile Copolymers.
- L-P-403 - Plastic Molding Material, Polytetrafluoroethylene (TFE)-Fluorocarbon.
- L-P-504 - Plastic Sheet and Film, Cellulose Acetate.
- L-P-506 - Plastic Sheet and Film, Polystyrene, Biaxially Oriented.
- L-P-512 - Plastic Sheet (Sheeting); Polyethylene.
- L-P-513 - Plastic Sheet and Insulation Sheet (Laminated, Thermosetting, Paper-Base, Phenolic-Resin).
- L-P-516 - Plastic Sheet and Plastic Rod, Thermosetting, Cast.
- L-P-523 - Plastic Sheet and Film, FEP - Fluorocarbon, Extruded.
- L-P-535 - Plastic Sheet (Sheeting) Plastic Strip, Vinyl Chloride Polymer and Vinyl Chloride Vinyl Acetate Copolymer, Rigid.
- L-P-1035 - Plastic Molding Material, Vinyl Chloride Polymer and Vinyl Chloride Vinyl Acetate Copolymer, Rigid.
- L-P-1041 - Plastic Molding and Extrusion Material, Vinylidene Chloride Vinyl Chloride Copolymer.
- L-P-1183 - Plastic Molding Material, Acrylonitrile-Butadiene-Styrene (ABS) Rigid.
- O-L-164 - Leather Dressing; Mildew-Preventive.
- W-C-596 - Connector, Cable Outlet, Electrical, Specific Purpose, Cable Connecting, General Grade, Locking, 2 Pole, 2 Wire, 15 Amperes, 125 Volts, 50/60 Hertz.
- FF-S-111 - Screw, Wood.
- FF-S-200 - Setscrews; Hexagon Socket and Spline Socket, Headless.
- FF-S-210 - Setscrews; Square Head and Slotted Headless.
- NN-P-530 - Plywood, Flat Panel.
- QQ-B-750 - Bronze, Phosphor, Bar, Plate, Rod, Sheet, Strip Flat Wire and Structural and Special Shaped Sections.
- QQ-C-390 - Copper Alloy Castings (Including Cast Bar).
- QQ-P-416 - Plating, Cadmium (Electrodeposited).
- QQ-S-571 - Solder; Tin Alloy; Tin-Lead Alloy, and Lead Alloy.
- QQ-W-343 - Wire, Electrical (Uninsulated).

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- TT-C-490 - Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings.
- TT-P-1757 - Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity.
- ZZ-R-765 - Rubber, Silicone.
- CCC-C-419 - Cloth, Duck, Cotton, Unbleached, Plied-Yarns, Army and Numbered.
- CCC-D-950 - Dyeing and After Treating Processes for Cotton Cloths.

MILITARY

- MIL-I-10 - Insulating Materials, Electrical, Ceramic, Class L.
- MIL-M-14 - Molding Plastics and Molded Plastic Parts, Thermosetting.
- MIL-C-17 - Cable, Radio Frequency, Flexible and Semirigid, General Specification For.
- MIL-S-61 - Shunts, Instrument, External, 50 Millivolt (Light-Weight Type).
- MIL-P-79 - Plastic Rods and Tubes, Thermosetting, Laminated.
- MIL-C-92 - Capacitors, Variable, Air Dielectric (Trimmer), General Specification For.
- MIL-V-95 - Vibrators, Interrupter and Self-Rectifying.
- MIL-T-152 - Treatment, Moisture and Fungus Resistant, of Communications, Electronic, and Associated Electrical Equipment.
- MIL-V-173 - Varnish, Moisture and Fungus Resistant (for the Treatment of Communications, Electronic, and Associated Electrical Equipment).
- MIL-I-631 - Insulation, Electrical, Synthetic-Resin Composition, Nonrigid.
- MIL-J-641 - Jacks, Telephone, General Specification For.
- MIL-P-642 - Plugs, Telephone, and Accessory Screws, General Specification For.
- MIL-T-713 - Twine, Fibrous, Impregnated, Lacing and Tying.
- MIL-P-997 - Plastic-Materials, Laminated, Thermosetting Electrical-Insulating: Sheets, Glass Cloth, Silicone Resin.
- DOD-D-1000 - Drawings, Engineering and Associated Lists.
- MIL-I-1361 - Instruments, Auxiliaries, Electrical Measuring; Shunts, Resistors, and Transformers.
- MIL-F-2312 - Felt, Hair or Wool, Mildew Resistant, and Moisture Resistant, Treatment for.
- MIL-R-3065 - Rubber, Fabricated Parts.
- MIL-C-3093 - Cable, Telephone, Inside Distribution Wiring, (WD-15/U, WF-9/U, and WT-3/U).
- MIL-C-3098 - Crystal Units, Quartz, General Specification for.
- MIL-C-3133 - Cellular Elastomeric Materials, Molded or Fabricated Parts.
- MIL-V-3144 - Vials, Level.
- MIL-I-3158 - Insulation Tape, Electrical Glass-Fiber (Resin-Filled): and Cord, Fibrous-Glass.
- MIL-P-3409 - Plastic-Material, Molding; Rigid Thermoplastic Polydichlorostyrene, For Use in Electronic Communications, and Allied Electrical Equipment.
- MIL-C-3432 - Cable and Wire, Electrical (Power and Control; Flexible and Extra Flexible, 300 and 600 Volts).
- MIL-F-3541 - Fittings, Lubrication.
- MIL-C-3607 - Connectors, Coaxial, Radio Frequency, Series Pulse, General Specification for.

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- MIL-C-3655 - Connector, Plug and Receptacle, Electrical (Coaxial, Series Twin), and Associated Fittings, General Specification For.
- MIL-C-3849 - Cord, Electrical (Tinsel).
- MIL-C-3883 - Cord, Electrical (Audio Frequency).
- MIL-C-3884 - Cord, Electrical (Short Lay).
- MIL-C-3885 - Cable Assemblies and Cord Assemblies, Electrical.
- MIL-L-3890 - Lines, Radio Frequency Transmission (Coaxial, Air Dielectric).
- MIL-K-3926 - Knobs, Control (for Use with Electronic, Communications, and Allied Equipment).
- MIL-S-3950 - Switches, Toggle, Environmentally Sealed, General Specification For.
- MIL-M-3971 - Meters, Time Totalizing, Non-Hermetically Sealed, Electrical: General Specification For.
- MIL-B-5423 - Boots, Dust and Water Seal (For Toggle and Pushbutton Switches and Rotary-Actuated Parts), General Specification For.
- MIL-P-5425 - Plastic Sheet, Acrylic, Heat Resistant.
- MIL-R-6106 - Relay, Electromagnetic (Including Established Reliability) Er (Type), General Specification For.
- MIL-R-7362 - Rubber, Synthetic, Solid, Sheet and Fabricated Parts, Synthetic Oil Resistant.
- MIL-I-7444 - Insulation Sleeving, Electrical, Flexible.
- MIL-P-7788 - Panel, Information, Integrally, Illuminated.
- MIL-P-8053 - Plywood, Metal-Faced.
- MIL-C-8073 - Core Material, Plastic Honeycomb, Laminated Glass Fabric Base, for Aircraft Structural and Electrical Applications.
- MIL-P-8184 - Plastic Sheet, Acrylic, Modified.
- MIL-S-8805 - Switches and Switching Assemblies, Sensitive and Push Snap-Action, General Specification For.
- MIL-S-8834 - Switches, Toggle, Positive Break, General Specification For.
- MIL-I-8846 - Inserts, Screw Thread, Helical Coil.
- MIL-H-10056 - Holder (Enclosure), Crystal, General Specification For.
- MIL-C-10065 - Cables, Special Purpose, Electrical (Multipair, Audio Frequency).
- MIL-C-10392 - Cord, Electrical (Audio, Miniature).
- MIL-C-10544 - Connectors, Plug and Receptacle (Electrical, Audio, Waterproof, Ten Contact, Polarized).
- MIL-C-10578 - Corrosion Removing and Metal Conditioning Compound (Phosphoric Acid Base).
- MIL-C-10581 - Cable, Telephone WF-8()/G.
- MIL-P-10971 - Pins, Spring, Tubular (Coiled and Slotted).
- MIL-C-12520 - Connectors, Plug and Receptacle (Electrical Waterproof); and Accessories; General Specification For.
- MIL-T-12664 - Treatment, Fungus Resistant, Paranitrophenol, For Cork Products.
- MIL-M-13231 - Marking of Electronic Items.
- MIL-C-13273 - Cord, Electrical (Retractable, 2, 3, and 4 Conductor, (WD-9/U, WT-2/U, WF-4/U).
- MIL-C-13777 - Cable, Special Purpose, Electrical: General Specification For.
- MIL-F-14072 - Finishes For Ground Electronic Equipment.

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MIL-F-14256 - Flux, Soldering, Liquid (Rosin Base).
 MIL-P-15024/6 - Plates, Identification.
 MIL-P-15024/8 - Plate, Tags and Band Identification, Cable Assembly, Type K2 Heat Shrinkable Tubing.
 MIL-P-15035 - Plastic Sheet: Laminated, Thermosetting, Cotton-fabric-base, Phenolic-Resin.
 MIL-P-15037 - Plastic Sheet, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin.
 MIL-P-15047 - Plastic-Material, Laminated Thermosetting, Sheets, Nylon Fabric Base, Phenolic-Resin.
 MIL-F-15160 - Fuses; Instrument, Power and Telephone.
 MIL-F-15733 - Filters, Radio Interference, General Specification For.
 MIL-M-16034 - Meters, Electrical-Indicating (Switchboard and Portable Types).
 MIL-B-16540 - Bronze, Phosphor, Castings.
 MIL-F-16552 - Filter, Air Environmental Control System, Cleanable, Impingement (High Velocity Type).
 MIL-P-18177 - Plastic Sheet, Laminated, Thermosetting, Glass Fiber Base, Epoxy-Resin.
 MIL-P-18324 - Plastic Material, Laminated Phenolic, For Bearings (Water or Grease Lubrication).
 MIL-F-18327 - Filters: High Pass, Low Pass, Band Pass, Band Suppression, and Dual Functioning, General Specification For.
 MIL-P-19161 - Plastic Sheet, Laminated, Glass Cloth Polytetrafluoroethylene Resin.
 MIL-P-19468 - Plastic Rods, Polytetrafluoroethylene, Molded and Extruded.
 MIL-S-19500 - Semiconductor Devices, General Specification For.
 MIL-C-19547 - Cable, Electrical, Special Purpose, Shore Use.
 MIL-G-20098 - Gypsum, Calcined.
 MIL-M-20693 - Molding Plastic, Polyamide (Nylon), Rigid.
 MIL-P-20700 - Pins, Grooved, Headless, Longitudinal Groove.
 MIL-P-21347 - Plastic Molding Material, Polystyrene, Glass Fiber Reinforced.
 MIL-I-21557 - Insulation Sleeving, Electrical, Flexible, Glass Fiber, Vinyl Treated.
 MIL-C-21617 - Connector, Plug and Receptacle - Electrical Rectangular, Polarized Shell, Miniature Type.
 MIL-P-22096 - Plastic, Polyamide (Nylon), Flexible Molding and Extrusion Material.
 MIL-I-22129 - Insulation Tubing, Electrical, Polytetrafluoroethylene Resin, Nonrigid.
 MIL-P-22241 - Plastic Sheet (and Film) Polytetrafluoroethylene (TFE-Fluorocarbon Resin).
 MIL-P-22296 - Plastic Tubes and Tubing Polytetrafluoroethylene (TFE-Fluorocarbon Resin), Heavy Walled.
 MIL-P-22324 - Plastic Sheet, Laminated, Thermosetting, Paper-Base, Epoxy-Resin.
 MIL-T-22361 - Thread Compound; Antiseize, Zinc Dust-Petrolatum.
 MIL-C-22520 - Crimping Tools, Terminal, Hand or Power Actuated, Wire Termination and Tool Kits, General Specification For.
 MIL-C-22931 - Cable, Radio Frequency, Semirigid Coaxial, Semi-air-dielectric, General Specification For.

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- MIL-C-22992 - Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type, General Specification For.
- MIL-I-23053 - Insulation Sleeving, Electrical, Heat Shrinkable, General Specification For.
- MIL-I-23053/5 - Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Crosslinked.
- MIL-B-23071 - Blowers, Miniature, for Cooling Electronic Equipment (10 to 500 CFM), General Specification For.
- MIL-S-23190 - Straps, Clamps and Mounting Hardware, Plastic For Cable Harness Tying and Support.
- MIL-I-23264 - Insulator, Standoff, (Style 01, 02, 03, 04, and 06).
- MIL-F-23419 - Fuse, Instrument Type, General Specification For.
- MIL-C-23437 - Cable, Electrical, Shielded Pairs.
- MIL-C-24308 - Connector, Electric, Rectangular, Miniature Polarized Shell, Rack and Panel, General Specification For.
- MIL-M-24325 - Molding Material, Plastic Epoxy Compounds, Thermosetting.
- MIL-I-24391 - Insulation Tape, Electrical Plastic, Pressure Sensitive.
- MIL-M-24519 - Molding Plastic, Polyester, Thermoplastic.
- MIL-P-25395 - Plastic Materials, Heat Resistant, Low Pressure Laminated, Glass Fiber Base, Polyester Resin.
- MIL-P-25421 - Plastic Materials, Glass Fiber Base - Epoxy Resin, Low Pressure Laminated.
- MIL-P-25515 - Plastic Materials, Phenolic-Resin, Glass-Fiber Base, Low Pressure Laminated.
- MIL-P-25518 - Plastic Materials, Silicone Resin, Glass-Fiber Base, Low Pressure Laminated.
- MIL-R-25988 - Rubber, Fluorosilicone Elastomer, Oil-and-Fuel Resistant, Sheets, Strips, Molded Parts, and Extruded Shapes.
- MIL-C-26482 - Connector, Electrical (Circular, Miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs, General Specification For.
- MIL-C-27072 - Cable, Special Purpose, Electrical, Multiconductor.
- MIL-A-27434 - Adapters, Connector, Coaxial, Radio Frequency, Between Series, General Specification For.
- MIL-C-27599 - Connector, Electrical, Miniature, Quick Disconnect (For Weapons Systems) Established Reliability.
- MIL-R-27777 - Relays, Telegraph, Passive, Solid-state, General Specification For.
- MIL-R-28750 - Relay, Solid State, General Specification For.
- MIL-R-28776 - Relays, Hybrid, Established Reliability, General Specification For.
- MIL-P-28809 - Printed-Wiring Assemblies.
- MIL-M-38510 - Microcircuits, General Specification For.
- MIL-M-38527 - Mounting Pads and Insulator Disks, Electrical-Electronic Component, General Specification For.
- MIL-C-38999 - Connector, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded and Breech Coupling), Environment Resistant Removable Crimp and Hermetic Solder Contacts, General Specification For.
- MIL-C-39010 - Coils, Fixed, Radio Frequency, Molded, Established Reliability, General Specification For.

