NOT MEASUREMENT SENSITIVE

MIL-T-28800E
3 September 1991
SUPERSEDING:
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30 September 1986

MILITARY SPECIFICATION

TEST EQUIPMENT FOR USE WITH ELECTRICAL AND ELECTRONIC EQUIPMENT, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the general requirements for test equipment (see 6.4.2.16) used in testing and calibrating electrical and electronic equipment. The test equipment may be of Military or commercial design and includes general purpose, special purpose, peculiar, console mounted, automatic test equipment (ATE), and calibration standards. This specification should also be used for built-in test equipment (BITE) (see 6.4.2.6) when the requirements for built-in test (BIT) (see 6.4.2.5) are not included in the system specification. Detailed requirements for particular test equipment should be tailored in a detail specification for that equipment (see 6.4.2.13).

1.1.1 Usage. The requirements of this specification are to be invoked according to type, class, style, and color, and may be tailored based on the installation and intended use of the equipment. Appendixes are provided to assist the specification writer with a checklist approach to the development of a detail specification invoking MIL-T-28800.

1.2 Classification. Test equipment specified herein is categorized by Type (design and construction requirements), class (environmental requirements), style (type of enclosure), and color. The associated detail specification will specify the required type, class, style, color, and other features such as configuration or convertible or rack-mountable (see 6.1 and 6.4.2.11).

1.2.1 Types. Test equipment types are classified as specified in a through c. Type I, Type II, or Type III specified herein, refers to equipment type.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6625

a. Type I. Type I equipment is designed specifically for Military use and conforms to the Type I requirements for design, construction methods, parts, materials, and processes specified herein and invoked by the associated detail specification.

b. Type II. Type II equipment is modified commercial-off-the-shelf (COTS) equipment which conforms to one or more Military requirements not available in Type III.

c. Type III. Type III equipment is COTS equipment which conforms to specific Military requirements as specified herein (see 6.4.2.9).

1.2.2 Classes. Test equipment covered by this specification is categorized by its intended location of use and the prevailing environmental conditions of such locations. The classes are specified in a through g (see table I):

a. Class 1. The use of Class 1 is discontinued for new procurement (see 3.7).

b. Class 2. Test equipment for use in the vicinity of aircraft, in tracked and wheeled vehicles, or for typical above-deck applications. Class 2 equipment may be contained in enclosures of Style A (see 1.2.3a) to provide protection in areas where the environmental conditions are uncontrolled.

c. Class 3. Test equipment for use as a portable (see 6.4.2.24) instrument in more than one location which has a substantial degree of environmental protection. Class 3 equipment may be contained in enclosures of Style B or F (see 1.2.3b or 1.2.3f), or if a front cover is required, of Style C or D (see 1.2.3c or 1.2.3d).

d. Class 4. The use of Class 4 is discontinued for new procurement (see 3.7).

e. Class 5. Test equipment for bench-top, rack-mount and occasional portable use in widely diverse, environmentally controlled locations. Class 5 equipment may be contained in enclosures of Style E or F (see 1.2.3e or 1.2.3f) or, if a front cover is required, Style D (see 1.2.3d).

f. Class 6. Test equipment for use in a fully protected and environmentally controlled service area such as a laboratory. Class 6 equipment may be designed with enclosures of Style B, E, or F (see 1.2.3b, 1.2.3e, or 1.2.3f).

g. Class 7. Test equipment which is considered to be advanced state-of-the-art in design and construction, or those which have special operational requirements, and which are not compatible with the environmental requirements of Classes 2 through 6. Class 7 equipment will have the environmental resistance specified in the associated detail specification.

TABLE I. Identification of environmental requirements by class and style.

Environmental conditions	Class 1/				
	2	3	5	6	7
Temperature, nonoperating (°C) (3.7.2 and 4.5.5.1)	-51 to 71	-51 to 71	-40 to 71	-40 to 71	2/
Temperature, operating (°C) (3.7.2 and 4.5.5.1)	-40 to 55 3/	-10 to 55	0 to 50	10 to 40	2/
Relative humidity (percent) 6/ (3.7.2 and 4.5.5.1)	95 ±5	95 ±5	95 ±5 4/,5/	95 ±5 4/	2/
Altitude, nonoperating (3.7.3 and 4.5.5.2)	4570 m (15,000 ft)	4570 m (15,000 ft)	4570 m (15,000 ft)	4570 m (15,000 ft)	2/
Altitude, operating (3.7.3 and 4.5.5.2)	4570 m (15,000 ft)	4570 m (15,000 ft)	3050 m (10,000 ft)	3050 m (10,000 ft)	2/
Vibration limits (max) (3.7.4.1 and 4.5.5.3.1)	3G	3G	2G	2G	2/
Bounce, loose cargo (3.7.4.3 and 4.5.5.3.3)	1/	1/	1/	1/	1/
Shock, functional (3.7.5.1 and 4.5.5.4.1)	30G 8/	30G 8/	30G 8/	30G 8/	2/
Bench handling (3.7.5.3 and 4.5.5.4.3)	Yes	Yes	Yes	Yes	Yes
Shock, high impact (3.7.5.4 and 4.5.5.4.4)	1/	1/	1/	1/	1/
Fungus resistance 9/ (3.7.7 and 4.5.6.1)	Yes	Yes	Yes	Yes	Yes
Explosive atmosphere (3.7.9 and 4.5.6.3)	Yes	N/A	N/A	N/A	N/A
Dust resistance (3.7.10 and 4.5.6.4)	Yes	N/A	N/A	N/A	N/A
Solar radiation (3.7.13 and 4.5.6.8)	1/	1/	N/A	N/A	N/A

TABLE I. Identification of environmental requirements by class and style. (cont.)

