

MIL-E-11991E(MI)
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 SUPERSEDING
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MILITARY SPECIFICATION

ELECTRONIC, ELECTRICAL, AND ELECTRO- MECHANICAL EQUIPMENT, GUIDED MISSILE AND ASSOCIATED WEAPON SYSTEMS, GENERAL SPECIFICATION FOR

This specification is approved for use by the US Army Missile 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 requirements for electronic, electrical, and electro-mechanical equipment which are common to guided missile and associated weapons systems. The detail fabrication, tests and performance requirements shall be as specified in the detail specification for this equipment. (See 6.3.12)

1.2 Classification. This specification is intended to cover all classes and types of electronic, electrical, and electro-mechanical equipment and all applicable phases of service test, preproduction, and production as defined in the detail specifications for the individual 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 listed in that 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

C-F-206

Felt Sheet, Cloth, Felt, Wool, Pressed

* J-W-1177

Wire, Magnet, Electrical

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 Missile Command, ATTN: DRSMI-RSDS, Redstone Arsenal, AL 35898, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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*	O-F-506	Flux, Soldering, Paste and Liquid
	T-R-605	Rope, Manila and Sisal
	NN-P-530	Plywood, Flat Panel
	QQ-A-673	Anode, Copper
*	QQ-A-1876	Aluminum Foil
	QQ-B-613	Brass, Lead and Nonlead, Flat Products (Plate, Bar, Sheet and Strip)
	QQ-B-626	Brass, Lead and Nonlead, Rod, Shaped, Forgings, and Flat Products with Finished Edges (Bar and Strip)
	QQ-C-390	Copper Alloy Castings (Including Cast Bar)
*	QQ-C-450	Copper-Aluminum Alloy (Aluminum Bronze) Plate, Sheet, Strip, and Bar, (Copper Alloy Numbers 606, 610, 613, 614, and 630)
*	QQ-C-465	Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630, 632M, and 642); Rod, Flat Products with Finished Edges (Flat Wire, Strip, and Bars), Shapes, and Forgings
	QQ-C-502	Copper Rods and Shapes; and Flat Products with Finished Edges (Flat Wire, Strips and Bars)
	QQ-C-530	Copper-Beryllium Alloy Bar, Rod, and Wire (Copper Alloy Number 172 and 173)
	QQ-C-571	Copper, Phosphor (Alloying Additive)
	QQ-C-576	Copper Flat Products with Slit, Slit and Edge-Rolled, Sheared, Sawed, or Machined Edges, (Plate, Bar, Sheet, and Strip)
	QQ-C-585	Copper-Nickel-Zinc Alloy Plate, Sheet, Strip, and Bar (Copper Alloy Numbers 735, 745, 752, 762, 766 and 770)
	QQ-C-586	Copper-Nickel-Zinc Alloy; Rod, Shapes and Flat Products with Finished Edges (Flat Wire, Strip and Bar)

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QQ-C-591	Copper-Silicon, Copper-Zinc-Silicon, and Copper-Nickel Silicon Alloys: Rod, Wire, Shapes, Forgings and Flat Products, (Flat Wire, Strip, Sheet Bar and Plate)
QQ-M-31	Magnesium Alloy, Bars, Rods, and Special shaped Sections, Extruded
QQ-M-38	Magnesium Alloy Die-Castings (AZ91A)
QQ-M-40	Magnesium Alloy Forgings
QQ-M-44	Magnesium Alloy Plate and Sheet (AZ31B)
QQ-M-55	Magnesium Alloy, Permanent and Semi-Permanent Mold Castings
QQ-M-56	Magnesium Alloy, Sand Castings
QQ-N-281	Nickel-Copper-Alloy (Monel and R-monel) Bars, Plates, Rods, Sheets, Strips, Wire, Forgings, and Structural and Special Shaped Sections
QQ-N-286	Nickel-Copper-Aluminum Alloy, Wrought
QQ-N-288	Nickel-Copper Alloy and Nickel-Copper-Silicon Alloy Castings
QQ-N-290	Nickel Plating (Electrodeposited)
* QQ-S-571	Solder, Tin Alloy, Tin-Lead Alloy, and Lead Alloy
QQ-S-763	Steel Bars, Shapes, and Forgings, Corrosion-Resisting
TT-P-320	Pigment, Aluminum, Powder and Paste, For Paint
TT-S-1732	Sealing Compound; Pipe Joint and Thread, Lead Free, General Purpose
ZZ-R-765	Rubber, Silicone
<u>Military</u>	
MIL-E-1	Electron Tubes, General Specification For
* MIL-I-10	Insulating Materials, Electrical, Ceramic, Class L

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MIL-W-80	Window, Observation, Acrylic Base, Antielectrostatic, Transparent (For Indicating Instrument)
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 Treatment of Communications, Electronic, and Associated Equipment)
* MIL-T-713	Twine, Fibrous, Impregnated, Lacing and Tying
MIL-R-1670	Rope, Tent-Lay
MIL-F-2312	Felt, Hair or Wool: Mildew Resistant, and Moisture Resistant, Treatment For
MIL-R-3065	Rubber, Fabricated Parts
MIL-R-3080	Resistors, Current-Regulating (Ballast Tubes)
* MIL-C-3133	Cellular Elastomeric Materials, Molded or Fabricated Parts
MIL-V-3144	Vials, Level
MIL-C-3883	Cord, Electrical, Shielded (Audio Frequency)
MIL-L-3890	Line, Radio Frequency Transmission (Coaxial, Air Dielectric)
MIL-L-3891	Luminescent Material and Equipment (Nonradioactive)
MIL-W-5044	Walkway Compound, Nonslip and Walkway Matting, Nonslip
MIL-W-5050	Walkway, Coating and Matting, Nonslip, Aircraft, Application of
MIL-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant
MIL-P-5516	Packing Preformed, Petroleum Hydraulic Fluid Resistant, 160 Deg. F

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*	MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
	MIL-E-6051	Electromagnetic Compatibility Requirements, Systems
	MIL-C-6183	Cork and Rubber Composition Sheet; for Aromatic Fuel and Oil Resistant Gaskets
	MIL-N-6710	Nickel-Chromium-Iron Alloy; Bars, Rods and Forgings
	MIL-N-6840	Nickel-Chromium-Iron Alloy; Plate, Sheet, and Strip
	MIL-R-6855	Rubber, Synthetic, Sheet, Strips, Molded and Extruded Shapes
	MIL-S-6872	Soldering Process, General Specification For
	MIL-S-7021	Asbestos Sheet, Compressed, For Fuel, Lubricant, Coolant, Water, and High Temperature Resistant Gaskets
	MIL-W-8160	Wiring, Guided Missile, Installation of, General Specification For
	MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
	MIL-M-10578	Corrosion Removing and Metal Conditioning compound (Phosphoric Acid Base)
	MIL-R-11050	Rectifier, Metallic, Selenium
	MIL-T-12664	Treatment, Fungus, Resistant, Paranitrophenol, For Cork Products
*	MIL-F-12784	Flux, Soldering (Stearine Compound LC-3)
*	MIL-F-14072	Finishes for Ground Electronic Equipment
	MIL-R-14224	Rectifiers, Metallic, Selenium (High Temperature)
*	MIL-F-14256	Flux, Soldering, Liquid (Rosin Base)
*	MIL-W-18142	Wood Preservative Solutions, Oil-Soluble, Ship and Boat Use

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MIL-S-19500	Semiconductor Devices, General Specification for
* MIL-G-20098	Gypsum, Calcined
* MIL-S-23190	Straps, Clamps and Mounting Hardware, Plastic, for Cable Harness Tying and Support
* MIL-T-23648	Thermistor (Thermally Sensitive Resistor) Insulated, General Specification For
MIL-L-25142	Luminescent Materials, Fluorescent
* MIL-P-25732	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 257 Deg. F (135 Deg. C)
* MIL-T-28800	Test Equipment For Use With Electrical and Electronic Equipment, General Specification For
MIL-M-38510	Microcircuits, General Specification For
* MIL-C-39003	Capacitor, Fixed, Electrolytic, (Solid-Electrolyte), Tantalum, Established Reliability, General Specification For
* MIL-C-39006	Capacitor, Fixed, Electrolytic (Nonsolid Electrolyte) Tantalum, Established Reliability, General Specification For
* MIL-C-39018	Capacitor, Fixed, Electrolytic (Aluminum Oxide) Established Reliability and Non-established Reliability General Specification For
MIL-T-43435	Tape, Lacing and Tying
MIL-C-56224	Cable and Harness Assemblies, Electrical, Missile System; General Specification For
* MIL-S-45743	Soldering, Manual Type, High Reliability, Electrical and Electronic Equipment
MIL-E-45782	Electrical Wiring, Procedures For
MIL-P-46843	Printed Wiring Assemblies
* MIL-S-46844	Solder Bath Soldering of Printed Wiring Assemblies