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- MIL-C-39012 - Connectors, Coaxial, Radio Frequency, General Specification For.
- MIL-R-39016 - Relays, Electromagnetic, Established Reliability, General Specification For.
- MIL-O-39021 - Ovens, Crystal, General Specification For.
- MIL-P-40619 - Plastic Material, Cellular, Polystyrene (For Buoyancy Applications).
- MIL-T-43435 - Tape, Lacing and Tying.
- MIL-I-45914 - Insert, Screw Thread-Locked In, Key Locked.
- MIL-S-45915 - Stud, Locked In-Key Locked.
- MIL-I-45916 - Insert, Screw Thread-Thread Cutting and Thread Forming.
- MIL-I-46058 - Insulating Compound, Electrical (For Coating Printed Circuit Assemblies).
- MIL-P-46112 - Plastic Sheet and Strip, Polyimide.
- MIL-P-46120 - Plastic Molding and Extrusion Material, Polysulfane.
- MIL-P-46129 - Plastic Molding and Extrusion Material, Polyphenylene Oxide, Modified.
- MIL-P-46161 - Plastic Molding Material, Polyterephthalate Thermoplastic, Glass Fiber Reinforced.
- MIL-C-49055 - Cable Special Purpose Electrical, (Flexible, Flat Unshielded), (Round Conductor), (Wire Size 20, 600 Volts, 105 Deg C and 150 Deg C.)
- MIL-P-50884 - Printed-Wiring, Flexible, General Specification For.
- MIL-C-55021 - Cable, Twisted Pairs and Triples, Internal Hookup.
- MIL-C-55036 - Cable, Telephone WM-130 ()/G.
- MIL-C-55074 - Connector, Plug and Receptacle, Telephone, Electrical, Subassembly and Accessories and Contact Assembly, Electrical, General Specification For.
- MIL-C-55081 - Connector, Plug, Electrical U-176()/G; Connector, Plug, Electrical U-319()/G; Connector, Receptacle, Electrical U-121()/G; Connector, Receptacle Electrical U-122()/G.
- MIL-P-55110 - Printed Wiring Boards.
- MIL-C-55116 - Connectors, Miniature Audio, Five-Pin.
- MIL-C-55181 - Connectors, Plug and Receptacle, Intermediate (Electrical) (Waterproof), General Specification For.
- MIL-C-55235 - Connectors, Coaxial, Radio Frequency, Series TPS.
- MIL-C-55243 - Connector, Plug and Receptacle, Electrical, Quick Connect and Disconnect, 12 Contacts, Medium Power.
- MIL-C-55302 - Connector, Printed Circuit Subassembly and Accessories, Plug, Pin Contacts, Right Angle, For Multilayered Printed Wiring Boards (.100 Spacing).
- MIL-O-55310 - Oscillators, Crystal, General Specification For.
- MIL-A-55339 - Adapters, Connector, Coaxial, Radio Frequency (Between Series and Within Series), General Specification For.
- MIL-R-55342 - Resistor, Fixed, Film, Chip, Established Reliability, Style Rm 2208.
- MIL-C-55357 - Cable, Telephone, Shielded (Inside Wiring).
- MIL-C-55365 - Capacitors, Chip, Fixed Tantalum, Established Reliability, General Specification For.
- MIL-S-55433 - Switch, Reed, General Specification For.

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- MIL-C-55446 - Cable, Telephone, Switchboard, Plastic Insulated, Plastic Jacketed.
- MIL-C-55583 - Cable Assembly, Special Purpose, Electrical, CX-11230()/G, Cable Assembly Adapter CX-10734()/G.
- MIL-S-55620 - Substrates, Ceramic, For Deposition of Thin Film Microcircuits.
- MIL-C-55668 - Cord, Electrical, Audio, Subminiature (Retractable and Straight).
- MIL-C-55681 - Capacitor, Chip, Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification For.
- MIL-I-81531 - Marking of Electrical Insulated Materials.
- MIL-W-81822 - Wire, Electrical, Solderless Wrap, Insulated and Uninsulated.
- MIL-I-81969 - Installing and Removal Tools, Connector Electrical Contact, General Specification For.
- MIL-R-83248 - Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant.
- MIL-C-83503 - Connector, Electrical, Flat Cable, Nonenvironmental, General Specification For.
- MIL-S-83731 - Switches, Toggle, Unsealed and Sealed Toggle, General Specification For.

STANDARDS

FEDERAL

- FED-STD-H28 - Screw Thread Standards For Federal Services.

MILITARY

- DOD-STD-35 - Automated Engineering Document Preparation System.
- DOD-STD-100 - Engineering Drawing Practices
- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking For Shipment and Storage.
- MIL-STD-143 - Standards and Specifications Order of Precedence for the Selection of.
- MIL-STD-198 - Capacitors, Selection and Use Of.
- MIL-STD-199 - Resistors, Selection and Use Of.
- MIL-STD-202 - Test Methods For Electronic and Electrical Component Parts.
- MIL-STD-252 - Wired Equipment, Classification of Visual and Mechanical Defects.
- MIL-STD-275 - Printed Wiring for Electronic Equipment.
- MIL-STD-276 - Impregnation of Porous Nonferrous Metal Castings.
- MIL-STD-417 - Classification System and Tests For Solid Elastomeric Materials.
- MIL-STD-454 - Standard General Requirements for Electronic Equipment (For Limitations see Section 3).
- MIL-STD-481 - Configuration Control-Engineering Changes, Deviations and Waivers (Short Form).
- MIL-STD-482 - Configuration Status Accounting Data Elements And Related Features.
- MIL-STD-681 - Identification Coding and Application of Hookup and Lead Wire.

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- MIL-STD-683 - Crystal Units (Quartz) and Holders (Enclosure), Selection of.
- MIL-STD-690 - Failure Rate Sampling Plans and Procedures.
- MIL-STD-750 - Test Methods for Semiconductor Devices.
- MIL-STD-810 - Environmental Test Methods.
- MIL-STD-883 - Test Methods and Procedures for Microelectronics.
- MIL-STD-965 - Parts Control Program.
- MIL-STD-1130 - Connection, Electrical, Solderless, Wrapped.
- MIL-STD-1277 - Splices, Clips, Terminals, Terminal Boards, Binding Posts, Electrical.
- MIL-STD-1286 - Transformers, Inductors, and Coils, Selection and Use of.
- MIL-STD-1346 - Relays, Selection and Application.
- MIL-STD-1395 - Filters and Networks, Selection and Use of.
- MIL-STD-1498 - Circuit Breakers, Selection and Use of.
- DOD-STD-1686 - Electrostatic Discharge Control Program for Protection Of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Exposure Devices) (Metric).
- MS35335 - Washer, Lock, Flat-External Tooth.
- MS91528 - Knob-Control, Plastic (Round, Concentric, Pointer, Spinner, Spinner Slip Clutch, Bar, Tactile, Knob Lock Pointer, and Knob Locks).

HANDBOOKS

MILITARY

- MIL-HDBK-216 - RF Transmission Lines and Fittings.
- DOD-HDBK-263 - Electrostatic Discharge Control Handbook For Protection Of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric).

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

DRAWINGS

ELECTRONICS COMMAND

- SC-A-19100 - Hardware for Chests and Cases.
- SC-A-46420 - Fasteners.
- SC-A-47183 - Hardware for Canvas and Leather Items.
- SC-A-47794 - Wood Guide.
- SC-B-61578 - Grounding to Chassis.
- SM-D-164859 - Cable Assembly, Special Purpose, Electrical.//Sample Drawing//
- SM-A-434065 - Cable, Radio Frequency WD-37()/U.
- DL-SC-B-883956 - Cable Assemblies, Electrical Power, 40A, 60A, 100A, and 200A.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions

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should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN GEAR MANUFACTURING ASSOCIATION (AGMA)

Publications Index

(Application for copies should be addressed to the American Gear Manufacturers Association, 1 Thomas Circle, Washington, DC 20005.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A582 - Free-Machining Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold-Finished, Specification For.
- ASTM D787 - Ethyl Cellulose Molding and Extrusion Compounds, Specification For.
- ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
- ASTM G21 - Resistance of Synthetic Polymeric Materials to Fungi.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

COLOR ASSOCIATION OF UNITED STATES, INCORPORATED

Department of Defense Standard Shades for Sewing Threads

(Application for copies should be addressed to the Color Association of United States, Incorporated, 200 Madison Avenue, NYC, NY 10016.)

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

- RS-463 - Fixed Aluminum Electrolytic Capacitors For Alternating Current Motor Starting Heavy Duty (Type 1) and For Light Duty (Type 2).

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, NW, Washington, DC 20006.)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

The Registry of Toxic Effects of Chemical Substances.

(Application for copies should be addressed to US Department of Health, Education and Welfare, Rockville, Maryland 20852.)

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3. REQUIREMENTS

3.1 Definitions. For the purpose of this specification, the definitions in MIL-STD-965 and the following paragraphs apply:

3.1.1 Standard item. A standard item is a part, material, or process limited to those selected in accordance with the requirements of Section 3 of this specification and which is completely described in and meets all requirements of an applicable document listed in Section 2 herein. When part selection standards are listed, the documents in those standards and the parts they cover are considered standard.

3.1.2 Nonstandard item. A nonstandard item is any part, material, or process which does not meet the above definition of a standard item (i.e., any item not within the selection limitations of Section 3 of this specification even though it may be specified in a military specification or standard).

3.1.3 Equipment of new design. These are equipment being designed to meet performance requirements of a specification and engineering details for construction have not been established. This includes equipment whose construction is based on a model provided by the Government or on a commercial model requiring militarization.

3.1.4 Equipment of established design. These are equipments for which engineering details of construction (Government drawings and specifications) have been established.

3.2 Applicability.

3.2.1 Equipment of new design. (See paragraph 3.1.3.) All of the requirements of this specification are applicable to the design or development of new equipment.

3.2.2 Equipment of established design. (See paragraph 3.1.4.) All requirements of this specification are applicable to equipment of established design except that, unless otherwise specified in the contract, contractors shall use all items specified on the Government furnished drawings. If an item is not specified or the item is a change or replacement for a specified item, the item shall comply with the selection requirements of 3.3. Such items shall also meet the requirements of this specification which are applicable for equipment of new design. A change in the vendor of microcircuits shall require a review of the new vendor's capabilities by the procuring activity.

3.2.2.1 Nonstandard item review. When specified in the contract, a review of all drawings and specifications furnished by the Government shall be performed for the purpose of replacing nonstandard items with standard items. Approval procedures of 3.4.3.1 shall apply.

3.3 Selection. Parts, materials, and processes shall be such as to enable the equipment in which they are used to meet equipment performance requirements. The Military Parts Control Advisory Groups (MPCAG) are recommended as sources of information in selecting standard items in accordance with this specification (see 3.1.1) and nonstandard items.

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(See 6.2.) All items shall be selected in accordance with the following order of precedence:

3.3.1 Standard items. (See paragraph 3.1.1.) The contractor shall give first preference to standard items and use them to the maximum extent possible.

3.3.2 Nonstandard items. (See paragraph 3.1.2.) If the use of standard items will not enable the equipment to meet its requirements, a nonstandard item may be used. The selection of nonstandard items shall be in the order of precedence established in MIL-STD-143.

3.4 Procedures. Whenever the word "part" appears, it is understood to mean "item" as stated in paragraph 1.1.

3.4.1 Parts Control Program. When specified in the contract, a parts control program in accordance with MIL-STD-965, Procedure I, shall be conducted. Telephonic request procedures of MIL-STD-965 are not applicable. (See 6.1.2.)

3.4.2 Approval procedure for equipment of new design. (See paragraph 3.1.3.)

3.4.2.1 Standard items. When specified, approval by the contracting officer is required for the use of all standard items and their sources. If the item is covered by a military specification requiring qualification and the sources are listed on the Qualified Products List, then approval will not be required for the source. When specified by the procuring activity, a listing of standard items shall be submitted for approval to the Government activity cited in the contract (see 6.1.2). When requested by the contracting officer, complete test data, substantiating that a standard item proposed for use meets all applicable specification requirements, shall be submitted by letter to the same Government activity.

3.4.2.2 Nonstandard items. Prior written approval by the contracting officer is required for all nonstandard items (and their sources) selected for use in the equipment. Prior to the submission of the request for approval to use a nonstandard item, all technical requirements and performance characteristics (form, fit, and function) of the item shall have been examined and verified by the contractor. Procedures for obtaining approval for use of nonstandard items shall be in accordance with MIL-STD-965.

3.4.2.2.1 Descriptive information and justification. Unless otherwise specified in the contract, nonstandard part approval requests, as specified in MIL-STD-965, shall be forwarded to the Government activity cited in the contract. (See 6.1.2.) When the nonstandard item is selected from a Government drawing, reference to this fact and the Government drawing number shall be provided as part of the information submitted.

3.4.2.2.2 Documentation. After nonstandard part approval is granted and when requested by the contracting officer, documentation by one or more of the following forms shall be submitted. The documentation shall be in the form of a drawing, a draft military detail specification or specification sheet, or an AEDPS generated document as specified below.

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When prior screening/burn-in or other special characteristic or parameter selection techniques are required for any item, full details and requirements shall be provided. Documentation submitted on microcircuit devices shall contain requirements in accordance with 3.10.26 of this specification. Documentation approved by the contracting officer establishes the configuration base line for the item and any subsequent changes to such documentation shall be in accordance with 3.4.

a. Drawings. The documentation required shall be prepared in the form of a drawing in accordance with DOD-D-1000 and DOD-STD-100 for catalog standard, custom designed, and limited rights items as defined in the contract (see 6.1.2).

b. Military detail specifications and specification sheets. The documentation required shall be prepared in the form of a draft military detail specification or specification sheet as specified in the contract (see 6.1.2).

c. Automated Engineering Document Preparation System (AEDPS). When specified in the contract, the documentation required shall be in the form of a Military Specification Exception resulting from the use of the AEDPS in accordance with procedures and requirements specified in DOD-STD-35. (See 6.1.2.) This form of documentation shall be applicable only to those items covered by the sub-parts of DOD-STD-35 in effect on date of invitation for bid or request for proposal. All other item documentation shall be in accordance with the requirements of 3.4.2.2.2.a. or 3.4.2.2.2.b.

3.4.2.2.3 Test data. When requested by the contracting officer, test data shall be submitted to the Government activities cited in the contract. (See 6.1.2.)

3.4.3 Approval procedure for equipment of established design. (See paragraph 3.1.4.) When construction is based on drawings provided by the Government, procedures of 3.4.3.1 and 3.4.3.2 shall be used. When the contractor desires to change a part specified on a government released document, he shall prepare the documentation in accordance with MIL-STD-481 or MIL-STD-482 and DD Form 2052, and shall submit that information to the MPCAG and the procuring activity.

3.4.3.1 Standard and nonstandard items.

a. No approval is required for the change of a source when the part is covered by a military specification requiring qualification and the new source is listed on the Qualified Products List or when the new source is listed as an "or equal" source on the Government released document. When the contractor desires to change only the source of a part specified on a Government Released Document and where a Qualified Products List is not applicable, prior written approval shall be required. Written approval for a change in source shall be obtained by submitting the following information:

- (1) Prime contractor
- (2) Contract number

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(3) Equipment identification

(4) Description of part including but not limited to following:

(a) Military Specification (when applicable)

(b) Military Type Designation (when applicable)

(c) Military Drawing Number (when applicable)

(d) Identification of current part manufacturer and manufacturer's part number.

(5) Identification of alternate proposed source (actual manufacturer) and manufacturer's part number.

(6) Reason for change in source.

(7) Objective evidence that parts supplied by alternate source to Military specification/Military drawings cited above comply with requirements therein and that part from alternate source is interchangeable with part from original source.

b. The preceding procedures shall be followed prior to the submission of required formal engineering change proposals or requests for deviation.

3.4.3.2 List of items. The contractor shall submit a list, prepared in accordance with MIL-STD-965, of standard parts used in the equipment which do not require approval because the source is listed on a Qualified Products List. A list of approved nonstandard items shall also be submitted prepared in accordance with MIL-STD-965.

3.4.4 Certification of test data. All test data submitted in accordance with the requirements of this specification shall be certified and signed by an official of the prime contractor.

3.4.5 Contractor's statement. The contractor shall include a statement that the submission is complete and in compliance with this specification and the contract. If partial information is submitted, it shall be so indicated in each letter and the letter for the final partial submission should indicate that such final transmittal completes the submission in accordance with this specification and the contract.

3.4.6 Technical data requirements. All information submitted by the contractor in accordance with this document shall be furnished as defined in the "Rights in Technical Data" clause of the contract.

3.5 Substitutions and interchangeability.

3.5.1 Substitutions. When substitution of one item for another is approved, provisions shall be made by the contractor to enable the equipment in the field to be maintained with both the new and original item. Prior written approval by the contracting officer is required for the use of all qualified and standard items which the contractor intends to substitute for items specified in the contract and subsidiary documents.

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(See 3.5.2.) Except for the above requirements, substitutions shall be in accordance with Requirement 72 of MIL-STD-454.

3.5.2 Interchangeability. Interchangeability of parts shall be in accordance with Requirement 7 of MIL-STD-454.

3.6 Derating. Derating shall conform to Requirement 18 of MIL-STD-454 and in accordance with appendix.

3.7 Established reliability. When a specific mean-time-to-failure, maximum failure rate, or other reliability measure is called for in the equipment specification, parts shall be selected, as applicable, from the established reliability specifications listed in table I. When parts other than those described in established reliability specifications are required, the contractor shall verify by appropriate test or analysis of available data or other documentation that the actual failure rate does not exceed the maximum failure rate level required for the application, at a confidence level equivalent to that specified in MIL-STD-690. The contractor shall submit his analysis for prior approval to the contracting officer.

TABLE I. Established reliability parts.