Environmental conditions	Style 1/					
	A	B	C	D,E,F, G and S	P	T
Transit drop (3.7.5.2 and 4.5.5.4.2)	46 cm (18 in)	300 mm (12 in)	200 mm (8 in)	N/A 10/	46 cm (18 in)	46 cm (18 in)
Watertight 0.9 m (3 ft) (3.7.6.1 and 4.5.5.5.1)	Cover on	N/A	N/A	N/A	N/A	Cover on
Splashproof (3.7.6.2 and 4.5.5.5.2)	Cover off	N/A	N/A	N/A	N/A	N/A
Dripproof (3.7.6.3 and 4.5.5.5.3)	N/A	Yes	Cover on	N/A	N/A	N/A
Salt exposure, structural parts (3.7.8.1 and 4.5.6.2.1)	48 hours	48 hours	48 hours 7/	48 hours 7/ 11/	N/A	N/A
Salt exposure, enclosure (3.7.8.2 and 4.5.6.2.2)	48 hours 7/	48 hours 7/	48 hours 7/	48 hours 7/ 11/	48 hours 7/	48 hours 7/
Dust resistance (3.7.10 and 4.5.6.4)	Yes Cover on	N/A Except for Class 2	N/A Except for Class 2	N/A Except for Class 2	Yes Cover on	Yes Cover on

Notes:
1. See 3.7 for complete environmental requirements.
2. As specified in the associated detail specification.
3. 20 minute operation at 71°C.
4. 75 ±5 percent RH above 30°C.
5. 45 ±5 percent RH above 40°C.
6. RH not controlled below 10°C.
7. Must be invoked by the associated detail specification when required.
8. Half-sine shock pulse (see 3.7.5.1).
9. Verification testing must be invoked by the associated detail specification.
10. Style S enclosures are tested with the equipment inside (see 4.5.5.4.2).
11. Not applicable to Style S.

1.2.3 Styles. Basic enclosure styles are specified in a through j. When specified in the associated detail specification, Styles B, C, D, and E will be capable of being converted for rack-mounting. All styles provide mechanical protection for the instrument. Ventilation openings, when permitted by the enclosure requirements, are designed to prevent accidental contact with live electrical circuits and mechanical moving parts. The degree of environmental protection provided is also specified in a through j (see 6.4.2.15).

a. Style A enclosure (ruggedized (see 6.4.2.26) combination case). Style A enclosures are watertight and permit operation of the equipment when the cover is opened or removed. Style A enclosures are designed to exclude any harmful or undesirable element from the contained instrument when subjected to any environmental conditions which may be encountered during storage, shipment, or unlimited portable use. Style A enclosures are integral parts of the equipment and are suitable for use or storage in exposed areas (see 3.6.1).

b. Style B enclosure (ruggedized equipment case). Style B enclosures will provide protection to the contained instrument from falling water particles and mechanical damage during bench-top use. Ventilation openings in the sides and rear are permitted when protected by suitable louvers. Style B enclosures are integral parts of the equipment (see 3.6.2).

c. Style C enclosure (semiruggedized combination case). Style C enclosures may be of ventilated construction which permit operation of the equipment when the front cover is opened or removed. Style C enclosures have no openings on the top surface and have all ventilation openings on the sides or rear. Style C enclosures provide protection to the contained instrument from falling water particles and mechanical damage encountered during portable use in semi-exposed areas. Style C enclosures are integral parts of the equipment (see 3.6.3).

d. Style D enclosure (combination case). Style D enclosures will provide mechanical protection to the enclosed instrument and will permit operation of the equipment when the cover is opened or removed. Style D enclosures have no openings on the top surface. Style D enclosures will provide some environmental resistance for equipment which is normally used in more than one location for portable applications. Style D enclosures are integral parts of the equipment (see 3.6.4).

e. Style E enclosure (equipment case). Style E enclosures provide protection from mechanical shock and conditions associated with bench-top use. Style E enclosures have no openings on the top surface. Equipment with Style E enclosures are normally used in an environmentally controlled area. Style E enclosures are integral parts of the equipment (see 3.6.5).

f. Style F enclosure (rack-mount case). Style F enclosures are designed for rack-mounting. Style F enclosures are normally contained in a Style G console cabinet. Style F enclosures are integral parts of the equipment (see 3.6.6).

g. Style G enclosure (console cabinet). Style G enclosures are designed to provide protection for the contained system components during storage, handling, and use compatible with the contained class of equipment. Style G enclosures may contain more than one modular unit, each incorporating one or more complete functions of the equipment (see 3.6.7).

h. Style P enclosure (transit case). Style P enclosures are of commercial design and are not integral parts of the contained equipment. Style P enclosures are designed to provide protection for the contained test equipment and all required components and accessories against shock, vibration, and other environmental conditions which may be encountered during use in more than one location (see 3.6.8).

i. Style S enclosure (soft transit case). Style S enclosures are of commercial design and are not integral parts of the equipment. Style S enclosures are designed to provide a method of transporting the contained equipment while providing protection for the equipment and all required components and accessories from environmental conditions which may be encountered during transit between work locations. Style S enclosures will contain all required components and accessories of the equipment. Style S enclosures are not intended to double as shipping containers (see 3.6.9).

j. Style T enclosure (ruggedized transit case). Style T enclosures are watertight and provide additional environmental protection for test equipment which has limited environmental resistance. Style T enclosures are designed to provide protection for the contained test equipment against shock, vibration, and deterioration from environmental conditions which may be encountered during storage and shipment. Style T enclosures are suitable for storage in exposed areas (see 3.6.10).

1.2.3.1 Convertible/rack-mountable capability. Convertible/rack-mountable instruments are designed for bench-top use and are capable of being mounted in an equipment rack (see 3.6.11.1).