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- * MIL-S-46860 Soldering of Metallic Ribbon Lead Materials to Solder Coated Terminals, Process For Reflow
- * MIL-P-55110 Printed Wiring Boards
- * MIL-R-55342 Resistor, Fixed, Film, Chip, Established Reliability, General Specification For
- * MIL-C-55365 Capacitor, Chip, Fixed, Tantalum, Established Reliability, General Specification For
- * MIL-C-55681 Capacitor, Chip, Multiple Layer, Fixed Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification For
- * MIL-C-83446 Coil, Chip, Fixed or Variable, General Specification For

STANDARDS

Federal

FED-STD-595

Colors

Military

- * DOD-STD-35 Automated Engineering Document Preparation System
- MIL-STD-129 Marking for Shipment and Storage
- MIL-STD-143 Standards and Specifications, Order of Precedence for the Selection of
- MIL-STD-171 Finishing of Metal and Wood Surfaces
- MIL-STD-186 Protective Finishing Systems for Rockets, Guided Missiles, Support Equipment and Related Materials
- MIL-STD-194 Systems for Painting and Finishing Fire-Control Material
- MIL-STD-403 Preparation for and Installation of Rivets and Screws, Rocket and Missile Structures

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	MIL-STD-454	Standard General Requirements for Electronic Equipment
	MIL-STD-750	Test Methods for Semiconductor Devices
	MIL-STD-810	Environmental Test Methods
	MIL-STD-883	Test Methods and Procedures for Micro-Electronics
*	MIL-STD-965	Parts Control Program
	MIL-STD-1131	Storage Shelf Life and Reforming Procedures For Aluminum Electrolytic Fixed Capacitors
	MIL-STD-1250	Corrosion Prevention and Deterioration Control in Electronic Components and Assemblies
*	MIL-STD-1316	Fuze, Design Safety, Criteria For
*	MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
*	MIL-STD-1512	Electroexplosive Subsystems, Electrically Initiated, Design Requirements and Test Methods
*	DOD-STD-1686	Electrostatic Discharge Control Program For Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
*	MIL-STD-2084	General Requirements for Maintainability of Avionic and Electronic Systems and Equipment
*	HANDBOOKS	
*	<u>Military</u>	
*	MIL-HDBK-217	Reliability Prediction of Electronic Equipment

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

* ARMY MISSILE COMMAND

- * QE-82-702-7A Acceptance Standard for Solder Splice Joints
- * QE-82-702-21 Quality Requirements for Wire Wrapped Electrical Connections
- * QE-82-702-22 Quality Requirements for Crimped Electrical Connections
- * QR-300 Reliability Program For Systems Equipment Development (Micom Product Assurance (Directorate Exhibit))

* MARSHALL SPACE FLIGHT CENTER

- * MSFC-SPEC-592 Selection and Use of Organic Adhesives in Hybrid Microcircuits

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

- * 2.2 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. The detail equipment specification for a specific weapon system shall govern.

3. REQUIREMENTS

- * 3.1 Applicability. The requirements of this specification and documents referenced herein shall not relieve the contractor of the responsibility for complying with all equipment performance and other requirements set forth in the detail equipment specification or contract for the particular equipment being furnished on contract. (see 6.3.12). When compliance with the requirements specified herein will not permit the contractor to comply with all equipment requirements, he shall so inform the procuring activity in writing and request approval to deviate from the specific requirements of this specification.

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3.1.1 Qualification. The equipment furnished under this specification shall be qualified in accordance with qualification requirements specified in the individual equipment and part detail specification.

- * 3.1.1.1 Purpose of qualification. Since many specifications are based on performance requirements, the possible variations in design and quality, and the nature of the requirements and tests for certain products are such that it is impractical to procure products solely on acceptance tests without unduly delaying delivery. To assure continuous availability of products in such cases, qualification of specific products is required prior to the opening of bids on the award.
- * 3.1.1.2 System qualification. The system or equipment qualification shall meet all of the requirements specified in the individual detail equipment specification. (See 6.3.12).
- * 3.1.1.3 Piece part qualification. The entire process by which products are obtained from manufacturer's, examined and tested, and then identified on a list of qualified products is known as qualification. Testing of a product compliance with the requirements of a specification in advance of, and independent of any specific procurement action is known as qualification testing. To establish a Qualified Products List (QPL), a specification must exist which requires qualification and sets forth the qualification examination and tests, and criteria for qualification retention.
- * 3.1.2 Environmental conditions. The equipment shall withstand any specified combination of environmental conditions herein without mechanical or electrical damage or degradation which will result in performance below the minimum specified by the procuring activity. (See 3.4).
- * 3.1.3 Quality of materials. The production design shall be based on the use of qualified materials, consistent with the severity of the known or predicted applications. When special materials or processes are required, their qualifications shall be required and their quality shall at least be equal to existing items covered by applicable government specifications. If an applicable specification does not exist and a new specification has to be developed, the new material or process shall meet the new specification requirements in order to insure acceptability. Every effort shall be made to avoid the use of special materials and processes which are nonstandard or not recognized commercially by government or DOD adopted industry standards (see 6.3.3). Methods which are not readily adaptable to quantity production methods at reasonable costs shall be avoided, but

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if necessary, require prior approval before acceptance. In order to provide acceptable reliability (see 6.3.4) within economic feasibility, employment of approved techniques such as printed circuits, miniature parts, modular and micromodular concepts and encapsulation will be considered justifiable. Maximum use shall be made of reclaim/recycled materials to the extent possible without jeopardizing the intended use of the part or equipment.

- * 3.1.4 Responsibility for procuring and installing parts and materials. The responsibility for procuring and installing parts and materials shall rest with the contractor, subject to the requirements specified herein.
- * 3.1.5 Qualified standard parts, materials and processes. Qualified standard parts, (see 3.2.3), materials and processes covered by standard documents (see 6.3.1) shall be used. Where standard documents are not specified herein, selection shall be made in accordance with MIL-STD-143 unless otherwise directed by the procuring activity.
- * 3.1.6 Choice of standard parts and materials. Unless otherwise specified herein or by the procuring activity, beginning with the design phase and continuing through completion of procurement; only part types, materials and processes qualified to military specifications, standards and DOD adopted industry standards will be considered acceptable items. The equipment manufacturer shall select the most economical approved items which will meet each design and performance requirement (see 6.3.2). When necessary to avoid delays in development, economic consideration may be waived by the procuring activity and approval given to the contractor to use more expensive qualified part types, materials or processes. When design changes are approved or procurement difficulties are encountered, which require the use of a different qualified part type or materials after initiation of the production phase, provision shall be made in the field for replacement of these parts and materials in the equipment. The application to the procuring activity for approval shall include complete reference to the qualified part or material which can be used for such replacement.
- * 3.1.7 Nonstandard parts. Nonstandard parts (see 6.3.3) shall be processed in accordance with MIL-STD-965 as specified in the procurement contract.

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- * 3.1.7.1 Military exception (ME) specifications. When a part or material covered by a current military specification or DOD adopted industry standard will not meet the system requirements and when specified in the contract, the procedures and requirements of DOD-STD-35 or a DESC drawing shall be used to document the part or material. (See 3.2.38.1 for microcircuits).
- 3.1.8 Critical and strategic material. The use of critical or strategic material shall be held to a minimum consistent with the requirement performance of the equipment. The contractor shall obtain approval from the procuring activity prior to finalizing a design that would require the use of critical or strategic material (see 6.3.8 and 6.3.9).
- 3.1.9 Dissimilar metals. Unless otherwise specified by the procuring activity, use of dissimilar metals shall be in accordance with MIL-STD-1250.
- 3.1.10 Protective against electrolytic corrosion. Where it is necessary that any combination of dissimilar metals be assembled, they shall be protected in accordance with MIL-STD-171, MIL-STD-186 and MIL-STD-1250, as applicable.
- * 3.1.11 Derating of electronic parts and materials. Unless otherwise specified by the procuring activity, derating of electrical, electronic and electro-mechanical parts and materials shall be in accordance with QR-800. The derating for each piece part or material in the system shall be completed and submitted for procuring activity approval prior to system design completion.
- * 3.1.12 Stress-derating. Unless otherwise specified by the procuring activity, stress-derating shall be performed on each electrical, electronic or electro-mechanical piece part within the system prior to system design completion.
- * 3.1.13 Worse-case analysis. Unless otherwise specified by the procuring activity, a worse-case analysis shall be performed on each electrical, electronic or electromechanical piece part within the system prior to design completion.
- 3.2 Materials, parts and processes.
 - 3.2.1 Materials.
 - * 3.2.1.1 Flammable materials. The control of flammable materials shall be in accordance with Requirement 3 of MIL-STD-454. Such materials shall not be used without approval of the procuring activity.
 - 3.2.1.2 Aluminum antiseize compound. Aluminum antiseize compound per TT-S-1732 shall be used in all threaded aluminum alloy assemblies.

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3.2.1.3 Electrical tape. Fabric or textile pressure sensitive (adhesive or friction) tape shall not be used, except as specified herein. Non-moisture absorbing tape may be used for mechanical purposes or when included in hermetically sealed assemblies as approved by the procuring activity.

3.2.1.4 Fungus-inert materials. Fungus-inert materials shall conform to Requirement 4 of MIL-STD-454.

* 3.2.1.5 Lubricants. All lubricants shall be in accordance with Requirement 43 of MIL-STD-454.