Part	Specification
Capacitors	MIL-STD-198
Coils, fixed, radio frequency, molded	MIL-C-39010
Filters and Networks	MIL-STD-1395
Relays, electromagnetic	MIL-R-6106, MIL-R-28776, MIL-R-39016
Resistors	MIL-STD-199
Transformers and Inductors (Audio and Power)	MIL-STD-1286

3.7.1 High reliability parts. High reliability parts as described below shall be used in new design applications. Requirements for use of these parts shall be initiated in advanced development, become mandatory at the beginning of engineering development and continue in all phases thereafter. These requirements shall be implemented in electronic electrical design specifications and in the system/equipment specifications. Where it is determined that these requirements are not applicable to a category/class of applications, the rationale and justifications shall be documented and any modifications to these requirements shall be included in the major subordinate command policy and appropriate specifications. Where modifications to these requirements are considered necessary in an individual application, the decision to do so shall be deliberate, fully justified and documented.

3.7.1.1 Microelectronic devices. Microelectronic devices shall be MIL-M-38510 Class B as a minimum. When a required device is not covered by MIL-M-38510 and a new specification or drawing is prepared, the nearest MIL-M-38510 specification sheet shall be used as a guide and shall include

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quality assurance requirements including screening and lot quality (acceptance) tests. As a minimum, all devices shall be required to pass the MIL-STD-883 Class B requirements of screening in accordance with Method 5004, and Group A and B lot quality conformance in accordance with Method 5005, and shall have at least initial verification of the Group C and D requirements of Method 5005. Such parts are nonstandard and shall require nonstandard part approval from the acquiring activity.

3.7.1.2 Discrete semiconductor devices. Discrete semiconductor devices shall be MIL-S-19500 level JANTX as a minimum. When a required device is not covered by MIL-S-19500 and a new specification or drawing is prepared, the nearest MIL-S-19500 specification sheet shall be used as a guide and the quality assurance requirements shall be specified in accordance with MIL-STD-750 to assure the device is the equivalent of level JANTX or better. Such parts are nonstandard and shall require nonstandard part approval from the acquiring activity.

3.7.1.3 Passive and other electrical/electronic and electromechanical parts. These parts shall be selected from established reliability (ER) military specifications (and shall meet, as a minimum, the ER failure rate level of "P" or higher (i.e., R, S, etc.) if available. (This applies only to those types of parts now covered by ER specifications.) When a part is not covered by an ER specification and a new specification or drawing is prepared, the nearest ER military specification for the part shall be used as a guide. Such parts are nonstandard and shall require nonstandard part approval from the acquiring activity.

3.8 Tropicalization (moisture (humidity), salt spray, and fungus resistance) of materials and parts. Tropicalization requirements of materials and parts shall conform to the following (overall tropicalization of equipment is specified in 3.11.8):

3.8.1 Moisture resistance of materials and parts. When nonstandard items must be used, drawings prepared for such items in accordance with 3.4.2.2.2 shall specify that the items meet the requirements of the moisture resistance test of Method 106 of MIL-STD-202. Appropriate electrical or mechanical requirements, or both, shall be used as criteria for passing or failing this test. The electrical measurement shall be made in the humidity chamber initially and during Step 7 of the tenth cycle of Method 106. When materials are tested, the low temperature and vibration subcycles shall be omitted. If the nonstandard item is specified in an available document (see 3.3.2) which does not contain moisture resistance requirements, the moisture resistance test of Method 106 of MIL-STD-202 shall be specified as an additional requirement. If the nonstandard item is specified in an available document (see 3.3.2), and a humidity, moisture resistance, moisture absorption, water absorption, or water immersion requirement is specified, it may be considered equivalent to the Method 106 of MIL-STD-202 test, subject to approval of the contracting officer.

3.8.2 Salt spray (corrosion) resistance of materials and parts. When nonstandard items must be used, drawings prepared for such items in accordance with 3.4.2.2.2 shall specify that the items shall be subjected to the salt spray (corrosion) resistance test of Method 101 of MIL-STD-202 and when examined visually with a 10-power magnifier shall show no evidence of degradation, such as flaking, pitting, blistering, loosening

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of finish or metal surface, or exfoliation of metal (corrosion along the grain boundaries of the metal resulting in peeling, separating, or both of successive layers of the metal). Electrical performance is not an accept or reject criterion. The items shall meet the applicable mechanical characteristics. If the nonstandard item is specified in an available document (see 3.3.2) which does not contain a salt spray (corrosion) resistance test, Method 101 of MIL-STD-202 shall be specified as an additional requirement. If the nonstandard item is specified in an available document (see 3.3.2) which contains a salt spray (corrosion) or a salt fog requirement, approval of the contracting officer is required to ascertain the equivalency of the salt spray requirement specified in the available document to that of Method 101 of MIL-STD-202. Nonmetallic materials such as plastics, rubbers, resins, and ceramics need not be subjected to this test.

3.8.3 Fungus resistance of materials and parts. When nonstandard items must be used, drawings prepared for such items in accordance with 3.4.2.2.2 shall specify that the items meet the fungus resistance requirement of 3.8.3.2.4 or 3.8.3.4.2, and 3.8.3.1 through 3.8.3.4.1, as applicable. If the nonstandard item is specified in an available document (see 3.3.2) which does not contain fungus-resistance requirements, the requirement of 3.8.3.2.4 or 3.8.3.4.2, as applicable, shall be specified as an additional requirement. If the nonstandard item is specified in an available document (see 3.3.2) and a fungus-resistance test and requirement is specified, that test and requirement may be considered equivalent to 3.8.3.2.4 or 3.8.3.4.2, as applicable, subject to approval of the contracting officer.

3.8.3.1 Materials in equipment of new design. Materials used in equipment of new design shall conform to Requirement 4 of MIL-STD-454. No fungus-susceptible materials, treated or otherwise, shall be used in new design equipment, except in hermetically sealed enclosures. Drawings prepared for the materials (see 3.8.3) shall specify that the materials meet the requirements of 3.8.3.2.4.

3.8.3.2 Materials in equipment of established design. When materials used in equipment of established design are specified in drawings furnished by the Government, and do not meet the fungus requirements of 3.8.3.2.4, the materials shall be cleaned in accordance with 3.11.3, treated in accordance with 3.8.3.2.1 through 3.8.3.2.3. The following materials shall be treated as specified in the referenced paragraphs:

Cork	3.9.4
Felt, hair, or wool	3.9.6
Fibrous material, organic	3.9.7
Leather	3.9.8
Thermosetting plastic materials using cotton, linen, or woodflour as a filler or base	3.9.11

Following cleaning and treatment, the contractor shall certify that the materials meet the fungus-resistance requirements of 3.8.3.2.4. (See 6.1.2.)

3.8.3.2.1 Treating materials. Treating materials containing a mercury-bearing fungicide shall not be used. The treating material used

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shall be compatible with the material or surface to be treated. Selection of treating materials shall be such that any increase in flammability of treated materials will be held to the practical minimum.

3.8.3.2.2 Toxicity. No treating materials shall be used that will produce toxic effects as identified in the Registry of Toxic Effects of Chemical Substances. This includes handling the treated material during fabrication, transportation, operation, or maintenance of the parts in which the treated materials are used or during use of the finished parts when used for the purpose intended. The contractor shall furnish certification data as specified in the contract (see 6.1.1) that the treating materials used on the materials conform to the above.

3.8.3.2.3 Flexibility. Treatment shall not affect the flexibility of treated materials to the extent that the equipment may fail to meet specified requirements when subjected to specified service conditions.

3.8.3.2.4 Requirement to be specified for fungus resistance of materials. The materials shall be tested in accordance with ASTM G-21, and when examined visually with the aid of a 10-power magnifier, there shall be no fungus growth after 28 days exposure to the test. The visual effects rating shall be "0." All nonplastic materials such as paint, ink, coatings, adhesives, lubricants, rubber, viscous damping fluid, silicone, etc., shall be prepared in the form of 2-inch squares or circles no more than 0.0625 inch thick for testing. Liquid or paste materials shall be prepared by impregnating a glass fabric to saturation.

3.8.3.3 Parts in equipment of new design. No fungus-susceptible parts, treated or otherwise, shall be used in new design equipment, except in hermetically sealed enclosures. Drawings prepared for the part (see 3.8.3) shall specify that the part meet the requirements of 3.8.3.4.2.

3.8.3.4 Parts in equipment of established design. When it is necessary to use parts containing fungus-nutrient material, as specified in drawings furnished by the Government, for equipment of established design, except in hermetically sealed enclosures, the parts shall be cleaned in accordance with 3.11.3 and treated in accordance with 3.8.3.4.1. After cleaning and treatment, the contractor shall certify that the parts meet the requirements of 3.8.3.4.2. (See 6.1.2.)

3.8.3.4.1 Treatment of parts. When treatment of parts is required (see 3.8.3.4), a moisture and fungus proofing (MFP) varnish conforming to MIL-V-173 shall be applied in accordance with MIL-T-152. The MFP treatment shall be applied after the part has been cleaned in accordance with 3.11.3. The MFP varnish shall not be applied to any part where the treatment will interfere with the performance of the part or equipment. (See 6.1.2.)

3.8.3.4.2 Requirement to be specified for fungus resistance of parts. The part shall be subjected to the fungus test specified in Procedure I, Method 508, of MIL-STD-810. In addition, there shall be abundant growth in at least 50 percent of the area of the control item after 14 and 28 days. No cleaning of the part is permitted for 72 hours prior to the fungus test. After 28 days exposure to the test, the part shall be examined visually with the aid of a 10-power magnifier and there shall

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be no fungus growth. Electrical or mechanical operation of the part shall not be an accept or reject criteria.

3.9 Materials.

3.9.1 Adhesives. Adhesives and their application shall conform to Requirement 23 of MIL-STD-454 and they shall be fungus-inert as determined by 3.8.3.2.4. Observation for visual effects rating shall be "0."

3.9.2 Arc-resistant materials. Arc-resistant materials shall conform to Requirement 26 of MIL-STD-454 and shall be fungus-inert as determined by 3.8.3.2.4. Observation for visual effects rating shall be "0."

3.9.3 Ceramic material and parts. Ceramic material shall conform to MIL-I-10. Ceramic insulators shall conform to MIL-I-23264. Ceramic parts shall be cushioned, when required, for protection against damage or breakage. Where ceramic parts are used for electrical purposes, all surfaces shall be glazed, or if glazing is impracticable, the surfaces shall be sealed or treated with Dow Corning DC-200, G.E. No. SF-99, or Union Carbide No. L-45, or equal. The use of wax is prohibited. However, insulators not under electrical stress, or insulation used in hermetically sealed containers, may be unglazed and untreated. The method of surface treatment shall be in accordance with recommendations of the manufacturer of the material used to treat the ceramic.

3.9.3.1 Ceramic substrates. Ceramic substrate materials used as the surface for deposition of thin film microcircuits shall conform to MIL-S-55620.

3.9.4 Cork. Cork shall be treated with paranitrophenol in accordance with MIL-T-12664.

3.9.5 Encapsulation and embedment (potting). Encapsulation and embedment shall conform to Requirement 47 of MIL-STD-454.

3.9.6 Felt. Hair felt shall conform to C-F-202 and shall be mildew-proofed in accordance with MIL-F-2312; inhibitors containing copper shall not be used when felt will come in contact with natural or synthetic rubber. Wool felt shall conform to C-F-206 and shall be given type III treatment in accordance with MIL-F-2312.

3.9.7 Fibrous material, organic. Organic fibrous material shall conform to Requirement 44 of MIL-STD-454, except that when duck is not required to be fire-resistant it shall conform to CCC-C-419 and shall be given Class B aftertreatment, using inhibitors "a," "b," "e," "f," or "h" as specified in CCC-D-950. Inhibitor "a" shall be used when duck will come in contact with natural or synthetic rubber, and inhibitor "e" or "h" when prolonged contact with skin can occur. The color of the fabric shall be olive drab No. 7 (see 6.3). Color of thread shall match S-1 from the Department of Defense Standard Shades for Sewing Threads.

3.9.8 Leather. Leather shall be treated with dressing material conforming to O-L-164.

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3.9.9 Lubricants. Lubricants shall conform to Requirement 43 of MIL-STD-454. Different lubricants shall not be used where a single lubricant will meet equipment requirements.

3.9.10 Metals and finishes. Metals and finishes shall conform to the following:

3.9.10.1 Castings. Castings shall conform to Requirement 21 of MIL-STD-454. All porous nonferrous castings shall be impregnated in accordance with MIL-STD-276.

3.9.10.2 Dissimilar metals. Selection and protection of dissimilar metal combinations shall be in accordance with MIL-F-14072.

3.9.10.3 Finishes, protective. Finishes shall be in accordance with 3.11.4.

3.9.10.4 Magnesium and magnesium alloys. Magnesium and magnesium alloys shall not be used. When unusual requirements necessitate the use of magnesium and magnesium alloys, prior approval for the use of the magnesium and magnesium alloys with appropriate finish (see 3.11.4) shall be obtained from the contracting officer for each specific application. Regular periodic inspection for corrosion, which will not require extensive disassembly of structures shall be required in maintenance instructions.

3.9.11 Plastic material and parts. Where not machined, plastic material and parts shall have the original smooth or polished surfaces. Surfaces that have been sawed, cut, punched, or otherwise machined shall be as smooth as practicable for the intended application. These surfaces shall be treated with a coating of the same or similar compatible resin, possessing electrical and moisture-resistant properties which are equal or superior to the base materials. Plastic materials and parts shall be non-burning or self-extinguishing and shall conform to Requirement 3 of MIL-STD-454. Plastic materials and parts shall conform with tropicalization requirements of 3.8. Plastic material and parts shall conform to the following, except that plastic material used for arc resistance shall be limited to the types specified in Requirement 26 of MIL-STD-454.

3.9.11.1 Thermoplastic. Thermoplastic material and parts shall conform to requirements of specifications referenced in table II. These materials shall not be treated and shall be masked during any treatment of the equipment if the treatment may result in degradation of the electrical or physical characteristics of the material. The thermoplastic material used shall be capable of passing the fungus requirements of ASTM G21. Visual effects rating shall be "0."

3.9.11.2 Thermosetting. Thermosetting plastic material and parts shall conform to requirements of specifications referenced in table III, unless used in hermetically sealed enclosures. Consideration should be given to limiting the use of phenolic materials in closed environments because of the possible corrosion caused by outgassing vapors. When phenolic materials are used, care should be taken to ensure that the material is completely cured to lessen the probability of outgassing.

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Information on the masking of these materials during overall treatment of equipment are specified in table IV.

TABLE II. Thermoplastic materials and parts.

Description	Specification
Cellular, polystyrene -----	MIL-P-40619
Insulation, electrical, synthetic resin, nonrigid -----	MIL-I-631
Molding Material	
Acetal, injection and extrusion -----	L-P-392
Acrylonitrile-butadiene-styrene (ABS) rigid -----	L-P-1183
Cellulose acetate -----	L-P-397
Cellulose acetate butyrate -----	L-P-349
Ethyl cellulose, molding and extrusion -----	ASTM D787
FEP fluorocarbon, molding and extrusion -----	L-P-389
Methacrylate -----	L-P-380
Plastic molding material, polyterephthalate	
thermoplastic, glass fiber filled -----	MIL-P-46161
Polyamide (nylon), flexible -----	MIL-P-22096
Polyamide (nylon), glass fiber reinforced -----	L-P-395
Polyamide (nylon), rigid -----	MIL-M-20693
Polycarbonate, injection and extrusion -----	L-P-393
Polychlorotrifluoroethylene -----	L-P-385
Polydichlorostyrene, rigid -----	MIL-P-3409
Polyester -----	MIL-M-24519
Polyethylene, low, medium, and high density and	
copolymers -----	L-P-390
Polyphenylene oxide -----	MIL-P-46129
Polypropylene, injection and extrusion -----	L-P-394
Polystyrene -----	L-P-396
Polystyrene, glass fiber reinforced -----	MIL-P-21347
Polysulfone -----	MIL-P-46120
Polytetrafluoroethylene (TFE-fluorocarbon) -----	L-P-403
Styrene-acrylonitrile copolymer -----	L-P-399
Styrene-butadiene -----	L-P-398
Vinyl chloride polymer, vinyl chloride-vinyl acetate	
copolymer, rigid -----	L-P-1035
Vinylidene chloride, rigid -----	L-P-1041
Rods, polytetrafluoroethylene, molded and extruded -----	MIL-P-19468
Sheet(s)	
Acrylic, heat-resistant -----	MIL-P-5425
Acrylic, modified -----	MIL-P-8184
Laminated, glass cloth, polytetrafluoroethylene resin --	MIL-P-19161
Polyethylene -----	L-P-512
Vinyl chloride polymer and vinyl chloride-vinyl acetate	
copolymer, rigid -----	L-P-535
Sheet and film	
Cellulose acetate -----	L-P-504
FEP-fluorocarbon, extruded -----	L-P-523
Film, polytetrafluoroethylene (TFE-fluorocarbon resin) -	MIL-P-22241
Polystyrene, biaxially oriented -----	L-P-506
Tubes and tubing, polytetrafluoroethylene (TFE-fluoro-	
carbon resin), heavy walled -----	MIL-P-22296

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TABLE III. Thermosetting plastic materials and parts.