1.2.4 Color. Test equipment is classified according to color as specified in a through k (see 3.2.1.47 and 3.2.3.1):

a. Color Z. Type III, Class 1 (MIL-E-15090) Light-gray (gloss).

b. Color Y. Type III, Class 2 (MIL-E-15090) Light-gray (semigloss).

c. Color X. Light-gray (semigloss) (FED-STD-595, No. 26307; TT-E-529 Type II).

d. Color W. Olive drab (semigloss) (FED-STD-595, No. 24087; TT-E-529, Type II).

e. Color V. Yellow (gloss) (FED-STD-595, No. 13538).

f. Color U. Yellow (lusterless) (FED-STD-595, No. 33538).

g. Color T. Black (lusterless) (FED-STD-595, No. 37038).

h. Color S. Green (Marine Corps green) (FED-STD-595, No. 34094).

i. Color R. Other (color normally provided by the manufacturer).

j. Color P. Special (color, other than specified herein, required by the associated detail specification).

k. Color N. Green (semigloss) (FED-STD-595, No. 24052, MIL-C-83286, Type I or II).

1.2.5 Configuration. When the associated detail specification invokes more than one type, class, style, or color requirement of this specification, the different configurations should be identified (see 6.4.2.11). Selection criteria for each class and style of equipment are specified in table I.

1.3 Navy shipboard use. Electronic test equipment furnished to the Navy that uses material restricted for Navy use (see 3.2.5.1, 3.2.5.2, 3.4.1.2.6.1, and 3.4.5.2.5.1), or that exceeds the size limitations of this specification (see 3.5.1.1), requires approval by the Navy prior to procurement.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

GG-P-455	Plates And Foils, Photographic (Photosensitive Anodized Aluminum)
NN-P-530	Plywood, Flat Panel
TT-E-529	Enamel, Alkyd, Semigloss, Low VOC Content
TT-P-1757	Primer Coating, Zinc Chromate, Low Moisture Sensitivity
TT-W-00571	Wood Preservation: Treating Practices
MMM-A-138	Adhesive, Metal To Wood, Structural

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MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys

MIL-C-3432	Cables (Power And Special Purpose) And Wire, Electrical (300 And 600 Volts)
MIL-C-4751	Casters, Rigid And Swivel, Precision Heavy Duty, And Shock Absorbing
MIL-C-5541	Chemical Conversion Coatings On Aluminum And Aluminum Alloys
MIL-C-7474	Casters, Industrial
MIL-C-28777	Cable Assembly, Electronic Test Equipment (3 Wires, 125 and 250 Volts AC and 28 VDC) Grounding Plug Connector
MIL-C-83286	Coating, Urethane, Aliphatic Isocyanate, For Aerospace Applications
MIL-C-85285	Coating, Polyurethane, High-solids
MIL-E-15090	Enamel, Equipment, Light-Gray (Formula No. 111)
MIL-F-14072	Finishes For Ground Electronic Equipment
MIL-G-3787	Glass Laminated, Flat; (Except Aircraft)
MIL-I-81219	Indicator, Elapsed Time, Electrochemical
MIL-J-641	Jacks, Telephone, General Specification For
MIL-L-19140	Lumber And Plywood, Fire-Retardant Treated
MIL-M-3171	Magnesium Alloy, Processes For Pretreatment And Prevention Of Corrosion On
MIL-M-10304	Meters, Electrical Indicating, Panel Type, Ruggedized, General Specification For
MIL-M-16034	Meters, Electrical-Indicating (Switchboard And Portable types)
MIL-M-45202	Magnesium Alloys, Anodic Treatment Of
MIL-P-642	Plugs, Telephone And Accessory Screws; General Specifications For
MIL-P-11268	Parts, Materials, And Processes Used In Electronic Equipment
MIL-P-15024	Plates, Tags And Bands For Identification Of Equipment
MIL-P-15280	Plastic Material, Unicellular (Sheets and Tubes)
MIL-P-85582	Primer, Coating, Epoxy, Waterborne
MIL-R-39005	Resistors, Fixed, Wire-Wound (Accurate), Established Reliability, General Specification For
MIL-S-901	Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment And Systems, Requirements For
MIL-S-5002	Surface Treatments And Inorganic Coatings For Metal Surfaces Of Weapons Systems
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification For
MIL-W-5088	Wiring, Aerospace Vehicle

STANDARDS

FEDERAL

FED-STD-151	Metals; Test Methods
FED-STD-595	Colors Used in Government Procurement

MILITARY

MIL-STD-12	Abbreviations For Use On Drawings, And In Specifications, Standards And Technical Documents
MIL-STD-108	Definitions Of And Basic Requirements For Enclosures For Electric And Electronic Equipment
MIL-STD-109	Quality Assurance Terms And Definitions
MIL-STD-130	Identification Marking Of US Military Property
MIL-STD-242	Electronic Equipment Parts, Selected Standards
MIL-STD-411	Aircrew Station Signals
MIL-STD-454	Standard General Requirements For Electronic Equipment
MIL-STD-461	Electromagnetic Emission And Susceptibility Requirements For The Control Of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement Of
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation
MIL-STD-681	Identification Coding And Application Of Hook-Up And Lead Wire
MIL-STD-781	Reliability Testing for Engineering Development, Qualification And Production
MIL-STD-783	Legends For Use In Aircrew Stations And On Airborne Equipment
MIL-STD-810	Environmental Test Methods And Engineering Guidelines
MIL-STD-965	Parts Control Program
MIL-STD-970	Standards And Specifications, Order Of Preference For The Selection Of
MIL-STD-1309	Definition Of Terms For Test, Measurement And Diagnostic Equipment
MIL-STD-1378	Requirements For Employing Standard Electronic Modules
DOD-STD-1399	Interface Standard For Shipboard Systems, Section 300 Electric Power, Alternating Current (Metric)
MIL-STD-1472	Human Engineering Design Criteria For Military Systems, Equipment And Facilities
MIL-STD-1653	Power Cable Assemblies
MIL-STD-1791	Designing For Delivery In Fixed Wing Aircraft
MIL-STD-2000	Standard Requirements For Soldered Electrical And Electronic Assemblies
MIL-STD-2073-1	DoD Materiel, Procedures for Development and Application of Packaging Requirements
MIL-STD-45662	Calibration System Requirements

HANDBOOKS

MILITARY

MIL-HDBK-246	Program Managers Guide For The Standard Electronic Modules Program

(Unless otherwise indicated, copies of Federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Ave, Bldg No. 4, Section D, Philadelphia, Pa. 19111-5094.)