3.2.1.6 Adhesives. Adhesives shall be in accordance with Requirement 23 of MIL-STD-454. (See 6.4).

* 3.2.1.7 Encapsulation. Unless otherwise specified by the procuring activity, encapsulation shall be accomplished in accordance with Requirement 47 of MIL-STD-454.

* 3.2.1.8 Plastic materials. Except as specified herein, all plastic and plastic materials shall be as specified in the detail equipment specification. (See 6.3.12)

3.2.1.8.1 Anti-electrostatic plastic materials. Anti-electrostatic plastic materials for dial and other transparent translucent anti-electrostatic applications shall conform to MIL-W-80.

* 3.2.1.8.2 Plastic base printed wiring board. Single and multi-layer rigid board shall conform to MIL-P-55110.

* 3.2.1.9 Fabric base materials. All fibrous materials shall be in accordance with Requirement 44 of MIL-STD-454. No cotton or linen-base materials shall be used except for mechanical applications. Such parts shall be vacuum impregnated with a varnish in accordance with MIL-V-173 and dried after machining operations are completed (see 3.2.1.9.7).

3.2.1.9.1 Fabric and thread. Fabric and thread shall conform to the following:

(a) Color. The color of fabric and thread shall be No. 34087 in accordance with FED-STD-595. For treated materials this requirement shall be met after treatment.

(b) Shrinkage. Fabric and thread shall be pre-shrunk or allowance shall be made for shrinkage in order to provide for satisfactory fit of the finished article both before and after the article is immersed in water and then dried.

3.2.1.9.2 Felt. Wool felt shall be in accordance with C-F-206 and shall be given Type III treatment in accordance with MIL-F-2312. Hair felt shall conform to MIL-F-2312 and shall be mildew-proofed as specified therein.

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3.2.1.9.3 Webbing. Webbing shall be in accordance with Requirement 44 of MIL-STD-454.

3.2.1.9.4 Thread. Thread shall be in accordance with Requirement 44 of MIL-STD-454.

3.2.1.9.5 Lacing twine, tape, and straps. Lacing twine, tape and straps for cable harnesses and other applications shall conform to MIL-T-713, Type P (waxed), MIL-T-43435, and MIL-S-23190, respectively.

3.2.1.9.6 Rope. Rope shall be in accordance with T-R-605 or MIL-R-1670. For severe outdoor use polyamide rope shall be used, subject to the approval of the procuring activity.

3.2.1.9.7 Cotton and linen. Cotton or linen shall not be used in the form of fabric or tape except as follows:

- (a) In construction of rotating electrical machinery where no other tape of sufficient mechanical strength is available.
- (b) On coils or parts such as inductors, transformers, and relays where the coil is subsequently completely encapsulated and covered against moisture and fungus (see 3.2.1.9).

3.2.1.10 Metals. Unless otherwise specified in the detail specification for the individual equipment, applicable metal usage shall conform to the following:

3.2.1.10.1 Aluminum alloys.

3.2.1.10.1.1 Aluminum alloy structural parts. Structural parts, that do not need to be grounded or electrically bonded, shall be anodized in accordance with MIL-S-8625 or shall be given a chemical film in accordance with MIL-C-5541, when approved by the procuring activity.

3.2.1.10.1.2 Aluminum alloy electrical parts. Aluminum alloy parts or assemblies used for electrical parts shall be constructed from corrosion resisting material and shall not be anodized. A chemical or mechanical cleaning caustic dip or chemical film in accordance with MIL-C-5541 shall be used.

* 3.2.1.10.1.3 Aluminum foil. Aluminum foil shall conform to QQ-A-1876.

* 3.2.1.10.1.4 Aluminum pigment for paint. Aluminum pigment, powder or paste for paint shall conform to TT-P-320.

3.2.1.10.2 Magnesium alloys. All magnesium alloys shall be subject to approval by the procuring agency, and shall conform to QQ-M-31, QQ-M-38, QQ-M-40, QQ-M-44, QQ-M-55 or QQ-M-56 whichever is applicable.

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3.2.1.10.3 Brass. Brass parts and assemblies shall conform to QQ-B-613 or QQ-B-626 whichever is applicable.

3.2.1.10.4 Bronze. Bronze parts and assemblies shall conform to QQ-C-390, QQ-C-450, or QQ-C-465, whichever is applicable.

3.2.1.10.5 Copper. Copper parts and assemblies, except copper wire, shall conform to QQ-A-673, QQ-C-502, QQ-C-530, QQ-C-571, QQ-C-576, QQ-C-585, QQ-C-586, QQ-C-591, or QQ-N-288 whichever is applicable.

3.2.1.10.6 Nickel alloys. Nickel alloy parts and assemblies shall conform to QQ-N-281, QQ-N-286, QQ-N-290, MIL-N-6710, or MIL-N-6840 whichever is applicable.

* 3.2.1.10.7 Ferrous alloys. Ferrous alloys shall be used in accordance with Requirement 15 of MIL-STD-454. Iron and steel alloys shall be finished in accordance with MIL-STD-171 and MIL-STD-186, except that parts shall be electroplated when functionally necessary or when paint films are subject to removal in service.

3.2.1.10.8 Other metals and alloys. Other metals and alloys shall be finished in accordance with MIL-STD-171 and MIL-STD-186, as necessary to meet the corrosion resistance requirements of the detail specification (see 6.3.12).

3.2.1.10.9 Finishes for metals. Unless otherwise specified in the detail specification, finishes for parts and assemblies shall conform to requirements specified in MIL-STD-171, MIL-STD-186, MIL-STD-194 or MIL-F-14072, whichever is applicable. Bright finishes shall not be used on external parts.

* 3.2.1.10.10 Solder. Solder, tin alloy, tin-lead alloy, and lead alloy shall conform to QQ-S-571. (See 3.2.1.22).

3.2.1.11 Paint finishes. Paint finishes shall be in accordance with MIL-STD-171 and MIL-STD-194. The colors of paints shall be in accordance with FED-STD-595. Consideration shall be given to human factors, camouflage, and standardization in the specification of paint colors in accordance with applicable requirements in MIL-STD-1472.

3.2.1.12 Special finishes. Special finishes, or modifications of the finishes specified herein, for parts and assemblies exposed to high temperature, erosion, rocket blast, severe corrosion, special mechanical or electrical applications shall be of a type approved by the procuring activity.

3.2.1.13 Castings. Castings shall be in accordance with Requirement 21 of MIL-STD-454.

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3.2.1.14 Rubber. Rubber materials, except cellular rubber types, used for the absorption of noise, shock, or vibration, or for applications where resiliency is required, shall be in accordance with MIL-R-3065. The type, class, and grade (including suffixes) of rubber materials shall be chosen in accordance with requirements of the applications.

3.2.1.14.1 Synthetic rubber. A general purpose synthetic rubber conforming to MIL-S-6855 shall be used where resistance to oil and fuel is required. A silicone rubber conforming to ZZ-R-765 shall be used where resistance to high and low temperature is required.

3.2.1.14.2 Cellular rubber. Cellular rubber used for the absorption of noise, shock, vibration, or where resiliency is required, shall be in accordance with MIL-C-3133. The type, class, and grade (including suffixes of cellular rubber shall be chosen in accordance with the requirements of the application.

3.2.1.15 Ceramic material. Ceramic material, except where used as the dielectric in capacitors, shall conform to MIL-I-10; however; prior approval for the use of glass-bonded mica shall be obtained from the procuring activity. Ceramic material not used for electrical purposes may be glazed or unglazed and need not be treated. Ceramics used for electrical purposes shall be glazed. The surface of glazed ceramics shall be smooth, uniform, and free from porosity. Ceramics shall be treated in accordance with directions furnished by the manufacturer of the material where glazing is impractical; such treatments must be approved by the procuring activity.

3.2.1.16 Glass. Glass shall be of the shatterproof type, unless otherwise approved by the procuring activity for each specific application. Glass used for protection of instruments, meters, cathode ray tube faces, and for viewing dials and indicators shall be clear, presenting no evidence of distortion when viewed from any angle.

3.2.1.16.1 Glass insulators and glass-bonded mica insulation. Glass insulators and glass-bonded mica insulation shall be in accordance with Requirement 11 of MIL-STD-454. Prior approval for the use of glass-bonded mica insulation shall be obtained from the procuring activity.

3.2.1.16.2 Glass fiber. Glass fiber materials shall not be used as the outer covering on cables, wires or other components where they may cause skin irritation to operating or maintenance personnel.

3.2.1.17 Insulating materials, electrical. Electrical insulating materials shall be in accordance with Requirement 11 of MIL-STD-454.

* 3.2.1.17.1 Arc-resistant material. Arc-resistant material used for insulation of electrical power circuits shall be in accordance with Requirement 26 of MIL-STD-454.

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3.2.1.17.2 Electrical breakdown prevention. Electrical breakdown prevention shall conform to Requirement 45 of MIL-STD-454.

3.2.1.18 Coating, nonslip. Platforms, steps, walkways, and other common working surfaces shall have a non-slip surface coating applied. Such coatings, as well as their methods of application, shall comply with MIL-W-5044, or MIL-W-5050. The coatings selected shall be subjected to the approval of the procuring activity.