Description	Specification
Core material, honeycomb, glass fabric base -----	MIL-C-8073
Laminated rods and tubes -----	MIL-P-79 <u>1/</u>
Laminated sheets (for designation plates) -----	L-P-387 <u>2/</u>
Laminated sheets	
Cotton-fabric-base, phenolic-resin -----	MIL-P-15035 <u>1/</u>
Glass-cloth, epoxy-resin -----	MIL-P-18177
Glass-cloth, melamine-resin -----	MIL-P-15037
Glass-cloth, silicone-resin -----	MIL-P-997
Nylon fabric base, phenolic-resin -----	MIL-P-15047
Paper-base, epoxy-resin -----	MIL-P-22324
Paper-base, phenolic-resin -----	L-P-513
Low pressure laminated material, glass fiber base	
Epoxy-resin -----	MIL-P-25421
Phenolic-resin -----	MIL-P-25515
Polyester resin -----	L-P-383
Polyester resin, heat-resistant -----	MIL-P-25395
Silicone resin -----	MIL-P-25518
Molding material and molded parts -----	MIL-M-14
Molding material plastic epoxy compounds thermosetting	MIL-M-24325
Plastic sheet and plastic rod, thermosetting cast ----	L-P-516
Plastic sheet and strip, polyimide -----	MIL-P-46112

1/Cotton-fabric-base laminates shall not be used unless high-impact resistance is required for gears, cams, or similar applications or unless specified herein for a particular application.

2/ Used only for labels for marking. (See 3.11.5.)

3.9.12 Plywood. Plywood shall be Douglas Fir or hardwood plywood conforming to NN-P-530 and Drawing SC-A-47794. Metal-faced plywood shall conform to MIL-P-8053. Pentachlorophenol treated plywood shall be used for the construction of boxes, cases, etc.

3.9.13 Rubber. The rubber used shall be capable of passing the fungus test of ASTM G21. Visual effects rating shall be "0." Rubber (natural or synthetic) shall conform to MIL-C-3133 for cellular type; MIL-R-7362 for rubber resistant to diester synthetic oils; ZZ-R-765 for silicone rubber; MIL-R-25988 for fluorosilicone rubber; MIL-R-83248 for fluorocarbon elastomers; and MIL-R-3065, MIL-STD-417 or ASTM D2000 for other types.

3.9.14 Springs. Springs shall conform to Requirement 41 of MIL-STD-454.

3.9.15 Tape, electrical. No cotton or linen tapes shall be used. Electrical tape shall be in accordance with Requirement 11 of MIL-STD-454.

3.9.16 Wood. Solid wood shall conform to requirements of Drawing SC-A-47794.

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TABLE IV. Masking of thermosetting plastic material during overall treatment of equipment.

Material	Treatment
CMG, CMI-5, CMI-10, GDI-30, GDI-30F, MAG, MAI-30, MAI-60, MDG, MFA-30, MME, MMI-5, MMI-30, MSG, MSI-30, SDG, SDI-5, SDG-F, SDI-30 per MIL-M-14. All types per L-P-516 GMG per MIL-P-79 GSG per MIL-P-997 All types per MIL-C-8073 GME, GMG per MIL-P-15037 NPG per MIL-P-15047 GEE, GEB, per MIL-P-18177 All types per MIL-M-24325 All types per MIL-P-25395 All types per MIL-P-25421 All types per MIL-P-25518 All types per MIL-P-46112	Do not treat; mask, if necessary during any treatment of the equip- ment which might result in degra- dation of the electrical or physical characteristics of the material.
GPI-100, MFE per MIL-M-14 GCP-F, GCP-H, HSP per L-P-387 PBE per MIL-P-79 PBE, PBE-P per L-P-513 PEE per MIL-P-22324 All types per MIL-P-25515	Treatment not required; need not be masked during any overall treatment of the equipment.

3.9.17 Radioactive materials. Radioactive materials shall not be used in parts and equipment except when prior approval for their use is obtained. The use of radium to provide self-luminous markings for parts or equipment is prohibited. When radioactive materials are approved for use, the radioactive material shipping and storage containers shall be marked in accordance with MIL-STD-129. (For the Electronic Research and Development Command, the request for approval shall be forwarded through the contracting officer to the Safety Officer, Fort Monmouth, NJ 07703.)

3.10 Parts.

3.10.1 Actuators, switch. Switch actuators shall be in accordance with MIL-S-8805.

3.10.2 Bearings. Bearings shall conform to Requirement 6 of MIL-STD-454.

3.10.3 Blowers. Where forced-air cooling is required, blowers used to circulate the air shall conform to MIL-B-23071. Blowers shall contain a filter which will trap and prevent ingress of contaminants.

3.10.4 Boots, dust and water seal. Boots for use on toggle and pushbutton switches, circuit breakers, and rotary-actuated parts, such

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as rotary switches, variable resistors, capacitors, inductors, and transformers, shall conform to MIL-B-5423.

3.10.5 Cable, electrical. Electrical cables shall conform to requirements 65 and 66 of MIL-STD-454 as well as the military specifications called out in the following paragraphs.

3.10.5.1 Cable, flat multi-conductor. Flat multi-conductor cables shall conform to MIL-C-49055.

3.10.5.2 Cable, 26-pair field communication. Field communication cables, 26-pair, shall conform to MIL-C-55036.

3.10.5.3 Cable, power, and control. Power and control cables shall conform to the following: (Also see 3.10.11.)

3.10.5.3.1 Cable, general purpose (600 volts and below). Power and control cables used for voltages up to and including 600 volts AC (rms) or corresponding DC shall conform to MIL-C-3432.

3.10.5.3.2 Cable, portable power. Portable power cables for alternating current shall contain ground wire(s). Portable power cables for 40-200 amperes shall be in accordance with Drawing DL-SC-B-883956. Power cable and cords subject to pedestrian or vehicular traffic shall have conductor sizes of No. 14 AWG or larger diameter, and shall conform to MIL-C-3432, Heavy Duty (designation H), or MIL-C-13777. Grounds (green) in cables are smaller than the primary conductors and shall be contained in the interstices of the primary conductors. Portable power cable constructed with polyethylene insulation shall have a neoprene jacket and shall meet the requirements of MIL-C-13777.

3.10.5.3.2.1 Cable, portable power, color-coding. Portable power cable shall be color coded as follows:

- a. Direct current, 2-conductor: One black (+), one white (-).
- b. In all alternating current (AC) power cables, the white conductor shall be used for neutral connections only. A conductor intended to be used as a grounding conductor shall have a green or green with one or more yellow stripes identifying it.
- c. Cables for single-phase AC, 2 pole, 3 wire service: One black, one white, plus green for ground(s).
- d. Cables for single-phase AC, 3 pole, 4 wire service: One black, one red, one white, plus green for ground(s).
- e. Cables for 3-phase, 3 pole, 4 wire (delta) service: One black, one red, one blue, plus green for ground(s).
- f. Cables for 3-phase, 4 pole, 5 wire (Y) service: one black, one red, one blue, one white, plus green for ground(s).

Note 1: In all 3-phase circuits, black shall be used for L₁ (Phase A); red for L₂ (Phase B); and blue for L₃ (Phase C). This color-coding shall be carried throughout the power distribution system.

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Note 2: Ground wires of No. 8 AWG or larger diameter may be uninsulated and covered with a green braid, or covered with a green sheath not necessarily of the same material specified for insulating the carrying conductors.

3.10.5.3.3 Cable, special purpose (up to 600 volts). Special purpose power and control cables used for voltages up to and including 600 volts AC (rms) or corresponding DC, and cables which cannot be type designated in accordance with MIL-C-3432 (e.g., cables containing rf coaxial conductors) shall conform to MIL-C-13777, except that wire size AWG No. 18 and smaller diameter shall be composed of tinned, soft, or drawn-and-annealed cadmium copper alloy one percent nominal cadmium content (or other copper alloy approved by the contracting officer) of not less than 85 percent conductivity, without steel strands. These cables are used for interconnecting units of complex systems, and for heavy-duty use where resistance to severe bending, twisting, impact, and abrasion is required. Cables not subject to pedestrian or vehicular traffic need not meet the requirement for impact resistance. A drawing of the cross-section of the cable shall be furnished to the contracting officer for approval prior to construction of a prototype or a production run (see 6.1.2).

3.10.5.3.4 Cable for short runs and prototype. When the total length of required interconnecting cable is too small for an economical run with extruded-on jacket (such as required in MIL-C-3432 and MIL-C-13777) and a reinforced jacket is not required, the cable may be made up of insulated hookup wire with a "blown on" jacket. The tubing used for jacketing shall meet the requirements for the applicable type in MIL-I-3930 or MIL-C-13777. Polyvinyl-chloride or polyvinyl-chloride-acetate insulated hook-up wires shall not be used as conductors.

3.10.5.4 Cable, radio frequency (rf). Radio frequency cables shall conform to MIL-C-17 and MIL-C-22931. (Supplementary information on these cables is provided in MIL-HDBK-216.)

3.10.5.5 Cable, switchboard telephone. Switchboard telephone cables shall conform to MIL-C-55446.

3.10.5.6 Cable, other than power or rf coaxial cable for fixed installations. Cables which will be permanently installed in racks or conduits, or permanently mounted within shelters, trailers, or equipment shall conform to MIL-C-3093, MIL-C-10065, MIL-C-19547, MIL-C-23437, MIL-C-27072, or MIL-C-55357.

3.10.5.7 Cable assemblies. Cable assemblies, except radio frequency, shall meet the requirements for the particular type of cable assembly specified in MIL-C-3885. Portable power cable assemblies in the 40, 60, 100, 150, and 200 ampere ranges shall be in accordance with Drawing DL-SC-B-883956. (For receptacles see 3.10.9.3.) Assembly drawings shall be in accordance with Drawing SM-D-164859. When not specified in the cable assembly drawing or other procurement document, the tolerance for cable assembly lengths shall be in accordance with table V.

3.10.5.7.1 Identification of cable assemblies. Cable assemblies shall be identified by means of marking on heat shrinkable tubing in accordance with MIL-P-15024/8 fitted over the cable jacket.

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TABLE V. Tolerances for cable assemblies and cord assemblies.

Tolerance 1/ (plus (+) only)				Tolerance 1/ (plus (+) only)			
Length 2/		Radio frequency	All other types	Length 2/		Radio frequency	All other types
Feet	Inches	Inches	Inches	Feet	Inches	Inches	Inches
0	2	1/8	3/16	40	0	6	9
0	4	1/8	1/4	50	0	8	12
0	6	3/16	1/4	75	0	11	18
0	8	1/4	1/2	100	0	16	24
1	0	3/8	5/8	125	0	21	30
1	6	1/2	1	150	0	26	36
2	0	9/16	1-1/8	175	0	31	42
2	6	5/8	1-1/4	200	0	36	48
4	0	3/4	2	250	0	45	60
6	0	1	2-1/2	300	0	54	72
10	0	1-1/2	3	350	0	63	84
18	0	2	4	400	0	72	96
25	0	3	5	450	0	81	108
32	0	4	7	500	0	90	120

1/ Tolerances apply to any length up to the next length listed, for example, the tolerance on a 24-foot rf cable assembly would be two inches. Tolerances on cable assemblies over 500 feet in length shall be +1-1/2 percent of the specified length for radio frequency cable assemblies and +2 percent for all other assemblies.

2/ The length of an assembly is the overall length including terminations.

3.10.6 Cable straps and clamps. Cable straps shall conform to MIL-S-23190. When rubber-coated metal clamps are used, the rubber shall conform to MIL-R-3065.

3.10.7 Capacitors. Capacitors shall conform to Requirement 2 of MIL-STD-454 except that "P" level failure rate or better shall be required. Motor-starting capacitors shall conform to EIA RS-463.

3.10.7.1 Variable air-dielectric, rotary. Variable rotary air-dielectric capacitors (except trimmer capacitors in accordance with MIL-C-92 shall not be used) shall be in accordance with the applicable drawing or contract requirements. After being tested as specified in 4.2.2.1, the capacitance change versus rotation of the rotor, shall not deviate from a straight line by more than the percentage specified on the applicable drawing or contract, and shall show no reversals in direction unless otherwise specified. The capacitor shall show no physical or mechanical damage, particularly to bearings or sliding contacts.

3.10.8 Circuit breakers. Circuit breakers shall conform to Requirement 37 of MIL-STD-454. For equipment of new design, circuit breakers shall meet the requirements of MIL-STD-1498.

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3.10.9 Connectors (electrical). Electrical connectors shall conform to requirements as outlined in Requirement 10 of MIL-STD-454, and the types specified below. Connectors, for use in applications requiring direct exposure to climatic conditions and possible water immersion, shall contain only fixed-type contacts sealed to the insert. Removable-type contacts may be used only in a protected or enclosed environment where water penetration is not a potential hazard. Connectors or terminations with removable contacts shall be limited to the rear-release type and within any equipment or systems requiring a variety of removable contact connectors or terminations, rear-release and associated insertion and removable tools for the contacts shall be common to these connective devices. Connector electrical contact installations and removal tools shall conform to MIL-I-81969. Where crimping of contacts is used, tools for crimp contacts should conform to MIL-C-22520. Leads carrying potentials above or below ground shall not terminate in pin contacts or other exposed contacts that can be accidentally touched or shorted. Positive clamping of cable or wire bundles shall be accomplished.

3.10.9.1 Audio, special purpose. Five- and ten-contact audio connectors shall be in accordance with MIL-C-55116 and MIL-C-10544, respectively.

3.10.9.2 Flat cable. Connectors for flat cable shall conform to MIL-C-83503.

3.10.9.3 Heavy duty, general purpose, power. Connectors for general purpose heavy duty application shall conform to MIL-C-22992. Connectors used for external applications shall be pressure and waterproof in the mated and unmated condition in accordance with the requirements of Classes C, J, or L of MIL-C-22992. Connectors used internally (within a protective enclosure, such as a shelter) may be in accordance with Class R of the specification provided waterproofness or pressureproofness is not a requirement of the application. High-current power connectors (60 to 200 amperes) shall conform to Class L of MIL-C-22992. For applications (AC) where grounding through the shell of the connector is essential, type C (conductive) finish shall be used. For applications (DC), where shell grounding is not required, type N (nonconductive) finish shall be used. Class L connectors are utilized only in accordance with DL-SC-B-883956.

3.10.9.4 Miniature, general purpose, multi-contact, low power, audio, and control. Miniature multi-contact connectors shall conform to MIL-C-26482 or MIL-C-55243, except that connectors conforming to MIL-C-55243 shall not be used for new design. MIL-C-26482 connectors shall be of the solder or crimp contact, bayonet coupling series. Solder contact connectors (Series 1) shall be used when waterproofness or pressureproofness is a requirement of the application. Crimp-contact connectors shall be of the rear-insertion and removal (Series 2) type and shall be used for moisture-resistant applications only. Miniature connectors with full scoop design required for applications of severe mechanical abuse and ruggedness, and electrical safety shall conform to MIL-C-27599 or MIL-C-38999 (Series 1). Use of size #22 AWG contacts in any miniature connector series shall have prior approval of the contracting officer.

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3.10.9.5 Power (bladed-type). Bladed-type power connectors for use in fixed installations or within protected shelters, where they are not exposed to field hazard or climatic conditions, shall conform to W-C-596. Power connectors shall be field replaceable, and polarized plugs and receptacles with grounding contacts shall be used. All power connectors shall be of dead-front construction with non-conductive body shells and non-metallic cable clamps, when exposed cable clamps are used.

3.10.9.6 Printed wiring board connectors. Two-part printed-circuit connectors consisting of two plastic bodies containing male and female quick-disconnect electrical contacts, and integral aligning hardware to assure proper mating of the quick-disconnect contacts, shall be used for mating plug-in printed wiring subassemblies. Printed-circuit connectors shall conform to MIL-C-55302 in accordance with MIL-STD-275. One-piece printed-circuit connectors shall not be used.