2.1.2 Other Government publications. The following other Government documents, drawings, or publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

FEDERAL

Code Of Federal Regulations, Title 29, Part-1910, Occupational Safety And Health Act (OSHA)

Code Of Federal Regulations, Title 21, Chapter I, Subchapter J, Radiation Control For Health And Safety Act Of 1968

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

MILITARY

NAVSEA ST000-AB-GYD-010/PEETE	Portable Electrical and Electronic Test Equipment (PEETE), Stowage Guide For

(Unless otherwise indicated, copies of Federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Ave, Bldg No. 4, Section D, Philadelphia, Pa. 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ISA-S82.01 -1988	Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment (General Requirements)
ANSI/ISA-S82.02 -1988	Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment (Electrical and Electronic Test and Measuring Equipment)
ANSI-S1.4-1983	Sound Level Meters, Specification For
ANSI-S1.11-1986	Octave, Half-Octave, And Third-Octave Band Filter Sets, Specification For
ANSI-Y32.2-1975	Graphic Symbols For Electrical And Electronic Diagrams
ANSI-Y32.16-1988	Standard Reference Designations For Electrical And Electronics Parts And Equipment

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B633	Standard Specification For Electrodeposited Coatings Of Zinc On Iron And Steel

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

CANADIAN STANDARDS ASSOCIATION (CSA)

CAN/CSA-C22.2 No. 231 Series M89	CSA Safety Requirements for Electrical and Electronic Measuring and Test Equipment

(Application for copies should be addressed to the Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, ON M9W 1R3.)

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA RS-310-C-77	Racks, Panels And Associated Equipment

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

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

ANSI/IEEE-STD-488.1	Standard Digital Interface For Programmable Instrumentation
ANSI/IEEE-STD-488.2	Standard Codes, Formats, Protocols, and Common Commands

(Applications for copies should be addressed to the IEEE Standard Sales, 345 East 47th Street, New York, NY 10017.)

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC-1010	Safety Requirements For Electrical Equipment For Measurement, Control, and Laboratory Use (General Requirements)

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

UNDERWRITERS LABORATORIES (UL)

UL 1414-1988	Across-the-Line Capacitors, Antenna-Coupling And Line-Bypass Components For Radio And Television Type Appliances

(Application for copies should be addressed to the Underwriters Laboratories, 1285 Walt Whitman Road, Melville, NY 11747.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Associated detail specification. The individual item requirements shall be as specified herein and in accordance with the applicable associated detail specification. In the event of any conflict between the requirements of this specification and the associated detail specification, the latter shall govern.

3.1.1 First article. When specified (see 6.2) a sample shall be subjected to first article inspection (see 4.3 and 6.3).

3.1.2 Bid sample. When specified in the solicitation, a bid sample shall be subjected to bid sample inspection (see 4.3).

3.1.3 Quality conformance. When specified in the contract or purchase order, a sample shall be subjected to quality conformance inspection (see 4.4).

3.2 Parts, materials, and processes. Parts, materials, and processes shall be as specified in 3.2.1 through 3.2.5.3.

3.2.1 Parts, materials, and processes, Type I. Type I parts, materials, and processes shall conform to applicable specifications and standards specified for use in a and b:

a. For Army use, MIL-P-11268 shall apply
b. For Navy ship and shore use MIL-STD-242 shall apply.

3.2.1.1 Selection of parts, materials, and processes. Parts, materials, and processes selected in accordance with 3.2.1 shall be considered as standard and shall be used whenever they are suitable for the purpose. Semiconductor devices are preferred in lieu of electron tubes, and microelectronic devices (see 6.4.2.21) shall be given first consideration in design. Nonstandard parts, materials, and processes shall be equivalent to or better than similar standard parts, materials, and processes. When the documents specified in 3.2.1 fail to provide an applicable specification or standard, the contractor shall use other established specifications or standards in the order of precedence specified in MIL-STD-970. Parts, materials,

and processes selected from other than the specifications or standards specified in 3.2.1 shall be in accordance with 3.2.1.1.1 for each manufacturer.

3.2.1.1.1 Parts control. Parts control shall be in accordance with MIL-STD-965 Procedure I.

3.2.1.1.2 Choice of parts and materials. Whenever an applicable invoked document provides more than one characteristic or tolerance for an item, the equipment manufacturer shall use items of broadest characteristics and of the greatest allowable tolerances that will fulfill the performance requirements (see 6.4.2.23). When the maximum physical dimensions of a part is specified, all new equipment shall be designed to accommodate the maximum physical size specified so that all parts having the same type designation will be physically interchangeable in the equipment.

3.2.1.1.3 Replaceability by standard parts and materials. Whenever the procuring activity (see 6.4.2.25) grants permission for a contractor to use nonstandard parts and standard parts exist, the design of the equipment shall permit replacement in the field of the nonstandard parts by the standard parts. The standard parts shall be listed in the technical manuals as the preferred replacement.

3.2.1.1.4 Equipment performance. The requirements of this specification with regard to the use of parts, materials, and process, either standard or approved nonstandard, shall not relieve the contractor of the responsibility for complying with all equipment performance and other requirements specified in the associated detail specification or contract.

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

3.2.1.2 Microelectronic devices. Microelectronic devices (see 6.4.2.21) shall be in accordance with MIL-STD-454, Requirement 64.