3.2.1.19 Cork. Cork shall be treated with fungus resistant agent in accordance with MIL-T-12664.

3.2.1.20 Wood. Unless otherwise specified, wood shall not be used except in approved component parts. When specified, solid wood shall be free from any defects that would adversely effect the utility of the parts made thereof.

3.2.1.20.1 Plywood. Plywood shall be Group A- (CS35) Hardwood plywood or Group B- (PS-1) Softwood plywood, construction and industrial, in accordance with NN-P-530. Plywood shall be treated for moisture and fungus resistance for interior or exterior usage, whichever is applicable, in accordance with MIL-W-18142.

3.2.1.21 Wire, electrical.

3.2.1.21.1 Hookup wire. Hookup wire shall be in accordance with Requirement 20 of MIL-STD-454.

* 3.2.1.21.2 Magnet wire. Magnet wire shall conform to J-W-1177.

3.2.1.21.3 Wiring and cabling. Unless otherwise specified in the detail specification, wiring and cabling shall be in accordance with MIL-W-8160, MIL-E-45782, MIL-C-45224 and Requirement 69 of MIL-STD-454, as applicable.

* 3.2.1.21.4 Crimped electrical connections. Crimped electrical connections shall be made in accordance with QE-82-702-22.

* 3.2.1.21.5 Wire wrapped electrical connections. Wire wrapped electrical connections shall be made in accordance with QE-82-702-21.

* 3.2.1.22 Flux.

* 3.2.1.22.1 Flux for soldering electrical and electronic connections. Flux used to solder electrical and electronic connections shall be in accordance with the documents referenced in 3.2.2.1.1, 3.2.2.1.2 or 3.2.2.1.3, as applicable. Only types R and RMA soldering flux shall be used in manual soldering.

* 3.2.1.22.2 Flux for nonelectrical joints. Flux used for the joining of parts to make a nonelectrical connection in the process of soldering shall conform to O-F-506, QQ-S-571, MIL-F-12784 or MIL-F-14256 as applicable.

3.2.2 Processes.

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3.2.2.1 Soldering.

* 3.2.2.1.1 Manual soldering. Manual (hand use of soldering iron) soldering to make electrical and electronic connections to terminals, wires, cables, connectors, components, printed circuit boards, and like parts, shall conform to MIL-S-45743.

* 3.2.2.1.2 Machine soldering. Machine or solder bath soldering to make electrical and electronic connections of terminals, wires, and components to printed circuit boards shall conform to MIL-S-46844. (See 3.2.3.19 for printed wire assemblies).

3.2.2.1.3 Reflow soldering. The procedure and controls for reflow soldering shall conform to MIL-S-46860.

3.2.2.1.4 Nonelectrical joints. Mechanical soldering of nonelectrical (structural) joints shall conform to MIL-S-6872. In no case shall MIL-S-6872 be used for soldering of electrical and electronic connections.

* 3.2.2.1.5. Solder splice joints. Solder splice joints shall be made in accordance with QE-82-702-7A.

3.2.2.2 Brazing. Brazing of steels, copper, copper alloys, nickel alloys, aluminum, and aluminum alloys shall be in accordance with Requirement 59 of MIL-STD-454.

3.2.2.3 Welding. Welding shall be in accordance with Requirement 13 of MIL-STD-454.

3.2.2.3.1 Cleaning prior to welding. Surfaces to be welded shall be cleaned in accordance with good commercial practice and shall be free from rust, scale, paint, grease, and other foreign material.

3.2.2.3.2 Cleaning after welding. 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-M-10578. Acid used for cleaning shall be completely neutralized and removed.

3.2.2.3.3 Welding process. Preheating shall be employed where distortion is likely to result from welding. Welds shall have through penetration and good fusion and shall be free from scabs, blisters, abnormal pock marks, and other harmful defects. Where undesirable internal stresses are likely to result from welding, welded items shall be stress-relieved. Inert-gas shielded arc welding shall be used, when practicable, for welding of aluminum magnesium or stainless steel.

3.2.2.4 Welds, resistance, electrical interconnections. Resistance welds for electrical interconnections shall be in accordance with Requirement 24 of MIL-STD-454.

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- * 3.2.2.5 Electrostatic discharge control. Electrostatic discharge control shall be in accordance with DOD-STD-1686.
- * 3.2.3 Parts. Unless otherwise specified herein, parts for guided missile and associated tactical equipment shall be selected from a military Qualified Products List (QPL) as first priority and be of the military specification established reliability (ER) types to the maximum extent possible. All nonstandard parts shall be processed in accordance with MIL-STD-965. When a part is not covered by an existing military specification or drawing (see 3.1.7) and a new specification or drawing is required, it shall be prepared in accordance with 3.1.7.1. The quality assurance requirement shall be specified to assure that the nonstandard part type failure rate, as determined from MIL-HDBK-217, is equal to or approximates the failure rate of that part type if it were procured as a QPL part type. All electrical, electronic and electromechanical piece parts shall be subjected to a 100% incoming inspection which shall consist of at least the measurement of the primary electrical characteristic parameters at 25+30C, package visual inspection and verification of the part marking requirements.
 - 3.2.3.1 Bearings. Bearings shall be in accordance with Requirement 6 of MIL-STD-454.
 - * 3.2.3.2 Capacitors. Capacitors shall conform to Requirement 2 of MIL-STD-454. For missile and associated tactical mission essential equipment (see 6.3.11), capacitors shall be established reliability (ER) level "P" or lower failure rate (R,S). When a capacitor used is not covered by a military specification (see 3.1.7) and a new specification or drawing is prepared, the nearest appropriate military specification for the type of capacitor shall be used as a guide and the product assurance requirements shall be specified to assure a life failure rate level "P" (0.1%/1000 hours) or lower failure rate (R,S).
 - * 3.2.3.2.1 Electrolytic capacitor warning. Where electrolytic capacitors, conforming to MIL-C-39018 or MIL-C-39006/9 or equivalent are used, either as specified herein or as approved by the procuring activity, a caution plate shall be affixed to the equipment. The caution plate shall be so conspicuously displayed as to insure that it will be seen prior to energizing the equipment. The warning plate shall be worded as follows: "WARNING ELECTROLYTIC CAPACITORS USED IN (insert name and location of chassis or equipment where capacitor is used). IF EQUIPMENT HAS BEEN STORED OR INOPERATIVE FOR A PERIOD LONGER THAN 12 MONTHS, THE CAPACITORS SHALL BE CHECKED OR REPLACED". For information on shelf life and reforming aluminum electrolytic capacitors, see MIL-STD-1131.
 - * 3.2.3.2.2 Wet electrolytic, capacitors. Wet slug tantalum and aluminum electrolytic type capacitors (MIL-C-39006/9 and MIL-C-39018) shall not be used without prior approval of the procuring activity. Tantalum Case Wet Slug Capacitors complying with MIL-C-39006/22 are authorized for use without prior approval of the procuring activity.

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3.2.3.3 Chassis, electronic. Chassis for electronic equipment shall be as specified in the detail specifications and drawings. Any deviation from the detail specification shall be submitted for approval by the procuring activity.

3.2.3.4 Electrical connectors. Electrical connectors shall be in accordance with Requirement 10 of MIL-STD-454.

3.2.3.4.1 Umbilical connectors. Umbilical connectors shall conform to the requirement specified in the individual equipment detail specification (see 6.3.12).

3.2.3.5 Controls. All controls shall be in accordance with Requirement 28 of MIL-STD-454.

3.2.3.5.1 Knobs. Unless otherwise specified, knobs shall conform to requirements in the detail specifications and drawings of individual equipment. (See 6.3.12).

3.2.3.5.2 Flexible tuning shafts. Flexible tuning shafts shall be in accordance with Requirement 42 of MIL-STD-454.

3.2.3.6 Crystal unit. Quartz crystal units shall be in accordance with Requirement 38 of MIL-STD-454.

3.2.3.7 Dynamotors. Dynamotors shall be in accordance with Requirement 46 of MIL-STD-454.

3.2.3.8 Circuit breakers. Circuit breakers shall be in accordance with Requirement 37 of MIL-STD-454.

3.2.3.9 Fuses and fuse holders. Fuses and fuse holders shall be in accordance with Requirement 39 of MIL-STD-454.

* 3.2.3.10 Gaskets. Rubber gaskets, intended to prevent leakage of petroleum products, glycol, alcohol and water, shall be made from material complying with MIL-A-7021, MIL-C-6183, or MIL-R-3065. O-ring gaskets shall be in accordance with MIL-P-5315, MIL-P-5516, or MIL-P-25732.

* 3.2.3.11 Gears and cams. All gears and cams shall be in accordance with Requirement 48 of MIL-STD-454 and the detail equipment specification.

3.2.3.11.1 Gears, heavy duty. Spur, worm, and bevel gears for heavy duty drives shall be of Class FS-416 corrosion-resisting steel conforming to QQ-S-763 or of bronze conforming to MIL-B-16540.