3.10.9.7 Rack and panel. Rack and panel connectors shall conform to MIL-C-24308, as applicable. Rack and panel connectors shall be furnished with polarized metal shells which shall provide positive orientation of the connectors before engagement of contacts and which shall protect the contacts in the unmated position. Mounting of connectors shall be accomplished through the metal shell so that no concentrated strain is on the insulator. Subminiature sizes shall be used only with subminiature size packages and then only with proper provision to insure positive alignment before mating. Internal type connectors shall conform to MIL-C-21617.

3.10.9.8 Radio frequency. Radio frequency connectors and adapters shall conform to the applicable requirements of the specifications listed in table VI. MIL-HDBK-216 shall be used as a guide for their selection and application. Contractors may use categories A, C, or D connectors of MIL-C-39012 in the fabrication of equipment; however, when spare parts are required, category A connectors shall be supplied.

TABLE VI. Radio frequency connectors and adapters.

Type	Specification
All types specified	MIL-C-39012
Adapters	MIL-A-27434
Adapters	MIL-A-55339
Pulse	MIL-C-3607
TPS	MIL-C-55235
Twin	MIL-C-3655

3.10.9.9 Right-angle power and control. In applications where right-angle bend is required, center-lock screw-multi-contact connectors conforming to MIL-C-12520 or MIL-C-55181, as applicable, shall be used.

3.10.9.10 Tactical communication cable. Hermaphrodite connectors U-185()/G, U-186()/G, and U-187()/G, for use with 26-pair tactical communication cable WM-130()/G per MIL-C-55036, shall conform to MIL-C-55074. Hermaphrodite spiral-4 connectors U-121()/G, U-122()/G, U-176()/G, and U-319()/G, for use with spiral-4 cable WF-8()/G per MIL-C-10581,

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shall conform to MIL-C-55081. Hermaphrodite connectors UG-1870()/U and UG-1837()/U, for use with the dual coaxial PCM cable WD-37()/U per Drawing SM-A-434065, shall conform to MIL-C-55583.

3.10.10 Controls. Controls shall conform to Requirement 28 of MIL-STD-454 and the following:

3.10.10.1 Knobs. Knobs shall conform to MIL-K-3926, except that the tactile forms shown on MS91528 shall be used only when the equipment is specifically designed to be operated in the dark.

3.10.10.2 Tuning-dial mechanisms. Tuning-dial mechanisms shall conform to Requirement 42 of MIL-STD-454.

3.10.11 Cords, electrical. Electrical cords for audio frequencies shall conform to the following: (Audio frequency cords may also be used where low DC carrying capability is a requirement.)

3.10.11.1 Cords, audio frequency, low capacitance. Audio frequency shielded cords, having a low-capacitance, shall conform to MIL-C-3883.

3.10.11.2 Cords, audio frequency, miniature. Miniature (thin-wall) audio frequency cords shall conform to MIL-C-10392 or MIL-C-13273.

3.10.11.3 Cords, audio frequency, short lay. Audio frequency cords, where extreme flexibility is required, shall conform to MIL-C-3884.

3.10.11.4 Cords, subminiature, audio frequency, retractile and straight. Subminiature audio frequency retractile and straight cords, stranded or tinsel wire conductors, shall conform to MIL-C-55668.

3.10.11.5 Cords, tinsel. Tinsel cords used for telephones, switchboards, microphones, and associated equipment shall conform to MIL-C-3849 (types specifying -55°C operation only). MIL-C-3849 covers normal and miniature tinsel cords; for subminiature cord requirements see 3.10.11.4.

3.10.11.6 Cord assemblies. All cord assemblies, except radio frequency, shall meet the requirements for a particular type of cord assembly specified in MIL-C-3885.

3.10.12 Crystal units, quartz, and crystal holders (enclosures). Quartz crystal units shall conform to MIL-C-3098 and crystal holders (enclosures) shall conform to MIL-H-10056. For equipment of new design, crystal units and holders shall meet the requirements of MIL-STD-683 (Requirement 38 of MIL-STD-454).

3.10.13 Filters, air. Filters in air-conditioning and ventilation systems shall conform to F-F-300 or MIL-F-16552. Air filters shall be cleanable and shall be made of fungus-inert material.

3.10.14 Filters, electrical. Radio interference filters shall conform to MIL-F-15733. Except coaxial, stripline, and waveguide filters; high-pass, low-pass, band-pass, and band-suppression filters shall conform to MIL-F-18327. The age expectance shall be "X" (10,000 hours) (see MIL-F-18327).

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3.10.15 Fuses and fuseholders. Fuses and fuseholders shall conform to Requirement 39 of MIL-STD-454. Fuses conforming to MIL-F-15160 and MIL-F-23419 shall be limited to those listed in table VII. Panel-mounted fuseholders shall be of the waterproof type and shall be such that the fuses can be replaced without the use of tools. Fuse clips constructed of copper-clad steel shall not be used.

TABLE VII. Fuses.

Style	Current rating (amperes)
F03 F09 F01, F02, F16, F19, F20, F21, F22, F28 FM01, FM02, FM03, FM04	0.010 through 10 15, 20, and 25 Any rating shown on Applicable military specification sheets

3.10.16 Gear assemblies, cams, and gears. Cams and gears shall be located to insure shaft alignment and support. All rolling and engagement elements shall be smooth, free of rough, sharp, or abrasive edges and faces. The contact surfaces shall be smooth, and of the proper hardness.

3.10.16.1 Cams. Cams shall provide smooth, continuous contact between the cam and its roller or mating contact surface without interference, or tight or loose spots. The roller or mating contact surface pressure shall be kept to a minimum. Cams mounted to shafts shall be secured to prevent motion between the cam and the shaft.

3.10.16.1.1 Metallic cams. Metallic cams shall be made of corrosion-resistant steel conforming to types 203 to 416 plus X in accordance with ASTM A582 or of bronze conforming to Alloy D3 of QQ-C-390 or QQ-B-750, except that aluminum alloys may be used for light-duty cams.

3.10.16.1.2 Plastic cams. Plastic cams shall be made from type NPG plastic conforming to MIL-P-15047; type FBE, FBG, FBI, or FBM plastic conforming to MIL-P-15035; or polyamide plastic, type 1, conforming to MIL-M-20693; or acetal plastic conforming to L-P-392; or plastic conforming to MIL-P-18324. However, type FBI and FBM, and plastic conforming to MIL-P-18324, shall not be used where electrical properties are required. Polyamide or acetal plastic shall not be used where continuous operating temperatures exceed 121°C (250°F).

3.10.16.2 Gear assemblies. All gears shall be in accordance with American Gear Manufacturers Association (AGMA) specifications. (Where a tolerance, different from that noted in an AGMA specification is required, this modified tolerance shall be shown on the drawing and the drawing shall have a note "AGMA" Quality No. (____) except as shown.) All gears, fitted on shafts, shall be secured to prevent relative motion between the gear and the shaft.

3.10.16.2.1 Metallic gears. Gears, operating in a lubricant bath enclosure, may be made of high-strength alloys. When non-corrosion-

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resistant alloys are used, the lubricant shall have corrosion-inhibiting additives.

3.10.16.2.2 Plastic gears. Materials and application for plastic gears shall be the same as for plastic cams (see 3.10.16.1.2).

3.10.16.3 Planetary or epicyclic gears. Planetary or epicyclic gearing is preferred to worm gearing for servo applications to reduce friction and provide better control of backlash.

3.10.16.4 Spring-loaded or split gears. Spring-loaded or split gears may be used to reduce backlash, but shall not be used to reduce the effect of errors in the manufacture of gears intended for critical (high accuracy) applications.

3.10.16.5 Spur and bevel gears. Spur and bevel gears for heavy duty drives shall be made of corrosion-resistant steel conforming to types 203 to 416 plus X in accordance with ASTM A582 or of bronze conforming to MIL-B-16540. Aluminum alloys may be used for spur and bevel gears for light duty drives only.

3.10.16.6 Worm gearing. Worm gears, transmitting an appreciable amount of torque, shall be made of bronze conforming to Alloy D3 of QQ-C-390 or QQ-B-750. The use of aluminum alloys is considered satisfactory for worm wheels transmitting very low torque, such as drives for dials in synchro transmission systems. Worms shall be made of corrosion-resistant steel conforming to types 203 to 416 plus X in accordance with ASTM A582.

3.10.17 Hardware for chests, cases, canvas, and leather. Hardware for chests and cases shall conform to Drawing SC-A-19100, and hardware for canvas and leather items shall conform to Drawing SC-A-47183.

3.10.18 Interlocks. Bypass devices, when provided, shall be of a manually-operated type and shall conform to one of the following:

3.10.18.1 Switch type. Bypass devices of the switch type shall be such that returning the chassis to the operating position by closing the door, cover, or plate will automatically open the bypass switch and leave the interlock in position to function normally.

3.10.18.2 Other types. Other types of bypass devices shall be equipped with a handle or otherwise insulated to provide maximum protection to personnel and shall be such that the equipment cannot be replaced or the door, cover, or plate closed without removing the device.

3.10.19 Isolators, shock. Isolators used with shock mounts shall be such that failure of the resilient material will not free the supported part. They shall be readily replaceable without disassembly of the equipment.

3.10.20 Jacks and plugs (telephone). Telephone-type jacks shall be limited to MIL-J-641/2, 3, 4, 5, 6, 8, 12, 17, and 18. When practicable, the jacks shall be so mounted that they can be inspected and cleaned easily with a burnisher, without removal. Telephone-type plugs shall be limited to MIL-P-642/4, 5, 7, and 10.

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3.10.21 Keys (telephone). Telephone-type keys shall be easily removable for replacement purposes. They shall be so mounted that they can be inspected and cleaned easily with a burnisher, without removal. Leakage paths between springs shall be increased by staggering the insulation in both the width and length directions.

3.10.21.1 Internal insulation. Internal insulation of telephone-type keys shall be type GDI-30, GDI-30F, MDG, SDG, SDG-F, SDI-5, or SDI-30 of MIL-M-14; type GME of MIL-P-15037; or Grade B of MIL-P-46161. Air gaps in insulation, which is not continuous, shall be filled with a compound whose dielectric constant is not greater than that of the insulation and whose other electrical properties are equal to or better than those of the insulation.

3.10.21.2 Sheet insulation. Sheet insulation shall be type GEE conforming to MIL-P-18177.

3.10.21.3 Buttons and pushers, insulation for. The insulation for buttons and pushers shall be either type CFG or CFI-5 conforming to MIL-M-14, or type GME conforming to MIL-P-15037.

3.10.21.4 Moisture resistance. After subjection to a relative humidity of 90 percent or higher for a minimum of 10 days with a maximum temperature of 65°C (see 4.2.3.1), the telephone-type keys shall be capable of meeting the following requirements:

- a. Enable the items in which the keys are used to meet equipment requirements and tests.
- b. Insulation resistance of at least 1 megohm between mutually insulated contacts, and between normally closed contacts with the key in the actuated position, when measured at a potential of 100 volts DC.
- c. Potential drop not exceeding 0.002 volt across any pair of contacts, with the contact carrying 100 milliamperes DC.

3.10.22 Lamps, lampholders, and lights. Lamps, lampholders, and lights shall conform to Requirement 50 of MIL-STD-454.

3.10.23 Level vials. Level vials shall conform to MIL-V-3144 and shall be centrally positioned in their holders with calcined gypsum conforming to MIL-G-20098.

3.10.24 Lubrication fittings. Lubrication fittings shall conform to MIL-F-3541, and, where practicable, shall be type I, II, or III.

3.10.25 Meters, indicating, and accessories. Indicating meters and accessories shall conform to Requirement 51 of MIL-STD-454. Unless otherwise specified in the contract, panel meters shall be the 2-1/2 inches size and meters conforming to MIL-M-16034 shall be color scheme W. Shunts shall conform to MIL-S-61 or MIL-I-1361, as applicable (Requirement 40 of MIL-STD-454). Meters conforming to MIL-M-3971 shall only be used in sheltered locations, such as depots or other such fixed locations.

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3.10.26 Microcircuits. All microcircuits shall be hermetically sealed except for the plastic coated microcircuits of 3.10.26.1.2. Microcircuits shall conform to Requirement 64 of MIL-STD-454. Contractor-prepared drawings or specifications for microcircuits, except hybrid microcircuits, may exclude qualification requirements, provided all other product assurance requirements of MIL-M-38510 are met.

3.10.26.1 Hybrid microcircuits.

3.10.26.1.1 Hermetically sealed hybrid microcircuits. A hermetically sealed hybrid microcircuit consists of elements which are of the film circuit type in combination with one or more of the following: discrete semiconductor devices, microcircuits, discrete passive devices, and chip passive devices, within a hermetic package. Hermetically sealed microcircuits shall meet the screening, qualification, and quality conformance requirements for class S or B of MIL-M-38510. Organic materials shall not be used for any purpose in the manufacture of these microcircuits, unless approval is received from the contracting officer.

3.10.26.1.2 Plastic-coated hybrid microcircuits. A plastic-coated hybrid microcircuit is non-hermetic, coated with an organic material, and consists of elements which are of the film circuit type in combination with one or more of the following: Hermetically sealed discrete semiconductor devices, hermetically sealed microcircuits, discrete passive devices, and chip passive devices. Plastic-coated hybrid microcircuits shall meet the screening, qualification, and quality conformance requirements for class S or B of MIL-M-38510. The hermeticity of all hermetically sealed portions of hybrid microcircuits shall meet the fine and gross leak test requirements of MIL-STD-883, Test Method 1014, prior to addition of any conformal coating.

3.10.26.1.3 Discrete semiconductor devices and microcircuits. Discrete semiconductor devices shall be in accordance with MIL-S-19500 and Requirement 30 of MIL-STD-454. If uncased chips are used, they shall be obtained from a manufacturer qualified under MIL-M-38510 for the specific device which uses the chip. Standard microcircuits shall meet the requirements of 3.10.26 and, if uncased chips are used, the chips shall be obtained from manufacturers qualified under MIL-M-38510 for the specific device or generically similar one which uses the chip.

3.10.26.1.4 Discrete chip passive devices for hybrid microcircuits. Discrete chip passive devices shall be as follows:

a. Ceramic capacitor chips. Ceramic capacitor chips shall conform to MIL-C-55681.

b. Tantalum capacitor chips. Tantalum capacitor chips shall conform to MIL-C-55365.

c. Resistor chips. Resistor chips shall conform to MIL-R-55342.

3.10.26.1.5 Nonstandard discrete semiconductor devices, microcircuits, discrete passive devices, and chip passive devices for hybrid microcircuits. Prior to inclusion in hybrid microcircuits, nonstandard discrete semiconductor devices, microcircuits, discrete passive devices, and chip passive devices shall be submitted for approval in accordance with 3.4.

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3.10.27 Motors, dynamotors, rotary power converters, and motor generators. Motors, dynamotors, rotary power converters, and motor generators shall conform to Requirement 46 of MIL-STD-454. In addition, they shall be suppressed so as not to produce excessive spikes or transients during operation.

3.10.28 Oscillators, crystal. Crystal oscillators shall conform to MIL-O-55310.

3.10.29 Ovens, crystal. Crystal ovens shall conform to MIL-O-39021.

3.10.30 Panels, integrally illuminated. If illumination of instruments and legendry is an equipment requirement, then applicable instrument or console panels shall conform to MIL-P-7788.

3.10.31 Pins, spring and grooved. Spring pins shall conform to MIL-P-10971. Grooved pins shall conform to MIL-P-20700.

3.10.32 Printed wiring, printed wiring boards, and printed wiring assemblies. Printed wiring, printed wiring boards, and printed wiring assemblies shall conform to Requirement 17 of MIL-STD-454 and the following:

3.10.32.1 Printed wiring assemblies. Printed wiring assemblies shall conform to MIL-P-28809. Printed wiring assemblies shall be of modular construction with regard to overall equipment, internal layout, and electronic part positioning. (Modular construction is defined as a method of utilizing construction of assemblies and subassemblies in the equipment which enables the items to be separately manufactured and tested; and which modules are readily replaceable or field repairable as individual items with the equipment of which they are a part.) The number and functional types of modules and their mechanical construction shall be minimized and standardized to the extent that testing, repair, and commonality will simplify maintenance. The number of electronic assemblies and subassemblies shall be in keeping with efficient space utilization. When required by the contract, a minimum of three different sets of printed wiring assemblies representative of the materials, layout, processes, electronic parts, and circuit packaging techniques to be employed shall be submitted to the contracting officer for determination of compliance with these requirements. Each assembly shall consist of a completely processed printed wiring assembly with a representative selection of electronic parts and associated hardware. These assemblies shall illustrate the application of the part mounting, soldering, cleanliness, and protective coating planned for use in the equipment. Warp and twist of the printed wiring assembly shall not exceed 3 percent after soldering part terminations to the conductor pattern, when tested in accordance with MIL-STD-275. Saponifiers (detergents) used in aqueous cleaning solutions shall not be used without prior approval of the acquiring activity. When saponifiers are used for cleaning purposes, care should be taken to remove all traces of the saponifier to prevent possible corrosion. Printed wiring assemblies shall be conformally coated in accordance with MIL-STD-275 with a coating material that conforms to MIL-I-46058. Except upon specific approval of the contracting officer, bare unassembled printed wiring boards shall not be repaired.