3.2.1.3 Semiconductor devices. Semiconductor devices shall be in accordance with MIL-STD-454, Requirement 30. Metallic oxide rectifiers shall not be used.

3.2.1.4 Electron tubes. Electron tubes shall be in accordance with MIL-STD-454, Requirement 29.

3.2.1.5 Resistors. Resistors shall be in accordance with MIL-STD-454, Requirement 33. Fixed film resistors with resistance values greater than 2 megohms shall not be used.

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

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

3.2.1.6 Capacitors. Capacitors shall be in accordance with MIL-STD-454, Requirement 2.

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

3.2.1.8 Quartz crystal and oscillator units. Quartz crystal units and crystal oscillators shall be in accordance with MIL-STD-454, Requirement 38.

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

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

3.2.1.11 Meters, electrical indicating, and accessories. Meters, including elapsed time indicators (time totalizing meters), shall be in accordance with MIL-STD-454, Requirement 51. External meter shunts shall be in accordance with MIL-STD-454, Requirement 40. Meters other than those in accordance with MIL-M-16034 for 90 mm (3.5 in) diameter, or larger, and MIL-M-10304 require procuring activity approval.

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

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

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

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

3.2.1.16 Circuit breakers. Circuit breakers shall be in accordance with MIL-STD-454, Requirement 37.

3.2.1.17 Fuses, fuseholders, and associated hardware. Fuses, fuseholders, and associated hardware shall be in accordance with MIL-STD-454, Requirement 39. For enclosures of any style other than Style A, the insulating cap of a nonindicating fuse post shall have a hole with a maximum depth of 11 mm (0.438 in) for contact with the metallic frame holding one end of the fuse to permit the insertion of a test probe 1.98 ±0.05 mm (0.078 in) in diameter for determining that the fuse has not failed. One spare fuse, of each type and rating used, shall be supplied and

attached to the equipment. Access to spare fuses for externally accessible fuseholders shall not require the disturbing of seams where calibration seals would normally be placed.

3.2.1.18 Switches. Switches shall be in accordance with MIL-STD-454, Requirement 58.

3.2.1.18.1 Rotary switches. Rotary switches shall be as specified in 3.2.1.18.1.1 and 3.2.1.18.1.2.

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

3.2.1.18.1.2 Materials. Materials used in the construction of rotary switches shall be as specified in a through c:

a. Contacts shall be gold alloy, gold-plated, silver alloy, or silver-plated and shall be self-cleaning.

b. Shafts shall be aluminum or corrosion-resistant material.

c. Metal parts, other than contacts and shafts, shall be made of corrosion-resistant material, except that bushing and bearing assemblies may be brass treated to prevent corrosion.

3.2.1.19 Electrical connectors. Electrical connectors, except power connectors, shall meet the requirements of 3.3.1.9.4.1 and be in accordance with MIL-STD-454, Requirements 1 and 10. Power connectors shall meet the requirements of 3.4.

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

3.2.1.21 Jacks. Jacks shall be as specified in 3.2.1.21.1 through 3.2.1.21.3.

3.2.1.21.1 Jacks, headset. Headset jacks shall be JJ-034 in accordance with MIL-J-641.

3.2.1.21.2 Jacks, microphone. Microphone jacks shall be JJ-033 in accordance with MIL-J-641.

3.2.1.21.3 Jacks, switching. When circuit switching jacks are required, such jacks shall accommodate, as applicable, either plug PJ-068 (three-contact) or plug PJ-055B (two-contact) of MIL-P-642.

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

3.2.1.23 Wire, hookup. Hookup wire shall be in accordance with MIL-STD-454, Requirement 20.

3.2.1.24 Cable, coaxial, radio frequency (RF). RF Coaxial cable shall be in accordance with MIL-STD-454, Requirement 65.

3.2.1.25 Cable, multiconductor. Multiconductor cable within the equipment shall be in accordance with MIL-STD-454, Requirement 66.

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

3.2.1.27 Threaded parts. Threaded parts shall be in accordance with MIL-STD-454, Requirement 12, except that threads shall be in accordance with MIL-S-7742 modified as in a through c:

a. Threads for screws, bolts, nuts, and similar devices shall be chosen from the recommended selection specified in the Recommended selection paragraph of MIL-S-7742. When used for adjustment, the threads may be of fine or extra fine thread series.

b. When MIL, AN, or other specifications for components, such as variable resistors and switches, are in conflict with the requirements of a, the requirements of the specification for the component shall apply.

c. Commercial threads in general use for mounting standard components are acceptable.

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

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

3.2.1.30 Springs. Springs shall be in accordance with MIL-STD-454, Requirement 41.

3.2.1.31 Knobs and handles, control. Knobs and handles for controls shall be in accordance with MIL-STD-454, Requirement 28.

3.2.1.32 Handles, enclosure. Handles for enclosures shall be in accordance with 3.6 for the enclosure style.

3.2.1.33 Latches, enclosure. Latches for enclosures shall be in accordance with 3.6 for the enclosure style.

3.2.1.34 Casters. Casters shall be in accordance with MIL-C-4751 or MIL-C-7474 as specified in the associated detail specification.

3.2.1.35 Valves, pressure equalizing. Pressure equalizing valves shall be of the automatic two-way type with manual override.

3.2.1.36 Flexible shafts for tuning dial mechanisms. Flexible shafts used in tuning dial mechanisms shall be in accordance with MIL-STD-454, Requirement 42.

3.2.1.37 Tools, special. Special tools shall be in accordance with MIL-STD-454, Requirement 63.

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

3.2.1.39 Fungus-inert materials. Inherently fungus-inert materials in accordance with MIL-STD-454, Requirement 4 shall be used.