3.2.3.12 Jacks, telephone. Telephone jacks shall be in accordance with Requirement 10 of MIL-STD-454.

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3.2.3.13 Plugs, telephone. Telephone plugs shall be in accordance with Requirement 10 of MIL-STD-454.

3.2.3.14 Lampholders and indicator lights. Lampholders and indicator lights shall be as specified in Requirement 50 of MIL-STD-454.

3.2.3.15 Level vials. Level vials shall conform to MIL-V-3144 and shall be centrally positioned in their holes and fastened with gypsum cement conforming to MIL-G-20098.

3.2.3.16 Meters, electrical-indicating, and accessories. Electrical-indicating meters and accessories shall be in accordance with Requirement 51 of MIL-STD-454.

* 3.2.3.16.1 Meters, electrical-indicating ruggedized. Unless otherwise specified, electrical indicating meters shall be ruggedized sealed meters.

3.2.3.16.2 Ammeter shuts. Ammeter shunts shall be in accordance with Requirement 40 of MIL-STD-454.

3.2.3.16.3 Iron and direct-current fields. Meters shall be so mounted that large masses of iron and direct current fields will not affect their operation. Iron vane type meters shall be mounted so that transformers or choke coils carrying current will not affect their operation.

3.2.3.16.4 Shielding. External thermocouple radio-frequency meters, especially those carrying currents above 1 ampere, and the leads thereto, shall be shielded as necessary to protect the thermocouples from currents caused by stray radio-frequency fields. For meters operating at high radio-frequency voltage above ground, shielding shall also be provided against stray capacity currents through the meter to the panel of the equipment.

3.2.3.16.5 Scale, dials and pointers. Unless otherwise specified in the detail specification; scales, dials, and pointers shall conform to requirements specified in MIL-STD-1472.

3.2.3.17 Counters.

3.2.3.17.1 Electromechanical counters. Numbers shall snap into place with an upward movement of the counter drum indicating a numerical increase. The height-to-width ratio of numeral shall preferably be one-to-one. When the last digits have no operational or maintenance value, they shall be replaced with stationary zeros. Counters shall be oriented so that they may be read from left to right. Large horizontal spaces between number drums, when more than three digits are displayed, shall be avoided. Mounting shall be as close to the panel surface as possible to provide maximum viewing angle and minimum shadow effects from ambient lighting.

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3.2.3.17.2 Electronic counters. Electronic counters shall be in accordance with the detail specification (see 6.3.12) or drawing.

3.2.3.18 Motors. Motors shall be in accordance with Requirement 46 of MIL-STD-454.

- * 3.2.3.19 Printed circuits. Unless otherwise specified, printed circuits and printed wiring boards shall be in accordance with Requirement 17 of MIL-STD-454. Printed circuit assemblies or printed wiring assemblies shall conform to MIL-P-46843. When documentation is prepared, MIL-P-46843 shall be specified on the top drawing. Printed circuit boards or printed wiring boards shall be designed to allow for automatic insertion of components where packaging density or system configuration permits (see 3.3.8). The printed wiring board materials, processes and the methods used to mount leadless chip carriers on printed wiring boards shall be approved by the procuring activity.

3.2.3.20 Selenium rectifiers. Selenium rectifiers of the open construction type shall conform to MIL-R-11050 or MIL-R-14224, whichever is applicable. Use of selenium rectifiers of the tubular variety shall be subjected to approval of the procuring activity.

- * 3.2.3.21 Relays. Relays shall be of the hermetically sealed type and shall conform to Requirement 57 of MIL-STD-454. Relays which are not of the solid state high reliability or established reliability type shall not be used without prior approval of the procuring activity.
- * 3.2.3.22 Resistors. Resistors shall conform to Requirement 33 of MIL-STD-454. For missile and associated tactical mission essential equipment (see 6.3.11), resistors shall be established reliability (ER) level "P" or lower failure rate (R,S). When a resistor used is not covered by a military specification (see 3.1.7) and a new specification or drawing is prepared, the nearest appropriate military specification for the type of resistor shall be used as a guide and the product assurance requirements shall be specified to assure a life failure rate level "P" (0.1%/1000 hours) or lower failure rate (R,S). Variable resistors shall not be utilized in new design without prior approval of the procuring activity.

3.2.3.23 Rivets and riveting. Rivets shall not be used to mount parts which may require removal for maintenance of the equipment. Rivets, when used, shall conform to requirements specified in the detail specification. Riveting shall be accomplished in accordance with requirements specified in MIL-STD-403.

3.2.3.24 Shock and vibration isolators. Shock and vibration isolators shall not be used unless it is impracticable to design and construct the equipment to meet the shock and vibration requirements specified in the detail equipment specification (see 6.3.12).

3.2.3.24.1 Design of isolators. The isolators may be of the resilient material or metallic type and may employ viscous damping. The design of the isolators shall be such that failure of the resilient material will not set the supported component free.

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3.2.3.24.2 Resilient materials for isolators. The resilient material used in isolators shall be ozone resistant and capable of giving the required performance when exposed to any temperature within the range specified herein under the environmental conditions.

3.2.3.24.3 Installation of isolators. All isolators shall be readily replaceable without major disassembly of the equipment. All electrical connections between a resilient supported component and its foundation shall be as flexible as practicable. Sufficient clearance shall be provided between parts to preclude the possibility of a cushioned part striking any other part.

3.2.3.24.4 Electrical bypass of shock mounts. All shock mounted assemblies shall be electrically bypassed by a flexible bonding strap of copper at least one inch wide by 1/16 inch thick, except in such cases where a strap of this size would impair the action of the shock mount. Deviations from this requirement are subject to the approval of the procuring activity.

3.2.3.25 Springs. Springs shall be in accordance with Requirement 41 of MIL-STD-454.

3.2.3.26 Switches. Switches shall be in accordance with Requirement 58 of MIL-STD-454.

3.2.3.27 Access interlock switches. Access interlock switches shall be designed and constructed to conform to Requirement 1 of MIL-STD-454.

3.2.3.28 Servomotors, synchros, resolvers, and tachometer generators. Servomotors, synchros, resolvers, and tachometer generators shall be in accordance with Requirement 56 of MIL-STD-454.

3.2.3.29 Terminals. Terminals, boards, and strips shall be in accordance with Requirement 19 of MIL-STD-454.

3.2.3.30 Transformers, inductors, and coils. Transformers, inductors and coils shall be in accordance with Requirement 14 of MIL-STD-454.

3.2.3.31 Transmission lines. Transmission lines and fittings shall be in accordance with Requirement 53 of MIL-STD-454.

3.2.3.32 Radio-frequency cables. Radio-frequency cables shall be in accordance with Requirement 65 of MIL-STD-454. Unless otherwise specified, cables for use in general purpose application shall have a nominal impedance of 50 to 93 ohms.

3.2.3.33 Multiconductor cables.

3.2.3.33.1 Interconnection cables. External cables used for interconnecting fire control instruments, generator units, weapons in anti-aircraft and guided missile systems shall conform to Requirement 71 of MIL-STD-454.

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3.2.3.33.2 Multiconductor cables, internal. Multiconductor cables used in electronic equipment shall be in accordance with Requirement 66 of MIL-STD-454.

3.2.3.34 Radio-frequency connectors. Radio-frequency connectors shall be in accordance with Requirement 10 of MIL-STD-454.

3.2.3.35 Waveguides and fittings. Waveguides and fittings shall conform to Requirement 53 of MIL-STD-454.

3.2.3.35.1 Absorbers. Absorbers shall conform to requirements specified in the detail specification of the individual equipment (see 6.3.12).

3.2.3.36 Transmission lines, coaxial, air dielectric. Coaxial air dielectric radio-frequency transmission lines shall be in accordance with MIL-L-3890.

3.2.3.37 Couplers, directional. Directional couplers shall be in accordance with Requirement 53 of MIL-STD-454.

3.2.3.38 Microcircuits, semiconductor devices and electron tubes.

- * 3.2.3.38.1 Microcircuits. All microcircuits shall conform to Requirement 64 of MIL-STD-454. When a nonstandard microcircuit device is approved for use, and a DOD-STD-35 or DESC drawing is not available, a new drawing shall be prepared in accordance with the requirements of MIL-M-38510, Appendix F. The nearest MIL-M-38510 specification sheet shall be used as a drawing preparation guide. The microcircuit group assignment of MIL-M-38510, Appendix E will be used to select the nearest applicable MIL-M-38510 specification sheet. The specification or drawing shall contain the quality conformance requirements specified in MIL-STD-883, Methods 5004 and 5005 in order to achieve the minimum quality level of a Class B1 device as specified in MIL-HDBK-217. Only hermetically sealed devices shall be used. The use of hybrids or custom devices shall be held to a minimum.