3.10.32.2 Printed wiring boards. Rigid single or multilayer printed wiring boards shall be in accordance with MIL-STD-275 and MIL-P-55110.

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3.10.32.2.1 Lead-mounted parts. Lead-mounted parts shall be in accordance with MIL-P-28809 and MIL-STD-275.

3.10.32.3 Flexible printed wiring. Flexible printed wiring shall conform to MIL-P-50884.

3.10.33 Relays. Relays shall be suppressed so as not to produce excessive spikes or transients during operation. Relays shall conform to Requirement 57 of MIL-STD-454, with the following additions:

a. Reed type relays shall consist of devices employing switch capsules in accordance with MIL-S-55433. This type of relay shall not be used in equipment where the open-circuit voltage between contacts exceeds 50 volts DC and the product of the contact voltage and load exceeds 15 voltamperes.

b. Solid-state relays shall meet the requirements of MIL-R-28750 for general purpose applications and MIL-R-27777 for telegraph applications.

c. Hybrid relays shall meet the requirements of MIL-R-28776 for EMI suppression applications.

d. For equipment of new design, relays shall be in accordance with MIL-STD-1346 and table I, with the same addition as above.

e. For established reliability applications see 3.7 and table I.

3.10.34 Resistors. Resistors shall conform to Requirement 33 of MIL-STD-454 except that "P" level failure rate or better shall be required.

3.10.35 Screws, other threaded devices, and related parts. Screws, threaded devices, and other parts shall conform to Requirement 12 of MIL-STD-454. A screw in a tapped hole in soft material shall be used only within the same limitation as that applied for thread-cutting screws. When mounting soft material to soft material a self-locking screw shall be used with a threaded bushing, insert, or staked, clinched, or pressed-in nut; or a self-locking insert shall be used. Screw threads shall conform to FED-STD-H28; the Unified Thread Form and Series shall be class 2A or 2B fit, and the American National Thread Series shall be class 2 fit. When screws and other threaded devices, and related parts, are to be made of carbon steel they shall be plated, type II, class 2, conforming to QQ-P-416; or of corrosion-resistant steel, passivated. The definition of significant surface in QQ-P-416 shall not apply. Machine screws, cap screws, nuts, and washers shall be selected from Drawing SC-A-46420.

3.10.35.1 Machine screws. When practicable, machine screws shall be no smaller than No. 6 (0.138-inch nominal size) and shall have drilled-fillister or pan heads. Flat-head screws shall not be used in sheet or thin material unless the thickness of the material is at least 1-1/2 times the height of the screwhead. The screwheads shall be completely seated in the material.

3.10.35.2 Self-locking screws. Self-locking screws shall provide a locking torque within the range specified in table VIII.

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TABLE VIII. Locking torque at 250C.

Fine thread series			Coarse thread series		
Screw Size	Maximum locking torque (in-lb)	Minimum breakaway torque (in-lb)	Screw size	Maximum locking torque (in-lb)	Minimum breakaway torque (in-lb)
-----	---	----	2-56	2.5	----
-----	---	----	4-40	5	----
-----	---	----	6-32	10	1.0
			8-32	15	1.5
10-32	18	2.0	-----	-----	-----
1/4-28	30	3.5	1/4-20	30	4.5
5/16-24	60	6.5	5/16-18	60	7.5
3/8-24	80	9.5	3/8-16	80	12.0
7/16-20	100	14.0	7/16-14	100	16.5
1/2-20	150	18.0	1/2-13	150	24.0

3.10.35.3 Setscrews. Setscrews shall be used only where uniquely required by design of the equipment. Setscrews shall be style 2 (cone-point) or style 4 (cup point). When one or more style 4 setscrews are used and the part is not adjustable in angular relationship to the shaft on which it is secured, one setscrew shall bear on a flat surface. Setscrews used on control knobs may be type II (slotted) conforming to FF-S-210. If setscrews, size 4 and smaller, are used, type II (spline socket) conforming to FF-S-200 shall be used.

3.10.35.4 Wood screws. Wood screws shall conform to FF-S-111. Steel wood screws shall be given type I (zinc phosphate) treatment conforming to TT-C-490, or the finish specified in 3.10.35.

3.10.35.5 Adjustment screws and similar devices. Adjustment screws and similar devices shall be prevented from rotating except when being adjusted.

3.10.35.6 Threaded bushings, inserts, nuts, and nut plates:

a. Anchor or clinch nuts or nut plates shall be used for threaded engagement in sheet metal where the metal thickness is less than the nominal thickness of corresponding machine-screw nuts in sizes No. 12 and smaller and semifinished hexagon regular nuts in sizes 1/4 inch and larger, as shown in FED-STD-H28.

b. Threaded inserts shall be sealed with zinc-chromate primer conforming to TT-P-1757 prior to insertion in the casting.

c. Threaded bushings; inserts; and staked, clinched, or pressed-in nuts shall be secured to the structure so as to resist rotation to torque values at least 20 percent higher than the maximum values specified in table VIII. The axial strength of the bushing, insert, or nut shall be such that, when so secured, the screw used in the application will fail before the bushing, insert, or nut fails.

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d. Screw-locking inserts shall provide a locking torque within the range specified in table VIII. Helical coil inserts shall conform to MIL-I-8846. Locked-in and key-locked inserts and studs shall conform to MIL-I-45914 and MIL-S-45915, respectively. Thread-forming screw thread inserts shall conform to MIL-I-45916.

3.10.35.7 Tightening of threaded parts. Threaded parts of steel shall be tightened to the torque values in table IX. Threaded parts of other size or material shall be tightened to a suitable design value established by the contractor for the particular application.

TABLE IX. Torque for tightening steel threaded parts.

Thread	Torque (in-lb)
6-32	7 to 9
8-32	14 to 18
10-24	19 to 23
10-32	25 to 39
12-24	32 to 39

3.10.35.8 Lockwashers. Except as specified herein, lockwashers shall conform to Requirement 12 of MIL-STD-454. Tooth-type lockwashers shall be steel, flat, external-tooth-type conforming to MS35335 with cadmium plate as shown thereon and shall be used only for grounding and in the suppression of electrical interference.

3.10.36 Semiconductor devices. Semiconductor devices shall conform to Requirement 30 of MIL-STD-454. Mounting pads and insulator disks shall conform to MIL-M-38527.

3.10.37 Servomotors, synchros, resolvers, and tachometer generators. Servomotors, synchros, resolvers, and tachometer generators shall conform to Requirement 56 of MIL-STD-454. In addition, they shall be suppressed so as not to produce excessive spikes or transients during operation.

3.10.38 Sockets, tube shields, and tube clamps. Sockets, tube shields, and tube clamps shall conform to Requirement 60 of MIL-STD-454.

3.10.39 Switches. Switches shall conform to Requirement 58 of MIL-STD-454 except that toggle switches shall conform to the following, as applicable:

- a. MIL-S-3950, when environmentally sealed switches are required.
- b. MIL-S-83731, when unsealed and sealed toggle switches are required.
- c. MIL-S-8834, when positive-break type or low-level switches are required.
- d. Switches required for low-level (dry circuit) applications shall have a wiping action design or shall be goldplated 125 millionths over 200 millionths nickel.

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3.10.40 Terminals, fixed, and terminal boards. Fixed terminals and terminal boards shall conform to Requirement 19 of MIL-STD-454 and shall be limited to those in MIL-STD-1277.

3.10.41 Transformers, inductors, and coils. Transformers, inductors, and coils shall conform to Requirement 14 of MIL-STD-454. For established reliability applications see 3.7 and table I.

3.10.42 Tubes, electron. Electron tubes shall be in accordance with Requirement 29 of MIL-STD-454.

3.10.43 Vibrators. Vibrators shall conform to MIL-V-95. Vibrators shall be suppressed so as not to produce excessive spikes or transients during operation.

3.10.44 Waveguides, waveguide assemblies, coaxial transmission lines, and related items. Waveguides, waveguide assemblies, and related items shall conform to Requirement 53 of MIL-STD-454. Magnesium waveguides and fittings shall not be used. Aluminum waveguides or fittings shall not be employed where they will come in contact with silver or copper-alloy waveguides or fittings. Copper-alloy flanges shall be silverplated; air-dielectric coaxial transmission lines shall conform to MIL-L-3890.

3.10.45 Windows. Where controls are so arranged as to require the reading of dials through windows in panels or control housing, the window shall be provided with non-glare shatterproof glass or plastic secured to the panel or housing by means of clips or equally effective mechanical devices. Cement alone shall not be used for securing the glass or plastic. To prevent most interference energy from entering or leaving the enclosure through the window opening, an effective shield shall be placed over the window opening. Discretion should be exercised in determining the maximum dimensions of an aperture for a specified frequency range because interference leakage increases with frequency.

3.10.46 Wires. Wires shall conform to the following:

3.10.46.1 Bare wires. Bare wires shall conform to QQ-W-343.

3.10.46.2 Hookup wires. Hookup wires shall conform to Requirement 20 of MIL-STD-454 and MIL-W-81822. Twisted pairs and triples shall conform to MIL-C-55021. Consideration should be given to tin-plated wires rather than silver-coated wires. Silver-coated wires may be subject to "red plague" corrosion, which is especially damaging to silver-coated wires. The problem is galvanic and is most serious to small-diameter copper wire. Corrosion begins at pinholes or breaks in the silver coating when bridged with moisture introduced through or under the insulation. It seriously impairs fatigue life and the electrical conductivity of the copper wire.

3.10.46.3 Magnet wires. Magnet wires shall conform to J-W-1177.

3.10.46.4 Wire harness. Conventional wire harness shall be utilized only in applications where it can be determined that the use of flat harness is impracticable from the standpoint of physical construction or mechanical behavior. Flat wire harness is available in widths up to approximately 2-1/3 inches and up to 75 conductors depending upon the

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wire sizes which range from #30 to #14 AWG. The cabling of conventional wires shall be effected by twine conforming to MIL-T-713, tape conforming to MIL-T-43435 and MIL-I-24391, or straps for cable harnessing conforming to MIL-S-23190. However, cord conforming to MIL-I-3158 shall be used where resistance to heat or chemicals is essential. Individual conductors thus secured shall lie essentially parallel; however, this does not prohibit the use of twisted pairs.

3.10.46.5 Identification of wiring. Wiring shall be identified by color coding or, if approved by the contracting officer, may be identified by other means such as marking of terminals at both ends of each lead or marking on the insulation. Color coding for chassis wiring shall be system I or II conforming to MIL-STD-681. Heat-shrinkable tubing used for marking terminals at the ends of each lead shall conform to MIL-I-23053, and shall be of the same basic material as the hook-up wire insulation provided that the temperature range of the tubing is equal to or greater than that of the hook-up wire insulation. MIL-I-23053/5, Class 1, shall be used for tubing on insulated hook-up wire. Marking on the tubing, after shrinkage shall conform to MIL-M-13231; marking size and hot-foil stamping shall conform to MIL-I-81531. Different colors may be used to distinguish tubing diameters.

3.10.46.5.1 Power distribution wiring identification. Green shall be used exclusively as the color for equipment ground wires in power distribution wiring. All neutral power conductors shall be white and white shall be used exclusively for neutral power conductors. The following examples shall be as specified:

- a. Single-phase, 2 pole, 3 wire, AC service
 - Black (hot)
 - White (neutral)
 - Green (ground)
- b. Floating single-phase, 2 pole, 3 wire, AC service
 - Grey (hot)
 - Grey (hot)
 - Green (ground)
- c. 3-phase AC circuits
 - Black (hot, phase A)
 - Red (hot, phase B)
 - Blue (hot, phase C)
 - White (neutral)
 - Green (ground)
- d. Single-phase, 2 pole, 4 wire AC service (except 220 Volts)
 - Black (hot)
 - Red (hot)
 - White (neutral)
 - Green (ground)

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3.11 Processes.

3.11.1 Anti-seize compound. Prior to assembly, all externally-threaded parts for use in aluminum and magnesium alloys shall be coated with anti-seize compound in accordance with MIL-T-22361.

3.11.2 Brazing. Brazing shall conform to Requirement 59 of MIL-STD-454.

3.11.3 Cleaning. Cleaning of materials, parts, and equipment shall be in accordance with Requirement 9 of MIL-STD-454 and the following: Materials, parts, and equipment shall be cleaned to remove such contaminants as corrosion products, dust, fingerprints, lubricating oils, mold release agents, sand, solder, flux residues, outgassing products, and any other contaminant. The cleaning procedure and cleaning agents shall have no deleterious effect on the performance requirements of the materials, parts, and equipment. The same cleaning procedures shall be applied to all equipment produced and delivered on a contract.

3.11.4 Finish, protective. Finishes (including color of finishes) shall be in accordance with MIL-F-14072.

3.11.5 Marking. Marking shall conform to MIL-M-13231. Front panel marking shall be group I as described in MIL-M-13231. Parts shall be so mounted that their identification markings will be readily visible with no or minimum disassembly of the equipment. Identification plates shall conform to MIL-P-15024/6. If the equipment includes radioactive material, it shall be marked in accordance with MIL-STD-129.

3.11.6 Riveting. Rivets shall conform to Requirement 12 of MIL-STD-454. Wet-driven rivets shall be installed using a zinc-chromate primer conforming to TT-P-1757. Rivets used on printed wiring boards need not be wet driven. The distance from the centers of the rivet holes to the edges of the material in which the rivets are placed shall be not less than two times the rivet diameter for aluminum and two and one-half times for magnesium. The size and spacing of rivets on aluminum plates are sometimes dictated by factors other than those mentioned above. The following are some general rules that may be helpful in proportioning aluminum riveted joints and connections:

a. The diameter of a rivet shall be not larger than three times the thickness of the outside plates or shapes, and shall be not smaller than the thickness of the thickest plate in which the rivet is driven.

b. A rivet used in the leg of an angle shall have a diameter not exceeding 0.3 times the width of the leg.

c. The minimum spacing of rivets shall be three times the nominal rivet diameter. The maximum spacing is often governed by the possibility of compression buckling of parts between rivets. Where buckling or strength requirements do not control, the spacing shall still be held below some reasonable maximum limit, such as twenty-four times the thickness of the sheet or plate.

d. In riveted joints that must be made pressure-tight by caulking the edge of the plates, the edge distance shall not exceed one and one-

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half times the rivet diameter or four times the thickness of the plate. Spacing of the rivets shall not exceed four times the rivet diameter or ten times the thickness of the plate.

3.11.7 Soldering. Soldering shall conform to Requirement 5 of MIL-STD-454, except as specified herein. The liquid flux shall be type R or RMA of MIL-F-14256 and flux-cored solder shall be type R or RMA of QQ-S-571.

3.11.7.1 Printed-circuit soldering. Printed-circuit and hand soldering shall be in accordance with Requirement 5 of MIL-STD-454. Liquid flux shall be type R or RMA of MIL-F-14256 and flux-cored solder shall be type R or RMA of QQ-S-571. Properly controlled dip soldering or other suitable automatic soldering means shall be used wherever practicable for connecting the part terminations to the conductor pattern. All printed-wiring solder joints shall consist of a complete concentric, void-free fillet of solder around the lead, wetting both the lead and the terminal area. The flux shall be used in minimum amounts with the flux residue removed after the soldering operation. If any portion of an existing printed-wiring solder joint is subsequently reheated to a temperature above 149°C (300°F), all solder in the joint shall be remelted to above the liquidus temperature and the joint shall be reformed.