3.2.1.40 Fibrous material, organic. Organic fibrous material shall be in accordance with MIL-STD-454, Requirement 44.

3.2.1.40.1 Wood. Wood shall not be used as an electrical insulator, and the use of wood for other purposes shall be restricted to those parts for which a superior substitute is not known. When used, wood shall be pressure-treated and impregnated to resist moisture, insects, and decay with a water-borne preservative conforming to TT-W-00571, and shall be made fire retardant by treatment in accordance with MIL-L-19140.

3.2.1.40.2 Sandwich panels. When aluminum-wood sandwich panels are specified in the associated detail specification, the wood shall not be treated as specified in 3.2.1.40.1. The wood used shall conform to NN-P-530 and the adhesive bonding of the aluminum shall conform to MMM-A-138.

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

3.2.1.41.1 Electrical tape. Fabric (textile) or plastic pressure-sensitive (adhesive or friction) tape shall not be used for electrical insulating purposes.

3.2.1.41.2 Sleeving on conductors. Sleeve insulation shall be in accordance with MIL-STD-454, Requirement 11.

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

3.2.1.43 Adhesives. Adhesives shall be in accordance with MIL-STD-454, Requirement 23.

3.2.1.44 Lubricants. Lubricants shall be in accordance with MIL-STD-454, Requirement 43.

3.2.1.45 Glass. All glass used in equipment 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. Consideration shall be given to the use of glareproof glass when the equipment to be viewed will be illuminated from outside light sources. Where extreme temperature differential may exist between the two faces of viewing glasses or windows with the possibility of moisture condensation resulting therefrom, provisions for the absorption of the condensation shall be made. All glass shall be shatterproof in accordance with MIL-G-3787, Class 1, Grade C.

3.2.1.46 Metals and metal treatments. Metals shall be of corrosion-resistant types, or shall be processed to resist corrosion. Standard MS or AN parts will not require refinishing.

3.2.1.46.1 Dissimilar metals. Selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-454 Requirement 16.

3.2.1.46.2 Nonferrous metals. Gold, nickel, chromium, rhodium, tin, lead-tin alloys, or platings of these metals, are satisfactory without additional protection or treatment other than buffing or cleaning.

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

3.2.1.46.4 Aluminum alloys. Aluminum alloys shall be as specified in 3.2.1.46.4.1 through 3.2.1.46.4.3.

3.2.1.46.4.1 Aluminum surfaces, general. Parts fabricated from aluminum 1100, alloys 3003, 5052, 6053, 6061, 6063, or 7072 shall be cleaned in accordance with MIL-S-5002 and may be used with or without other surface treatment. Other aluminum alloys shall be cleaned in accordance with MIL-S-5002, and shall be anodized in accordance with MIL-A-8625, Type I or II, or given a chemical treatment using materials conforming to MIL-C-5541, Class 1A or 3.

3.2.1.46.4.2 Aluminum surfaces, bonded and grounded. When bonding or grounding, aluminum 1100, alloys 3003, 5052, 6053, 6061, 6063, 7072, or equally corrosion-resistant alloys, shall be used. These alloys may be used without other surface treatment, or given a chemical treatment in accordance with MIL-C- 5541, Class 3.

3.2.1.46.4.3 Aluminum surfaces, extreme wear-resistant. Hard anodic finishes conforming to MIL-A-8625, Type III, may be applied to obtain extreme wear resistant surfaces on areas of aluminum alloys not subject to repeated high tensile stresses.

3.2.1.46.5 Magnesium and magnesium alloys. Magnesium and magnesium alloys shall be finished in accordance with MIL-M-3171 or MIL-M-45202. Magnesium shall not be used for electrical or electronic assemblies (such as chassis with sockets, connectors, resistors, capacitors, and inductors) where grounding or contact may be impaired because of corrosion or electrolytic action. Parts which require electrical grounding or soldering may be tin plated.

3.2.1.46.6 Zinc and zinc-plated parts. Zinc parts and zinc-plated parts shall be given a dichromate treatment in accordance with ASTM B633.

3.2.1.47 Finishes, Type I. Type I finish processes shall be as specified in 3.2.1.47.1 through 3.2.1.47.3. Type I finish colors shall be in accordance with a through k.

a. Color Z. Light-gray (gloss) MIL-E-15090, Type III, Class 1.

b. Color Y. Light-gray (semigloss) MIL-E-15090, Type III, Class 2.

c. Color X. Light-gray (semigloss) FED-STD-595, No. 26307, TT-E-529, Type II.

d. Color W. Olive drab (semigloss) FED-STD-595, No. 24087, TT-E-529, Type II.

e. Color V. Yellow (gloss) FED-STD-595, No. 13538.

f. Color U. Yellow (lusterless) FED-STD-595, No. 33538.

g. Color T. Black (lusterless) FED-STD-595, No. 37038.

h. Color S. Green (Marine Corps green) FED-STD-595, No. 34094.

i. Color R. Other (color normally provided by the manufacturer).

j. Color P. Special (color, other than listed herein, specified in the associated detail specification).

k. Color N. Green (semigloss) FED-STD-595, No. 24052, MIL-C-83286, Type I or II.

3.2.1.47.1 Finishes, parts. Unless contained in hermetically sealed units, parts (including hardware items of the equipment not covered by subsidiary specifications) shall be resistant to corrosion, and there shall be no destructive corrosion, after subjection to a 48 hour salt spray test in accordance with FED-STD-151. Where applicable, these parts shall have finishes providing rates of heat transfer which do not harm the parts. Parts which are lubricated in equipment may be tested in a lubricated condition. Lusterless finishes shall be used on all surfaces visible to operating personnel. Where cleaning operations on metal parts are not

specified in detail, such operations shall be in accordance with the best commercial practices which will not cause subsequent destructive corrosion (see 6.4.2.12).