- * 3.2.3.38.1.1 Hybrid microcircuits. Hybrid microcircuits shall comply with the requirements of MIL-M-38510 and Requirement 64 of MIL-STD-454. When a nonstandard hybrid microcircuit device is approved for use and DESC drawing is not available, a new drawing or specification shall be prepared in accordance with MIL-M-38510, Appendix G. The drawing or specification shall contain the Quality Assurance Requirements specified in MIL-STD-883 Method 5008 or Methods 5004 and 5005, as required. Only hermetically sealed devices shall be used. Hybrid microcircuits shall be vacuum baked at $150 \pm 2^\circ\text{C}$ for 4 hours minimum except that if epoxy die attach or substrate attach are used, the vacuum bake shall be for 16 hours minimum. The transfer from the vacuum bake to the dry nitrogen seal box shall be direct with no exposure to the ambient air. The dry nitrogen seal box moisture level shall not exceed 100ppm. The 16 hour vacuum bake may be modified to include a combination of prebake and vacuum bake when moisture analysis test (MIL-STD-883, Method 1018) indicates less than 1,000ppm inside the hybrids. A parts list shall be generated for

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each hybrid microcircuit listing each unique piece part and the quantity of each contained within the package. Each unique piece part shall be traceable to the drawing. Each unique piece part shall comply with the specification for that part type. Organic adhesives used inside hybrid microcircuits shall comply with MSFC-SPEC-592.

- * 3.2.3.38.1.1.1 Discrete semiconductor and integrated circuit chips. Where available, all discrete chips used in hybrid, multichips or module microcircuits shall be selected from those wafer lot types which the manufacturer has processed, inspected, and approved for assembly into a part type for which the manufacturer has an approved Qualified Product Listing.
- * 3.2.3.38.1.1.1.1 Leadless chip carriers (LCC). Leadless chip carriers shall conform to the requirements of MIL-M-38510, including the package configurations of Appendix C. The drawing or specification requirements of 3.2.3.38.1 shall apply for monolithic device types and 3.2.3.38.1.1 shall apply for hybrid device types.
- * 3.2.3.38.1.1.2 Custom LSI microcircuits. Custom LSI microcircuits shall comply with MIL-M-38510 and shall be class S, B or MIL-STD-883 Method 5008. Documentation of Custom LSI Microcircuits shall comply with Appendix F and G of MIL-M-38510. The sealing requirements of 3.2.3.38.1.1.7 shall apply.
- * 3.2.3.38.1.1.3 Ceramic capacitor chips. Ceramic capacitor chips shall meet requirements of MIL-C-55681.
- * 3.2.3.38.1.1.4 Tantalum capacitor chips. Tantalum capacitor chips shall meet the requirements of MIL-C-55365.
- * 3.2.3.38.1.1.5 Resistor chips. Chip resistors shall meet the requirements of MIL-R-55342.
- * 3.2.3.38.1.1.6 Coil chips. Chip coils shall meet the requirements of MIL-C-83446.
- * 3.2.3.38.1.1.7 Sealing requirements for custom and/or hybrid microcircuits. Hybrid microcircuits using utetic bonding shall be vacuum baked at $150^{\circ} + 2^{\circ}\text{C}$ for 4 hours minimum immediately prior to sealing, and microcircuits using organic adhesives shall be vacuum baked at $150^{\circ}\text{C} + 2^{\circ}\text{C}$ for sixteen (16) hours minimum. The transfer from vacuum bake to dry nitrogen seal box shall be direct with no exposure to the ambient air. The dry nitrogen seal box shall have a moisture level less than 100 PPM. If a combination of prebake plus vacuum bake yields a hybrid microcircuit with less than 1000 PPM when tested in accordance with MIL-STD-883 Method 1018, the amount of vacuum bake required may be reduced.
- * 3.2.3.38.2 Semiconductor devices. Semiconductor devices shall comply with Requirement 30 of MIL-STD-454. All semiconductor devices shall be JANTX, JANTXV or JANS types. When a required device is not covered by MIL-S-19500 and a new specification or drawing is prepared (see 3.1.7), the nearest appropriate MIL-S-19500 specification sheet shall be used as a guide and the quality

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assurance requirements shall be appropriately specified in accordance with MIL-STD-750 to assure the device is the equivalent of JANTX, JANTXV or JANS. Only hermetically sealed semiconductor devices shall be used.

3.2.3.38.3 Electron tubes. Electron tubes shall be in accordance with Requirement 29 of MIL-STD-454.

3.2.3.38.4 Equipment using electron tubes, semiconductors and microcircuits. Equipment using electron tubes semiconductors, microcircuits or any combination of these devices shall be furnished with a complete set of devices installed or mounted in its operating socket or permanently affixed operating position. These devices shall be the ones used in testing the equipment and each device shall remain as previously mounted or affixed.

3.2.3.38.5 Electron tube, semiconductor and microcircuit selection. The equipment shall be so designed that it will conform to all requirements without special tube, semiconductor or microcircuit selection. Deviations require complete engineering justification by the contractor and approval by the procuring activity.

3.2.3.38.6 Ratings of electron tubes, semiconductors and microcircuits. Electron tube, semiconductor and microcircuit ratings shall not be exceeded when the equipment is subject to specified service conditions, and shall conform to its limits as specified in MIL-E-1, MIL-S-19500 or MIL-M-38510, as applicable (see 3.1.11).

3.2.3.38.7 Current-regulating devices. Current-regulating devices of the non-electron type shall conform to MIL-R-3080.

3.2.3.38.8 Electron tube development. The contractor shall not undertake any electron tube development without prior approval of the procuring activity.

* 3.2.3.38.9 Electron tube, semiconductor and microcircuits complement report. The complement of electron tube, semiconductor devices, and microcircuits used in the equipment design shall be reported in accordance with the requirements of the procuring activity.

3.2.3.38.10 Sockets, tube shields, parts and tube clamps. Sockets, tube shields, parts, and tube clamps shall be in accordance with Requirement 60 of MIL-STD-454.

3.2.3.38.11 Filament and heater connections. Electron tube heaters or filaments shall be so connected that the removal of any one tube does not change the filament voltage of any other tube more than 20 percent.

3.2.3.39 Vibrators. Vibrators shall conform to MIL-V-95.

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3.2.3.40 Fastener hardware. Fastener hardware shall be in accordance with Requirement 12 of MIL-STD-454.

- * 3.2.3.40.1 Color of fastening and assembly screws. External fastening and assembly screws which are loosened, removed, or otherwise manipulated in normal process of installing and servicing shall be of a color providing a strong contrast with the background surface or of a type which makes them easily distinguishable from any other screws, unless equipment requires camouflaging for concealment.

3.2.3.41 Cable, low capacitance. Low-capacitance electrical cable shall be Type WS conforming to MIL-C-3883.

3.2.3.41.1 Derating of cables. Power cable shall be derated for the operating ambient temperature in excess of 30 degrees C which is the usual ambient on which cable manufacturers rate the current-carrying capacity of cables. The American Wire Gage of the copper conductor shall be chosen to provide the required current carrying capacity at the elevated ambient temperature. The correction factors shall be those recommended by the cable manufacturer.

3.2.3.42 Tuning dial mechanisms. Tuning dial mechanisms shall be in accordance with Requirement 42 of MIL-STD-454.

3.2.3.43 Readouts. Readouts for indicating alpha-numeric or symbolic information shall be in accordance with Requirement 68 of MIL-STD-454.

3.2.3.44 Electrical filters. Electrical filters shall be in accordance with Requirement 70 of MIL-STD-454.

3.2.3.45 Batteries. Batteries shall be in accordance with Requirement 27 of MIL-STD-454.

- * 3.2.3.46 Thermistors. The use of thermistors shall be in accordance with MIL-T-23648.

- * 3.2.3.47 Standard electronic modules. Standard electronic modules shall be in accordance with Requirement 73 of MIL-STD-454.

- * 3.3 Design. The design of the equipment shall embody the current state of the art, or advance the state of the art, as necessary and consistent with contractual requirements for the particular missile weapon system. Common equipment of other than DOD systems or off the shelf equipment shall not be used in new designs without prior approval of the procuring activity unless the parts, materials and processes comply with or exceed this specification.

- * 3.3.1 Objectives. The primary objective of this specification is to obtain an optimum overall system or equipment design and manufacture which shall provide the functional, operational, performance and long term storage capability as specified in the detail equipment specification (see 6.3.12).

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* 3.3.2 Maintainability.

* 3.3.2.1 Design criteria. Physical design for maintainability shall be in accordance with Requirement 103, MIL-STD-2084, except those portions of the third and fourth sentences of paragraph 4.1 pertaining to weights of WRAs shall be disregarded. Weight limitations shall be governed by MIL-STD-1472.

* 3.3.2.2 Built-in-test. Criteria for design and application of built-in-test (BIT) shall be in accordance with Requirement 104, MIL-STD-2084, except as follows:

* 3.3.2.2.1 The first sentence of paragraph 13 that reads "When reliability development tests in accordance with MIL-STD-2068(AS) are required..." is changed to read "When reliability development tests are required...."

* 3.3.2.2.2 In fourth sentence, paragraph 13, delete "...of MIL-STD-2068(AS)." at end of sentence.

3.3.3 Equipment performance. The equipment shall be designed so that failure of a component normally used for performance improvement shall not completely disable the equipment. The design shall allow continued operation at a reduction in performance; for example, if failure occurs in the automatic frequency control (AFC) circuits of a receiver, the circuitry shall be designed to provide for operation from a manual position without increasing the probability of failure of the remaining units.