3.11.8 Treatment, overall, moisture and fungus proofing treatment (MFP), on equipment of established design. Unless otherwise specified, when overall tropicalization treatment is a contractual requirement, a moisture and fungus proofing (MFP) varnish conforming to MIL-V-173 shall be applied in accordance with MIL-T-152. The MFP treatment shall be applied after the equipment has been cleaned in accordance with 3.11.3. When tape is used on parts of the equipment that are marked against treatment, the tape applied shall be an electrical grade. In the application of the MFP coating, care should be taken to assure that the coating does not affect the circuit constants and thereby degrade performance. Information on the masking of thermosetting materials during overall treatment of equipment are specified in table IV. (See 3.9.11.1 and 3.9.11.2.)

3.11.9 Welding. Welding shall conform to Requirement 13 of MIL-STD-454, except that spot or other intermittent welds in aluminum or magnesium shall be limited to lightly stressed, non-critical structures and at least two spot or other intermittent welds shall be used. Continuously welded seams shall be made on cases intended to house electronic communications equipment. Welds running into mating surfaces shall be machined flat and true with the mating surfaces. Welded assemblies shall be cleaned to remove rust, scale, oxidation products, and excess flux by sandblasting, wire brushing, or other suitable means. Prior to painting, steel parts that have been arc-welded or acetylene-welded shall, in addition, be subjected to vat passivation or a phosphoric acid etch in accordance with MIL-C-10578. Acid used for cleaning shall be removed from the part and surrounding area.

3.11.10 Wiring practices, internal. Internal wiring practices (except for printed wiring) shall conform to Requirement 69 of MIL-STD-454 and the following:

3.11.10.1 Cabling. Insulated wires shall be formed into cables,

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except where operation of the equipment would be adversely affected thereby or where it is physically impracticable as in the case where the resulting cables would be excessively large and would interfere with operation or maintenance. Lacing or tying may also be effected by pressure-sensitive tape conforming to MIL-I-24391. Cord conforming to MIL-I-3158 shall be used where resistance to heat or chemicals is essential.

3.11.10.2 Clearance. Clearance between wires or cables, and parts such as electron tubes, resistors, etc., shall be provided to avoid deterioration of the wires or cables because of the heat dissipated by such parts when the equipment is subjected to the equipment service conditions.

3.11.10.3 Protection. Wires and cables shall be so placed and protected as to avoid contact, under equipment service conditions, with rough or irregular surfaces or sharp edges. Wires shall not be bent sharply where they enter insulation material.

3.11.10.4 Inductive and capacitive effects. Wires and cables shall be so located that inductive and capacitive effects, unless used as a design feature, will be the minimum practicable.

3.11.10.5 Insulating sleeving. In addition to the specifications cited in Requirement 69 of MIL-STD-454, insulating sleeving may also conform to MIL-I-7444, MIL-I-22129, or MIL-I-21557. Vinyl materials shall not be used in an enclosed environment because of the possibility of outgassing.

3.11.10.6 Splicing and stretching. Wires in continuous run between two terminals shall not be spliced or stretched during the cabling or wiring operation.

3.11.10.7 Connections.

3.11.10.7.1 General. Wire leads to be soldered shall be cleaned and pretinned in accordance with Requirement 5 of MIL-STD-454. Resistance welding or electrical interconnections shall be in accordance with Requirement 24 of MIL-STD-454. Fraying of textile ends of wires shall be prevented mechanically or by application of varnish conforming to MIL-V-173 applied in accordance with MIL-T-152. No varnish, lacquer, inspection paint, or other coating shall be applied to completed electrical connections, except that these connections need not be masked during overall treatment with transparent protective coating materials.

3.11.10.7.2 Part terminations and lug terminals. Part terminations and lug terminals shall conform to Requirement 19 of MIL-STD-454.

3.11.10.7.3 Wire-wrap terminations. For terminations located on 0.100 inch spacing requiring smaller wire than those specified in MIL-STD-1130, the wire shall consist of a copper alloy conductor with a tough, cut-through-resistant insulation. Such terminations shall be applied to 0.025 inch by 0.25 inch terminal, incorporate a minimum of 1-1/2 insulated turns and 6 uninsulated turns, and have a minimum of 2 pounds strip force.

3.11.11 Grounding. Ground connection to shields and to other mechanical

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parts, except the chassis or frame, shall not be made to complete electrical circuits, but only to eliminate high-potential AC points. Intermediate-frequency transformers, however, may be grounded through their cases if other means of grounding is impracticable.

3.11.11.1 Grounding to chassis. Grounding to chassis shall conform to Drawing SC-B-61578.

3.11.11.2 Wire and cable shielding. Wire or cable shielding shall be grounded to the chassis or frame of the equipment. When the wire or cable terminates in a connector:

a. For equipment requiring EMI suppression (transmitting or receiving, or both) shield terminations shall be peripherally bonded using an EMI backshell on the connector.

b. In other cases, the shielding shall be connected through a pin of the connector, unless it is a coaxial type or another type where this procedure is impractical. Shielding shall end at a sufficient distance from exposed conductors to insure against shorting or arcing between the conductor and the shielding. Shielding shall be terminated by a crimping ferrule, or by soldering at the end of the shielding.

3.11.12 Electrostatic discharge control. An appropriate electrostatic discharge control program shall be established in accordance with DOD-STD-1686 or DOD-HDBK-263. Procedures shall cover handling, storing and testing of electrostatic sensitive parts. Design selections of desired parts should include a consideration of the effectiveness of the input or other protective elements included in the part design.

3.12 Workmanship. Workmanship shall be in accordance with Requirement 9 of MIL-STD-454 and as specified in the equipment specification.

3.13 General surveillance. The contractor shall conduct a thorough and continuous examination of all systems and component parts to ensure maximum use of plating, painting, chemical coating, metal treating, fungus control, cleaning, etc., consistent with the paragraphs and documents specified herein.

3.13.1 Corrosion. The contractor shall give particular attention to avoidance of construction that promotes corrosion through the admission and retention of water, either directly or by condensation. Where inadequacies are encountered, best industry practice on advanced state-of-the-art shall be considered, but must receive procuring agency approval prior to implementation. The contractor shall be cognizant of the possibilities of deterioration due to the incompatibility of dissimilar metals and materials (see MIL-F-14072). The contractor shall endeavor to make corrections or provide means of separation, if material changes are not practicable.

3.13.2 Surveillance of subcontractors. The contractor shall monitor and inspect the deterioration prevention measures instituted by all subcontractors, making available to them all applicable information and requiring their compliance to the same standards as for the contractor.

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3.14 Equipment storage design considerations. The contractor shall be completely cognizant of the long-term storage requirements that are unique with the equipment. The following are design considerations that shall be considered in ensuring final system reliability:

- a. Provide for a dry atmosphere not exceeding 30 percent relative humidity. If necessary, fill and maintain with dry nitrogen.
- b. Avoid designs that are not self-draining or that may collect water in crevices, pockets, hollows, wells, etc.
- c. Use materials and finishes that provide the best resistance to atmospheric deterioration.
- d. Make mating construction from materials with suitable galvanic compatibility as defined in MIL-F-14072, or insulate galvanic couples when they cannot be avoided.
- e. Provide clean metal surfaces prior to application of protective finishes.
- f. Use adherent, good quality, organic coatings.
- g. Use electrodeposited coatings with inherent oxidation resistance, such as nickel and chromium plate, or provide supplementary treatment for corrodible finishes.
- h. Avoid hygroscopic materials.
- i. Use nonmetallic construction.
- j. Minimize high-stress concentration features.
- k. Seal all joints.
- l. Provide for adequate inspection and maintenance.
- m. Provide adequate protection against electrostatic discharge for ESD sensitive parts and equipment.

3.15 Equipment protection degrees.

3.15.1 Hermetically sealed. Protective finishes are not required for interior surfaces of hermetically sealed assemblies or components, nor for parts enclosed therein. Finish requirements are applicable however, to the external surfaces of hermetically sealed packages.

3.15.2 Desiccated design. The use of packaged desiccant shall not be considered as the panacea for control of humidity or corrosion. Parts and assemblies, stored in desiccated areas, shall be finished with normal finishes. The desiccant shall be in a container and not in direct contact with the surfaces of functional parts. The desiccant requirement shall be to maintain a relative humidity not to exceed 30 percent at the design temperature extremes of storage. When desiccant is included, provision shall be made for periodic inspection and replacement.

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3.15.3 Sealed spaces. Contractors should make every effort to employ flat or O-ring gaskets, tape, barrier films, sealants (either curing or noncuring types), and paint to provide sealed joints for spaces for functioning components. An effective joint seal, for example, would consist of a flat or O-ring gasket, tape wrapped, and overcoated with paint. The use of gasket-sealed spaces will not be considered as the panacea for humidity and corrosion control and should only be used where disassembly is required for maintenance purposes. Parts and assemblies shall be finished by normal finish requirements.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 Quality conformance inspection. This inspection shall consist of group A, group B, and group C inspection as specified in 4.2.1 through 4.2.3.1 (see table X), and applies to variable capacitors, telephone keys, and any items not specified by reference to individual specifications, standards, or drawings. All other items shall be inspected in accordance with their individual specifications, standards, and drawings. This does not relieve the contractor of his responsibilities for performing any additional inspection which is necessary to control the quality of the product and to assure compliance with all specification requirements.

4.2.1 Group A inspection. Each variable capacitor and telephone key on contract, or any other part not covered by a referenced individual specification, shall be inspected for conformance to the Group A inspections specified in table X. Factors of lot composition not defined herein, or in the contract, shall be in accordance with MIL-STD-105. Each lot shall be subject to sampling inspection, utilizing the procedures of MIL-STD-105, using the general inspection levels, and AQL's indicated in table X.

4.2.1.1 Visual and mechanical inspection. Parts shall be inspected for compliance with this specification, as follows: They shall be examined for workmanship, mechanical fit, loose nuts and screws, and miscellaneous defects. Controls and fastening devices shall be examined for mechanical operation. Wiring, soldered connections, ground connections, welds, finishes, etc., shall be examined for workmanship. Clearances, dimensions, and mechanical adjustments shall be inspected. Examination also may be made for other visual or mechanical defects, similar to those described above. Visual and mechanical defects shall be classified as major or minor in accordance with MIL-STD-252. Visual and mechanical defects not covered by MIL-STD-252 shall be classified as major or minor in accordance with the definitions of MIL-STD-105.

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TABLE X. Inspection procedures.

Requirement paragraph			Test Para-graph	AQL			
Inspec-tion	Capacitors, Variable	Keys, Telephone		Group A		Group B	Group C
				Major	Minor		
<u>Group A</u>							
Visual and mechan-ical	3.10.7	3.10.21	4.2.1.1	1%	4%	N/A	N/A
<u>Group B</u>							
(Capac-itors, variable only)	3.10.7.1	N/A	4.2.2.1	N/A	N/A	6.5%	N/A
<u>Group C</u>							
(Keys, tele-phone only)	N/A	3.10.21.4	4.2.3.1	N/A	N/A	N/A	see 4.2.3

4.2.2 Group B inspection (variable capacitors only). Variable capacitors shall be inspected in accordance with the applicable inspection on table X. Sampling shall be in accordance with special inspection level S-4 of table II of MIL-STD-105. The AQL shall be 6.5 percent defective. Samples submitted to this test shall not be furnished on contract.

4.2.2.1 Test of variable, air-dielectric, rotary capacitors. Variable capacitors shall be tested in accordance with the requirements for variable, air dielectric, capacitors as specified in the contract or drawing (see 3.10.7.1). After completion of the minimum 25,000 operations specified therein, the capacitor shall be installed in the equipment using these capacitors, and the equipment then subjected to specified performance. Any failure of the equipment caused by the capacitor shall be considered failure of the capacitor to pass this test. After testing in the equipment, the capacitor shall be removed therefrom, disassembled and inspected. Any damage, particularly to bearings or sliding contacts, shall also be considered failure to pass this test.

4.2.3 Group C inspection (telephone-type keys only). Telephone-type keys shall be inspected in accordance with the applicable inspection of table X. Samples of four keys of the same general design, construction, and material shall be selected each month without regard to their quality for inspection. Actions required relative to Group C failures shall be as specified in the contract.

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4.2.3.1 Testing of telephone-type keys. Telephone-type keys shall be tested in accordance with Method 106 of MIL-STD-202 and shall then comply with 3.10.21.4. No initial measurements or polarizing voltage and load are required.

5. PACKAGING. Not applicable.

6. NOTES

6.1 Ordering data.

6.1.1 Procurement requirements. Procurement documents should specify:

- a. Whether AEDPS is applicable. (See 3.4.2.2.2.)
- b. Whether certification of treating materials is required. (See 3.8.3.2.2.)
- c. Whether copies of descriptive information and justification be furnished to the MPCAG (See 6.2).

6.1.2 Data requirements. When this specification is used in a procurement which incorporates a DD Form 1423 and invokes the provisions of 7-104.9(n) of the Defense Acquisition Regulations (DAR), the data requirements identified below will be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (DD Form 1423) incorporated into the contract. When the provisions of DAR-7-104.9(n) are not invoked, the data specified below will be delivered by the contractor in accordance with the contract requirements. Deliverable data required by this specification is cited in the following paragraphs:

Paragraph	Data Requirement	Applicable DID
3.8.3.2, 3.8.3.4, 3.8.3.4.1, 3.11.8	Moisture-Fungus Proofing (MFP) Statement of Treatment	DI-E-1131
3.4.2.2.2.c	Specification Requirement Sheets (SRS)	DI-E-1133
3.4.2.2.1	Nonstandard Part Approval Requests Proposed Additions to an Approved PPSL	DI-E-7028
3.4.2.2.2.b, 3.4.3	Military Detail Specifications and Specification Sheets	DI-E-7029
3.4.2.2.3, 3.4.3	Test Data for Nonstandard Parts	DI-E-7030
3.4.2.2.2.a, 3.4.3	Drawings, Engineering and Associated Lists	DI-E-7031
3.7.1.1, 3.4.3.4	Custom and/or Hybrid Microelectronics/ Non-Standard Part Approved Request	DI-E-XXXX

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(Copies of data descriptions required by the contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

6.2 Military Parts Control Advisory Group (MPCAG). The Military Parts Control Advisory Group (MPCAG) has been established for the purpose of providing advice on part selection in specific commodity areas. Government contractors may make use of these services prior to selection and submission for approval of standard and nonstandard parts. Address all inquiries to the applicable MPCAG as listed in MIL-STD-965. In all cases reference the Government contract number involved.

6.3 Color of textiles. Standard samples of Olive Drab No. 7 may be obtained from Defense Personnel Support Center, ATTN: Sample Unit DPSC-TTC, 2800 South 20th Street, Philadelphia, Pennsylvania 19101. When requesting samples, indication should be given as to type of material concerned.

6.4 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodian:
Army - ER

Preparing Activity:
Army - ER

Review Activities:
Army - AT, AV, MI, ME
Desc - EP

Project Number:
MISC-AD54

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APPENDIX

Electronic Parts Derating Requirements

10 SCOPE

10.1 Scope. This identifies and establishes the general electronic parts derating requirements. Derating below the levels specified herein shall be performed as needed to meet equipment or systems reliability requirements specified in the contract. Electronic parts derating practice is essential to achieve the designed-in reliability of equipment, assuring a margin of safety by limiting the electrical and thermal stresses applied. The derating requirements, presented herein are applicable to the electronic parts in contracts in which this specification is included.

20 REFERENCED DOCUMENTS

20.1 Government documents. The following documents form a part of this appendix to the extent specified herein.

SPECIFICATION

MILITARY

MIL-C-39006/22 - Capacitor, Fixed, Electrolytic (Nonsolid Electrolytic), Tantalum, (Polarized, Sintered Slug) 85 Deg C (Voltage Derated To 125 Deg C), Established Reliability, Style Clr79.

STANDARD

MILITARY HANDBOOK

MIL-HDBK-217 - Reliability Prediction of Electronic Equipment

30 DEFINITIONS

30.1 Definitions. See Figure 1 for stress relationships.

30.1.1 Derating factor. A factor that when multiplied by the Rated Stress Value (30.1.2) will yield the Maximum Acceptable Stress Value (30.1.3). (May be expressed as the ratio of Maximum Acceptable Stress Value to the Rated Stress Value.)

30.1.2 Rated Stress Value. Maximum specification stress limit (worst case allowable) for a given parameter. Exceeding this value creates a high probability of part damage/failure. (NOTE: Where the part specification includes provisions for varying the maximum specification stress limit (Rated Stress Value) as a function of some environmental impact, such adjustments shall be included in the determination of this value.)

30.1.3 Maximum acceptable stress value. An arbitrarily established level of stress with a value such that a reliability safety margin is established between this value and the Rated Stress Value (30.1.1). This value should be addressed as the assumed maximum stress limit for design purposes.