3.2.1.47.2 Finishes, enclosure. Unless color is impregnated into the material or is otherwise specified by the procuring activity, enclosures shall be finished with enamel or urethane coating. Lacquer in any form shall not be used for equipment which contains vinyl such as that used for electrical insulation. The finish shall be enamel as specified for Color Y, if weather-protected, and as specified for Color Z, if weather-exposed. Test equipment for use in the vicinity of aircraft shall be finished with Color V enamel or Color N urethane in accordance with the color classification of the equipment. The front panel finish shall be as specified for the enclosure, or may be black anodized finish conforming to the finish of Color T. When equipment for use in the vicinity of aircraft has panels finished with yellow, the finish shall be Color U.

3.2.1.47.2.1 Finishes, enamel. For enamel finishes, zinc chromate primer in accordance with TT-P-1757 shall be applied prior to application. Two coats of enamel shall be used, each applied as a continuous film of approximately 0.03 mm (0.001 in) thickness. Finishes in accordance with MIL-F-14072, Type I may be used in lieu of the two coats of enamel except that colors specified herein shall be used. Finishes in accordance with MIL-C-85285 may be substituted. MIL-P-85582 may be used in lieu of primers authorized by MIL-C-85285.

3.2.1.47.3 Finishes, fastener and assembly screw. Exposed surfaces of external fasteners and assembly screws which are manipulated, loosened, or removed in the normal processes of servicing and installing the equipment shall be finished, preferably in a noncorrosive black or bright finish, to provide strong contrast with the color of the surface upon which these fasteners and screws appear. Other external fasteners and assembly screws used for securing the internal parts to the chassis shall be similar in color to the surface upon which they appear.

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

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

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

3.2.1.51 Soldering. Soldering shall be in accordance with MIL-STD-2000.

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

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

3.2.2 Parts, materials, and processes, Type II. Unless otherwise specified in the associated detail specification, the parts, materials, and processes requirements for Type II shall be the same as Type III.

3.2.3 Parts, materials, and processes, Type III. All parts, materials, and processes used in Type III equipment shall permit the equipment to comply with all applicable requirements of its class.

3.2.3.1 Finishes, Type III. Unless otherwise specified in the associated detail specification, the finish color of Type III equipment shall be Color R and the finish process shall be as normally provided for the equipment (see 3.2.1.47).

3.2.3.2 Elapsed time indicators, Type III. When specified in the associated detail specification, the equipment shall be provided with an internally mounted, miniaturized, solid-state elapsed time indicator (ETI) or internal clock capable of measuring and directly indicating the actual time that the equipment is in an operating condition. With the exception of mounting configurations, the solid state ETI shall meet all requirements invoked by MIL-I-81219 for nonmercuric indicating cells. The time range full-scale reading shall be at least 5000 hours with a minimum readout resolution of 500.

3.2.4 Interchangeability. Should any conflict arise between any of the interchangeability requirements of this specification and the associated detail specification, the contractor shall immediately inform the procuring activity of such conflict. Unless otherwise advised by the procuring activity representative, the interchangeability requirements specified in the associated detail specification shall govern.

3.2.4.1 Interchangeability, Type I. Interchangeability shall be in accordance with MIL-STD-454, Requirement 7.

3.2.4.1.1 Interchangeability of reordered equipment. For reordered equipment, interchangeability shall exist between units and all replaceable assemblies, subassemblies, and parts of a designated model of any previously manufactured equipment supplied or designated by the procuring activity. Such interchangeability shall be measured against the designated model, manufacturing drawing, or other technical information provided for the purpose. When the contract or order does not stipulate whether the model, drawings, or other information shall govern, the designated model shall be used.

3.2.4.2 Interchangeability, Type II. Unless otherwise specified in the associated detail specification, the interchangeability requirements for Type II shall be the same as Type III.

3.2.4.3 Interchangeability, Type III. Type III interchangeability shall be as specified in a and b:

a. Units and all replaceable assemblies, subassemblies, and parts of a designated model provided under a single contract or order from any manufacturer shall be fully interchangeable.

b. All replaceable assemblies, subassemblies, and parts of a designated model provided by a manufacturer shall be interchangeable on a noninterference basis with all such designated models provided by that manufacturer on previous contracts or orders. Different suffix letters or other suitable identifiers acceptable to the procuring activity shall constitute different models for this requirement.

3.2.5 Restricted materials. Restricted materials shall be as specified in 3.2.5.1 through 3.2.5.3.

3.2.5.1 Material restricted for Navy use. Regardless of other requirements, the materials and parts specified in a through c shall not be used in equipment for the Navy unless specifically approved or specified by the procuring activity and unless the presence of the materials and parts is specified in that approval or specification.

a. Mercury, including mercury batteries.

b. Radioactive material.

c. Lithium electrochemical cells exceeding authorized size, power, and chemical makeup limitations (see 3.4.1.2.6.1 and 3.4.5.2.5.1).

3.2.5.2 Other restricted materials and gases. The types or kinds of materials, specified in a through p shall not be used except where such materials are fabricated into completed approved standard parts, or use of the material is approved by the procuring activity:

a. Cellulose acetate.
b. Cellulose nitrate.
c. Cellulose regenerate.
d. Cork.
e. Felts, hair, or wool.
f. Asbestos and asbestos compounds.
g. Jute.
h. Leather.
i. Linen.
j. Magnesium and magnesium alloys.
k. Organic fiberboard.
l. Paper and cardboard.
m. Plastic (using cotton, linen, or wood flour as a filler).
n. Wood.
o. Fungus nutrients.
p. Polychlorinated biphenyls.

3.2.5.2.1 Carcinogens. 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, the materials shall be evaluated in accordance with 3.9.

3.2.5.2.2 Helium. Helium shall not be used as pressurizing gas in sealed units containing electron tubes. When necessary to use helium for leak detection purposes, exposure shall be limited to the time necessary for the test, followed by thorough purging.

3.2.5.3 Combination of materials. The equipment shall contain no combination of materials which cause deterioration of any material contained in the equipment due to the effects of outgassing.