3.3.4 Over-design. It is not intended that the equipment be "over-designed", especially where such over-design results in serious penalties to the overall weapon system, prohibitive cost, or severe delay in delivery.

* 3.3.5 Reliability. Reliability shall include, as a minimum, the requirements of MICOM Product Assurance Directorate Exhibit QR-800. Quantitative reliability requirements shall be specified in the contract and the end item system requirement specification.

3.3.6 Operation and maintenance.

3.3.6.1 Simplicity. The equipment shall represent the simplest design consistent with functional requirements and expected environmental conditions. To the maximum extent possible, it shall be capable of operation, maintenance, and repair by semiskilled personnel.

3.3.6.2 Ease of operation. Unless otherwise specified in the detail specification, operating controls shall conform to Requirement 28 of MIL-STD-454.

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- * 3.3.6.3 Ease of adjustment and maintenance. The equipment shall be so constructed that all parts, terminals, and wiring (other than encapsulated or hermetically sealed modules) are accessible for circuit checking, adjustment, maintenance, and repair with a minimum of disturbance to other parts and with a minimum number and variety of special tools. These controls shall not be readily available for access by unauthorized operational personnel. Adjustments required shall be the minimum consistent required performance. Accessible adjustments shall be capable of being returned to their original settings quickly so personnel experienced in the use of the equipment will not get the equipment out of alignment inadvertently with a result that would require a great amount of time to realign the equipment. If sequential adjustments are required, the adjustments shall be marked with a symbol to designate the order of adjustments. Harmonizing or mop-up of adjustments (where, for example, after "A", "B", and "C" are all adjusted, "A" must be readjusted) shall be avoided unless the equipment is greatly simplified by having such adjustments. Tools required for tuning and adjustment shall be provided with the equipment and stored by convenient means near the components on which they are to be used. Test points or jacks shall be conveniently located to provide proper operating adjustments and maintenance. All adjustments shall contain the following features:

(a) Under nominal service conditions, optimum adjustment shall fall within the center fifty percent of the adjustment range.

(b) Under any probable combination of service conditions optimum adjustments shall fall within the center eighty percent of the adjustment range.

(c) Under any known combination of service conditions, optimum adjustment shall fall within the center ninety percent of the adjustment range.

(d) All adjustments shall contain a simple reliable locking device, which does not change adjustment settings. The preferred type of locking device shall be one which is manually operated.

- * 3.3.6.4 Accessibility. Accessibility shall be in accordance with 3.3.2.1.
- * 3.3.6.5 Interchangeability. Interchangeability shall be in accordance with 3.3.2.1.
- * 3.3.6.6 Chassis protection. When a chassis, module, or subassembly is removed from its normal rack position or housing, it shall be possible to place the chassis, module, or subassembly on any side, except front and rear, on a smooth surface without causing damage to any of its components. It shall be possible to operate the chassis, module, or subassembly when removed from its housing. Chassis shall be of rugged construction for protection against rough handling as experienced in field operations.
- 3.3.6.7 Closed loop circuits. Closed loop circuits shall be so designed that external test equipment can be inserted for routine maintenance and diagnostic purposes.

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3.3.6.8 Power supplies. All low voltage regulated power supplies shall have easily removable regulator subassemblies. Wherever possible, power supplies shall be capable of the following:

(a) Continuous twenty percent overload under normal operating conditions, where normal current is taken as the maximum current at nominal input voltages, with favorable conditions of adjustments, and part(s) or component tolerances.

(b) Continuous twenty percent overload at ten percent less than the nominal source voltage and five percent less than the source frequency.

* **3.3.7 Human engineering.** Unless otherwise specified in the detail specification, human engineering shall be in accordance with applicable provisions of MIL-STD-1472.

3.3.8 Producibility. In the design of equipment, the contractor shall choose tolerances and fabrication techniques, where possible and consistent with the state-of-the-art, which lend themselves to mechanized or semimechanized production in order to minimize redesign in the transition from design acceptance to production. The use of grid patterns for layout and parallel orientation of components is preferred for planar circuitry and should be used where possible to facilitate mechanized production. The potential quantity involved will be specified by the procuring activity. In addition, the design shall be suitable for manufacturer by other comparable contractors without comprehensive production engineering changes.

3.3.9 Safety and protective devices. Safety and protective devices for personnel and equipment shall be in accordance with Requirement 1 of MIL-STD-454.

3.3.9.1 Explosion proofing (explosion-proof and dust-ignition-proof). Equipment that will be exposed to a hazardous concentration of gases, vapors, or dust shall be made explosive-proof or dust-ignition-proof, as applicable during normal or abnormal operations. (Abnormal operations include rupture of containers or failure to ventilation systems). Equipment which produces arcing or sparking in normal operations shall be totally inclosed or effectively isolated from solid explosives even though flammable gases, vapors, or dust, may not be present in the atmosphere. Electrical components, which have not been certified by a nationally recognized testing agency as approved for use in a hazardous atmosphere of the specific gas, vapor, or dust involved, shall be tested to assure safe performance in the hazardous atmosphere. The agency responsible for the design of the equipment shall specify the test method to be used after approval by the procuring activity. The explosion-proof or dust-ignition-proof requirements of this paragraph are not applicable to missile electronic test equipment or missiles with liquid propulsion or liquid power systems unless so designated by the procuring activity.

3.3.9.2 Electroexplosives. The design of electroexplosive subsystems and fuzes shall be in accordance with MIL-STD-1512 and MIL-STD-1316, respectively.

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3.3.10 Electrical overload protection. Electrical overload protection for electrical and electronic equipment shall be in accordance with the applicable class of Requirement 8 of MIL-STD-454.

3.3.10.1 Corona prevention. All pertinent parts of the equipment shall be such that, when operating under any service conditions specified in the detail specifications, corona discharge shall be in accordance with Requirement 45 of MIL-STD-454.

3.3.10.2 Time delay devices. Time delay devices of a type approved by the procuring activity shall be incorporate where necessary for the protection of the equipment.

3.3.11 Interference suppression. Interference suppression shall be in accordance with Requirement 61 of MIL-STD-454.

3.3.11.1 Anti-jamming. The electronic systems or equipment shall be designed to obtain the maximum inherent protection against possible interfering signals due to enemy jamming, inadvertent radio interference, and atmospherics.

3.3.11.2 Electromagnetic interference control. Electromagnetic interference control shall be in accordance with Requirement 61 of MIL-STD-454

3.3.11.3 Electromagnetic environment control. Electromagnetic environment control shall be compatible with the systems requirement in MIL-E-6051.

3.3.12 Running-time indicators. One or more running-time indicators shall be installed in each piece of equipment as required by the detail equipment specifications (see 6.3.12).

* **3.3.13 Covers, removable.** Front panels or removable cover plates shall employ captive type screws or similar devices for retention. The captive fasteners shall employ slotted heads or knurled and slotted heads and shall be of such design as to be capable of definite individual loosening prior to movement of the part to which they are captive. Design and construction shall be such as to provide for their self-alignment with their retaining nuts, blocks, or inserts without sticking and without damage to their threads. Where applicable, a chain shall be used on removable covers for which no convenient location for depositing the cover is expected to be available during maintenance. Captive fasteners shall be painted or otherwise marked in a conspicuous manner to effect high visual contrast with the removable cover unless equipment requires camouflaging for concealment. Access covers and panels shall be interlocked in accordance with Requirement 1 of MIL-STD-454.

3.3.14 Cooling. Adequate means shall be employed to maintain parts within their maximum permissible operating temperature under all operating conditions. Exhaust fans and blowers shall be designed for operation from the applicable ac power supply if possible (see 3.3.20).

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

* 3.3.16 Test equipment. New test equipment shall be designed in accordance with MIL-T-28800.

3.3.16.1 External. The equipment shall be designed to provide for connections for such test equipment as may be required for its installation, maintenance, calibration and repair. The equipment shall be designed in such a manner as to permit the use of test equipment generally available to the Armed Services to accomplish all necessary test. The contractor shall not design external test equipment without approval of the procuring activity.

* 3.3.16.2 Test points. Criteria for design and application of test points shall be in accordance with 3.3.2.2.

3.3.16.3 Built-in test equipment. Built-in test equipment shall be incorporated to the fullest practicable extent to permit monitoring of performance on a go-no-go basis. Techniques shall be included for assessment of over-all performance of the entire equipment. The built-in test equipment shall enable rapid assessment of performance by semi-skilled personnel. Marginal checking techniques providing information regarding anticipated failure shall be incorporated to the fullest extent possible. The built-in test equipment shall enable test and evaluation of all modules and plug-in components except electron tubes and transistors. Modules aligned while operating with inputs from built-in test equipment shall not require realignment when installed in their proper position within the operating equipment.

3.3.16.4 Accuracy. When test instruments are built into an equipment, they shall be required to maintain their accuracy under all electrical, mechanical and other environmental conditions required by the equipment

3.3.16.5 Accessibility (test points and terminals). Access to test points and terminals of each article of equipment for required circuit checking shall be in accordance with Requirement 36 of MIL-STD-454.