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30.1.4 Actual Stress Value (Nominal). The actual (measured or predicted) stress value of a given parameter created by a set of circuit and environmental conditions recognized as "normal", "ambient", "mid-range", etc. (This is the stress value used in reliability allocation and prediction tasks.)

30.1.5 Actual Stress Value (Worst Case). The actual (measured or predicted) stress value of a given parameter created by a set of circuit and environmental conditions consisting of the simultaneous application of the most adverse (in terms of required function of the item) values (within the stated operating ranges) of biases, signal inputs, loading, and environments. (This is the stress value of concern in the search of potential overstress conditions.)

30.1.6 Overstress condition. Any operating condition for a given parameter where the Actual Stress Value (Worst Case) (30.1.5) exceeds the Maximum Acceptable Stress Value (30.1.3).

40 DERATING REQUIREMENTS

40.1 Basic requirements for the derating of electrical/electronic parts are as listed in the following tables:

40.1.1 Table I. Microcircuit Derating Criteria

40.1.2 Table II. Diode Derating Criteria

40.1.3 Table III. Transistor Derating Criteria

40.1.4 Table IV. Resistor Derating Criteria

40.1.6 Table VI. Relay/Switch Derating Criteria

40.1.7 Table VII. Miscellaneous Parts Derating Criteria

40.2 Electrical/electronic part selection and application shall be derated in compliance with Tables I through VII to the extent practical. Parts may be derated further consistent with good design practices or to meet system reliability requirements.

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TABLE I. Microcircuit derating criteria.

MICROCIRCUIT TYPE	CRITICAL STRESS PARAMETER	DERATING FACTOR
Digital	Fanout Operating Frequency <u>1/</u>	0.80 0.75
Linear	Supply Voltage Input Signal Voltage	0.70 0.70
Voltage Regulator	Input Voltage Output Current Power Dissipation	0.80 0.75 0.60
Hybrid	<u>2/</u>	<u>2/</u>
All Types	Junction Temperature <u>3/</u>	110°C Max

1/ Does not apply to microprocessor or peripheral LSI chips.

2/ Use individual derating criteria of components constituting hybrid microcircuit.

3/ Junction temperature (T_j) may be determined using the method for monolithic microelectronic devices in accordance with MIL-HDBK-217.

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TABLE II. Diode derating criteria.

DIODE TYPE	CRITICAL STRESS PARAMETER	DERATING FACTORS
General Purpose (<500 MW)	Power Reverse Voltage Surge Current Fwd Current	0.50 0.50 0.50 0.50
Rectifier; Switching (Pin/Schottky); or Thyristors (SCR/ TRIACS)	Power Reverse Voltage Surge Current Fwd Current	0.30 0.50 0.50 0.50
Varactor	Power Reverse Voltage Fwd Current	0.50 0.75 0.75
Zener	Power Fwd Current Zener Current	0.50 0.50 $0.5 (I_{Zmax} + I_{Znom})$
Reference	Power Fwd Current Zener Current	0.30 0.50 $0.5 (I_{Zmax} + I_{Znom})$
All Types	Junction Temp	110°C Max

GENERAL NOTE: For power or current derating, the rated stress value decreases as the temperature increases above the temperature derating point (T_s). (See MIL-HDBK-217 discrete semiconductors and the part specification.) In no case should the actual power (P) or current (I) rise above the line connecting points A, B, and C, as shown in Figure 2.

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TABLE III. Transistor derating criteria.

TRANSISTOR TYPE	CRITICAL STRESS PARAMETER	DERATING FACTOR
General Purpose (<500 MW) and Switching	Power Current Voltage	0.50 0.75 0.75
Power	Power Current Voltage	0.30 0.75 0.75
JFET	Power Voltage	0.50 0.75
All Types	Junction Temp.	110°C Max

GENERAL NOTE: For power or current derating, the rated stress value decreases as the temperature increases above the temperature derating point (T_s). (See MIL-HDBK-217 discrete semiconductors and the part specification.) In no case should the actual power (P) or current (I) rise above the line connecting points A, B, and C, as shown in Figure 2.

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TABLE IV. Resistor derating criteria.

RESISTOR TYPE	CRITICAL STRESS	DERATING FACTOR
<u>Fixed</u>		
Carbon Composition	Power	0.50
Film	Power	0.50
Wirewound, Precision		
1.0% tolerance	Power	0.50
0.5% tolerance	Power	0.25
Wirewound, Power	Power	0.50
<u>Variable</u>		
Wirewound	Power	0.50
Non Wirewound	Power	0.50
All Types	Voltage	0.80

GENERAL NOTE: For power derating, the rated stress value decreases as the temperature increases above the temperature derating point (T_s) (See resistor specifications). The derating factor shall be applied to the rated stress value so that in no case will the actual power (P) rise above the line connecting points A, B, and C, as shown in Figure 3.

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TABLE V. Capacitor derating criteria.

TYPE CAPACITOR	CRITICAL STRESS PARAMETER	DERATING FACTOR
<u>Fixed</u>		
Ceramic, Glass, Porcelain, or Mica	Voltage	0.50
Paper/Plastic	Voltage	0.50
Tantalum (Foil/Film)	Voltage Temperature	0.70 70°C Max
Tantalum (Solid)	Voltage Temperature	1/ 70°C Max
Tantalum (Wet-slug per MIL-C-39006/22 only)	Voltage	0.50
Aluminum	Voltage Temperature	0.50 85°C Max
<u>Variable</u>		
Ceramic or Glass	Voltage	0.50
Air	Voltage	0.30

1/ The derating factor is a function of the series resistance value as follows:

<u>Series Resistance</u>	<u>Voltage Derating Value</u>
3.0 Ohms/volt	0.60
2.0 Ohms/volt	0.50
1.0 Ohms/volt	0.40
0.5 Ohms/volt	0.30
0.1 Ohms/volt	0.20

GENERAL NOTE: Voltage values include the sum of DC and peak AC voltages. For voltage derating, the rated stress value decreases above the temperature derating point (Ts) (See capacitor specifications). The derating factor shall be applied to the rated stress value so that in no case will the actual voltage (V) rise above the line connecting points A, B, and C, as shown in Figure 3.

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TABLE VI. Relay/switch derating criteria.

LOAN TYPE BY DEVICE	CRITICAL STRESS PARAMETER	DERATING FACTOR
<u>Power Relay/Switch</u>		
Capacitive	Contact Current	0.75
Resistive	Contact Current	0.75
Inductive	Contact Current	0.40
Motor	Contact Current	0.20
Filament	Contact Current	0.10
<u>Lower Power Relay</u>		
Load Type per Specification	Contact Current	0.50

GENERAL NOTE: The peak inrush current shall not exceed the maximum acceptable stress level.

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TABLE VII. Miscellaneous parts derating criteria.

PART TYPE	CRITICAL STRESS PARAMETER	DERATING FACTOR
Transformers and Chokes	Insulation Breakdown Voltage Current Hot-spot Temperature Voltage Between Windings	0.50 0.70 <u>1/</u> <u>2/</u>
Connectors	Voltage Current (contact rating)	<u>3/</u> 0.50 0.50
Fuses	Current	<u>4/</u>

- 1/ Part shall be used at winding temperature at least 30°C below insulation rating.
- 2/ Voltage maximum between windings or windings to case shall not exceed 60 percent of rating for steady state conditions or 90% of rating with transients.
- 3/ Derating factor shall be based on the highest anticipated altitude at which the equipment is expected to operate.
- 4/ For fuses mounted on printed circuit boards and conformally coated:

<u>Fuse Current Rating (Amp)</u>	<u>Current Derating Factor</u>
0.125	0.25
0.5	0.40
1.0	0.45
2-15	0.50

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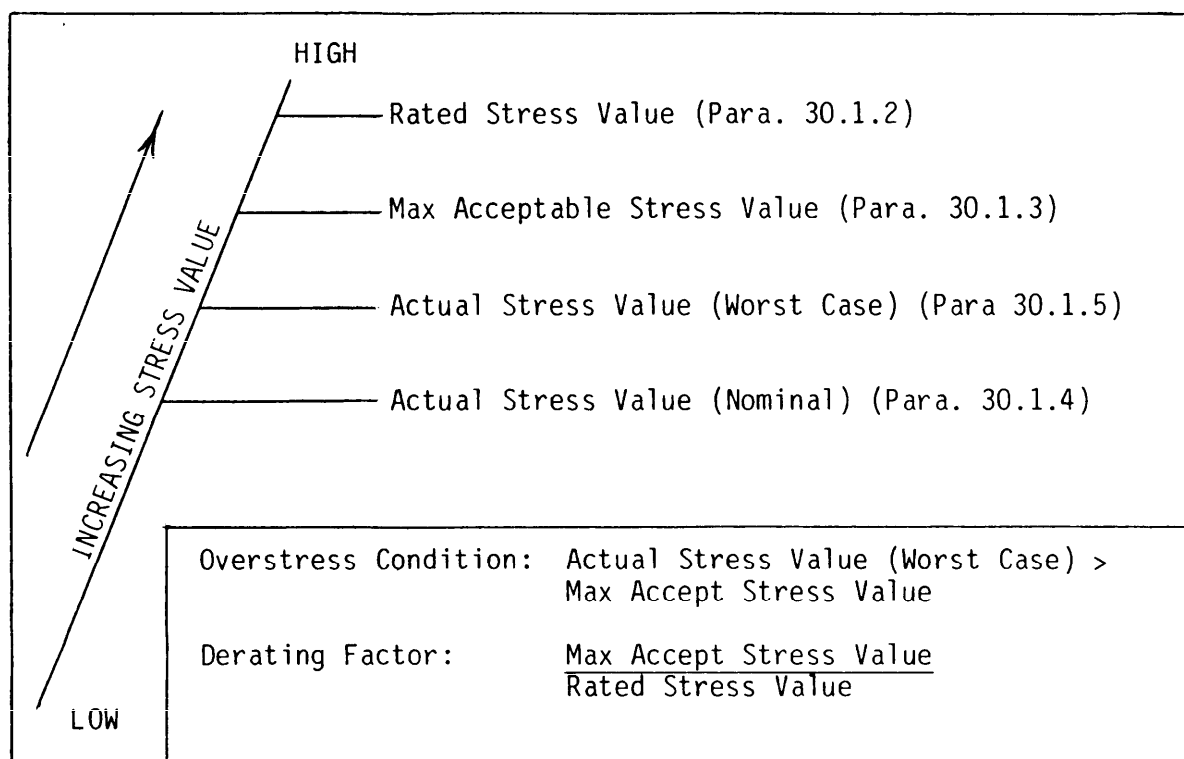


FIGURE 1. Stress relationships.

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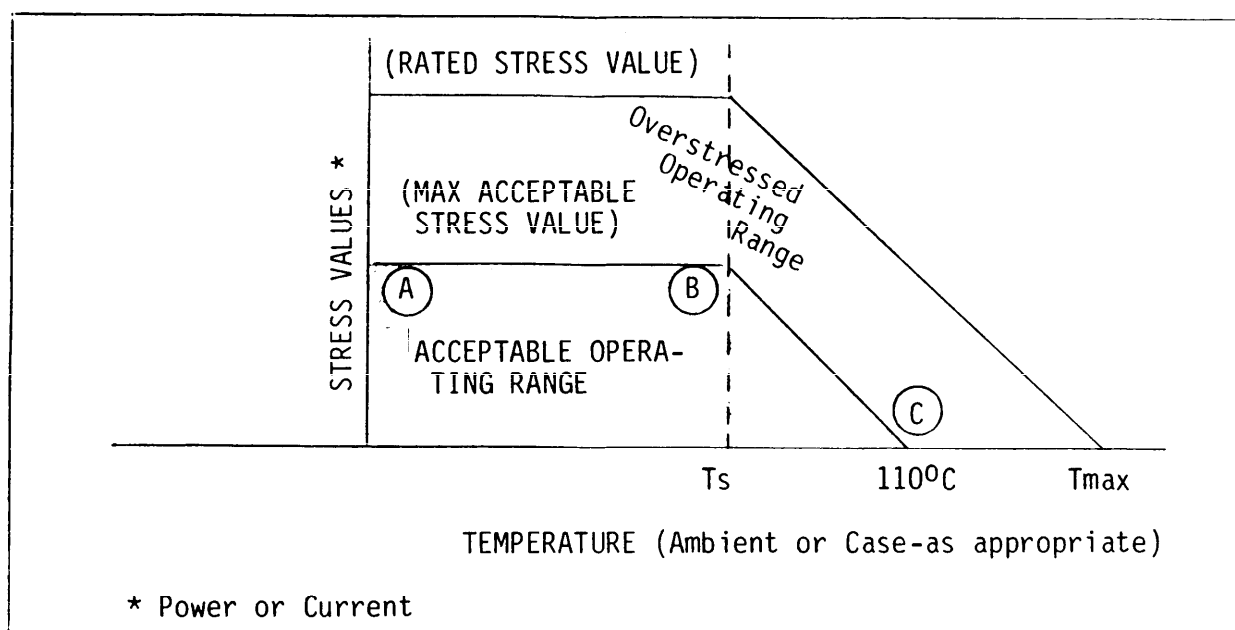


FIGURE 2. Stress values vs temperature - use with Tables II and III.

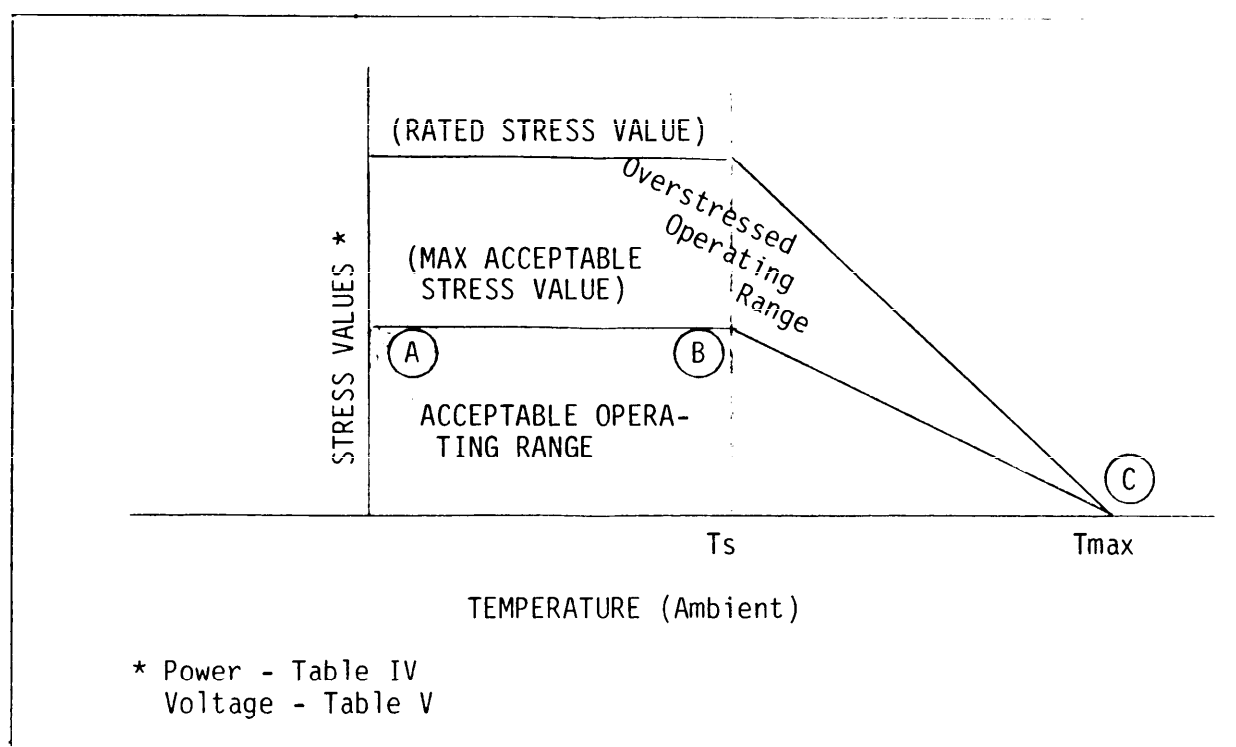


FIGURE 3. Stress values vs temperature - use with Tables IV and V.

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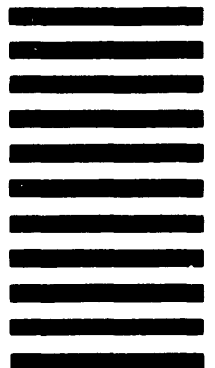
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