3.3.17 Tools.

3.3.17.1 Standard tools. The requirements as to the type and quantity of standard tools for use with the equipment shall be kept to the minimum without detracting from the practicability of the design (see 6.3.5).

3.3.17.2 Special tools. Special tools shall be in accordance with Requirement 63 of MIL-STD-454.

3.3.17.3 Handling and equipment weight. Equipment weights and handling characteristics shall conform to applicable requirements of MIL-STD-454.

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3.3.18 Tropicalization. Tropicalization for protection against moisture and fungus shall be accomplished by conforming to MIL-T-152, and requirements specified in the detail specification of the equipment. The detail specification shall specify either Type I or II treatments and the parts or assemblies that require treatment (see 6.3.12).

3.3.19 Electrical power source. Electrical power sources shall be in accordance with Requirement 25 of MIL-STD-454.

3.3.20 Thermal design. Thermal design shall conform to Requirement 52 of MIL-STD-454 (see 3.3.14).

3.3.21 Enclosures. Enclosures for electric and electronic equipment shall be in accordance with Requirement 55 of MIL-STD-454.

3.3.22 Hydraulics. The design and installation of hydraulics systems shall be in accordance with Requirement 49 of MIL-STD-454 or as specified in the detail specification (see 6.3.12).

* 3.3.23 Grounding, bonding, and shielding. Unless otherwise specified by the procuring activity, grounding, bonding, and shielding shall be in accordance with Requirement 74 of MIL-STD-454.

* 3.3.23.1 Single point grounding. To minimize degradation of performance and safety caused by circulating ground currents, each missile system shall utilize a single point grounding system in which the various ground planes (power, signal, earth, etc.) are electrically connected at only one point. Waiver of this requirement requires approval of the procuring activity.

* 3.3.24 Substitutability. Unless otherwise specified by the procuring activity, substitutability of parts shall be in accordance with Requirement 72 of MIL-STD-454.

3.4 Environmental.

3.4.1 Altitude. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 500, LOW PRESSURE.

3.4.1.1 Pressurization. Whenever pressurization of the electronic equipment is required by the detailed specification the following provisions shall be met:

(a) The case shall have sufficient strength to withstand the applicable pressure differences. A means shall be provided for determining the effectiveness of the seal. This may consist of suitable fitting to permit the use of an air pump for increasing the pressure approximately 5 pounds per square inch above sea level pressure.

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(b) The case shall be of a type that will permit ready opening and clearing for access to the equipment for repair and maintenance. The equipment shall be completely operable after removal from the case, and alignment shall be unaffected by replacement in the case.

(c) When possible and advantageous, external points shall be provided for check without removal from the case.

(d) Sealing instructions shall be placed on one side of the case.

(e) Those parts of equipment that are pressurized shall be capable of withstanding any pressures developed under the required external operating conditions when pressurized initially on the ground to such an extent that no arcing or loss of power due to corona occurs that would not occur at sea level pressure, or not more than 5 pounds per square inch gage at minus 20 degrees C to plus 50 degrees C.

(f) Unless specified or permitted in the detail specification, pressure shall be maintained without the use or need of a pressurization pump.

3.4.2 Temperature. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 501, High Temperature, and Method 502, Low Temperature.

3.4.3 Relative humidity. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 507, Humidity.

3.4.4 Dust and sand. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 510, Dust.

3.4.5 Salt laden air. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 509, Salt Fog.

3.4.6 Rainfall. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 506, Rain.

3.4.7 Wind and ice load. The wind and ice load requirements shall be as specified in the detail specification for the equipment (see 6.3.12).

3.4.8 Insects and rodents. The equipment shall be adequately protected to assure positive prevention of any damage that can be caused by insects and rodents.

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3.4.9 Fungus. The equipment shall not be damaged nor shall its performance be impaired when subjected to the fungus supporting tests specified in MIL-STD-810, Method 508, Fungus.

3.4.10 Mechanical.

3.4.10.1 Vibration. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 514, Vibration.

3.4.10.2 Acceleration. When specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 513, Accelerations.

3.4.10.3 Shock. Unless otherwise specified in the detail specification, the equipment shall be capable of withstanding, without discernible damage to the equipment, the applicable test specified in MIL-STD-810, Method 516, Shock.

3.4.11 Orientation. When the equipment is to be operated on sandy, muddy, or frozen terrain, it shall be capable of being leveled on slopes up to 10 degrees when required to accomplish the specified operation.

3.5 Marking.

3.5.1 Identification. Unless otherwise specified in the detail specification; equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-454, Requirement 67.

3.5.1.1 Hookup wire identification. Hookup wire identification shall be in accordance with Requirement 20 of MIL-STD-454.

3.5.2 Marking for shipment. Unless otherwise specified in the detail specification of the equipment, marking for shipment shall conform to MIL-STD-129.

3.5.3 Nomenclature. Nomenclature shall be in accordance with Requirement 34 of MIL-STD-454 and as specified in the contract.

3.5.3.1 Mounting of labels and nameplates. Labels and nameplates shall be securely and permanently mounted by adhesives, screws or rivets (whichever is applicable) that will not stain the labels under specified environmental conditions. They shall be mounted so that they are not obstructed from view by units or parts.

3.5.4 Reference designations. Reference designations for replaceable parts shall be applied as specified herein and shall be in accordance with Requirement 67 of MIL-STD-454.

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3.5.5 Battery circuits. Components designed to operate from internal batteries shall be marked with the following in a convenient form for use by operating and maintenance personnel:

- (a) Battery type number.
- (b) Battery location and position.
- (c) Polarity.
- (d) Nominal voltage.
- (e) Interconnection between batteries.

3.5.6 Luminescent. Luminescent marking shall conform to MIL-L-3891 or MIL-L-25142, as applicable.

* 3.6 Workmanship. Workmanship shall be in accordance with Requirement 9 of MIL-STD-454.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Sampling and inspection. Requirements for sampling and inspection shall be as specified in the contract and in the equipment detail specification (see 6.3.12).

*

5. PACKAGING.

* 5.1 Packaging and marking. Packaging and marking shall be as specified in the equipment detail specification (see 6.3.12).

6. NOTES.

6.1 Intended use. This specification is intended for use in specifying requirements for electronic, electrical and electromechanical equipment which are common to guided missile and associated weapon systems.

6.2 Ordering data. Procurement documents shall specify the following:

- (a) Title, number and date of this specification.
- (b) Title, number and date of the detail specification for the equipment (see 6.3.12).
- (c) Other applicable documents.

6.3 Definitions. For the purpose of this specification, the following definitions shall apply.

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- * 6.3.1 Standard documents. Standard documents are those specifications, standards, and other publications listed in Section 2 herein and documents referenced therein.
- * 6.3.2 Standard parts and materials. Standard parts and materials are those which meet all applicable requirements and test (including qualification test) given in the applicable standard documents (see 6.3.1). When an applicable preferred parts list is cited, the standard part or material is one which conforms to the appropriate standard document.
- * 6.3.3 Nonstandard parts, materials and processes. As pertaining to this general specification; nonstandard parts, materials, and processes are those that are not covered by Federal or military specifications and standards or DOD adopted industry standards referenced herein or in the detail specification. DOD adopted industry standards are those coordinated with and accepted by DOD and listed in the DOD Index of Specifications and Standards.
- 6.3.4 Reliability. The probability that an item of equipment will perform its specified function without failure for a specified period of time under given conditions.
- 6.3.5 Standard tools. Standard tools are common tools manufactured by two or more recognized tool manufacturers and listed in the individual catalog of the two or more manufacturers.
- 6.3.6 Effective voltage. Effective voltage may be obtained by multiplying the ac voltage by 1.414.
- 6.3.7 Equipment failure. An equipment failure is the cessation of ability to meet the minimum performance requirements of the equipment specifications. Further, equipment failure shall imply that the minimum specified performance is not reobtainable through permissible readjustment of operator controls.
- 6.3.8 Critical materials. Those materials vital to the national defense, the main source of which is within the continental limits of the United States, which may not be produced in quality and quantity sufficient to meet requirements.
- 6.3.9 Strategic materials. Those materials vital to the security of a nation because the available production will not be sufficient in quantity or quality to meet the requirements in time of national emergency.
- 6.3.10 Casting defects. Casting defects are defects that would cause a casting to fail to keep a part or assembly from functioning as it was intended.
- 6.3.11 Mission essential equipment. Mission essential equipment is that interdependent equipment in a missile weapon system which is assigned a mission on the battlefield in support of forces in contact with the enemy and without which the assigned mission cannot be successfully completed.

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6.3.12 Detail equipment specification. Since this specification covers only the general requirements for materials, parts, processes, design and construction, the detail equipment specification (see 6.2b), drawings, contract, or order should specify the actual requirements from the multiple choices or exceptions available herein.

- * 6.4 CAUTION. Certain chemicals have been identified in the Occupational Safety and Health Act (OSHA) as cancer-producing substances (carcinogens). Before using any materials which might contain these chemicals, they should be evaluated in accordance with the Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart Z.
- * 6.5 Changes to previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modification, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:
Army-MI

Preparing Activity:
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