3.3 Design and construction. The test equipment shall be designed and constructed to permit compliance with all applicable requirements of its class and the performance, accuracy, and other requirements in the associated detail specification. The basic design objectives are that the equipment will:

a. Conform to military service needs, under continuous use, for long periods, without overhaul and with limited maintenance.

b. Represent the simplest design consistent with the functional and environmental requirements specified herein and in the associated detail specification.

c. Provide adequate safety factors by derating part specification values to ensure high equipment reliability under all service conditions.

d. Be easy to install and maintain, thus reducing requirements for skilled maintenance personnel.

3.3.1 Design and construction, Type I. Type I design and construction shall be as specified in 3.3.1.1 through 3.3.1.9.4.5.

3.3.1.1 Navy standard electronic modules (SEM) program. The design of test equipment for Navy use shall be reviewed for applicability to the SEM program in accordance with MIL-HDBK-246. SEM use shall be in accordance with MIL-STD-1378.

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

3.3.1.2.1 Mechanized production. When designing new equipment, contractors shall include, when possible, circuits that have been or can be reproduced by mechanized or semimechanized production facilities consistent with the state-of-the-art.

3.3.1.2.2 Types of construction. The types of construction specified in a through d are in the mechanized or semimechanized category, and shall be considered:

a. Subassemblies using printed circuits, upon which the parts are printed or mechanically placed and electrically connected

b. Construction in which several ceramic or filled plastic wafers are placed one above the other and components printed or mounted thereon

c. Three-dimensional, or folded-type construction, in which the parts are mechanically placed and electrically connected

d. Microcircuits using deposited or printed techniques, including circuits employing combinations of these processes and discrete parts

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

3.3.1.2.3 Nonrepairable subassemblies. Nonrepairable subassemblies (see 6.4.2.22) shall be considered as nonstandard parts and the use of nonrepairable subassemblies shall be in accordance with the requirements specified for the use of nonstandard parts (see 3.2.1.1).

3.3.1.3 Human engineering. Human engineering shall be in accordance with design criteria of MIL-STD-1472, selectively applied as requirements or guidance specified in the associated detail specification.

3.3.1.4 Mechanical design and construction. Mechanical design and construction shall be as specified in 3.3.1.4.1 through 3.3.1.4.7.

3.3.1.4.1 Accessibility. Accessibility of components shall be in accordance with MIL-STD-454, Requirement 36, and as specified herein (see 3.13.1.4).

3.3.1.4.2 Thermal design. Thermal design shall be in accordance with MIL-STD-454, Requirement 52 and as specified herein. The equipment shall be capable of operating continuously for 24 hours, at the maximum operating temperature for the applicable class, when restricted on the top, sides, and rear with a clearance of 50 mm (2 in). All blowers or fans necessary for the cooling system shall be internal to the enclosure and shall generate no noise in excess of the acoustic noise

limitations of 3.7.12. If forced air cooling is used, the motor shall be capable of operating from all specified power sources and an externally accessible air filter shall be provided. A thermal switch shall be provided which will interrupt the power source when the internal temperature rises to the degree of possible damage to the equipment. When specified in the associated detail specification, an override switch shall be provided for the thermal switch. Except for Hall effect motors, direct current (dc) or brush type motors shall not be used. Ventilation openings, including air intake and exhaust openings for forced air cooling, shall be in accordance with a through g.

a. Style A enclosure may have air intake and exhaust openings in the front panel.

b. Style B enclosure shall have no ventilation openings located on the top of the enclosure or in the front panel. Ventilation openings on the sides or rear shall be protected by louvers.

c. Style C enclosure shall have no ventilation openings located on the top of the enclosure. Ventilation openings on the sides or rear shall conform to 3.7.6.3.

d. Styles D through F enclosure ventilation openings shall not prevent the equipment from conforming to the applicable requirements. Style D and E enclosures shall have no ventilation openings located on the top of the enclosure.

e. Style G enclosure shall be provided with vents to preclude a temperature rise of more than 10°C from intake to output, and when forced ventilation is required to provide satisfactory cooling, the cooling system shall be so arranged that a positive pressure is maintained on the enclosed equipment. Intake louvers shall be not less than 450 mm (18 in) above the surface on which the enclosure stands.

f. Styles P and T enclosures shall not have ventilation openings.

g. Style S enclosures may have closeable ventilation flaps corresponding to the allowable ventilation openings of the enclosed equipment.

3.3.1.4.3 Moisture pockets. Moisture pockets shall be in accordance with MIL-STD-454, Requirement 31.

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

3.3.1.4.5 Lubrication requirements. Test equipment shall be designed to minimize the need for lubrication and the use of lubricants.

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

3.3.1.4.7 Tuning dial mechanisms. Tuning dial mechanisms shall be in accordance with MIL-STD-454, Requirement 42.

3.3.1.5 Mounting and fastening. Mounting and fastening shall be as specified in 3.3.1.5.1 through 3.3.1.5.4.

3.3.1.5.1 Resistor and capacitor mounting. Resistors shall be securely mounted in such a manner as to allow for expansion with temperature changes. Capacitors shall be securely mounted. Resistors and fixed capacitors shall not be mounted by their wire leads without providing other mechanical support for the body of the component, except that components whose weight is 15 grams (0.5 ounce) or less may be secured by their leads if the total length of both leads measured between the points on the component from which the leads egress and the midpoints of the lead attachment terminals does not exceed 25 mm (1 in). In no case shall the wire leads be less than 6.5 mm (0.25 in) for components with axial leads, except for printed circuit applications and in nonrepairable items (see 6.4.2.22).

3.3.1.5.2 Receptacle and connector mounting. When receptacles are mounted on a vertical surface the largest polarizing or prime key or keyway of the receptacle shall be at the top center of the shell of the receptacle.

3.3.1.5.2.1 Connectors, similar. The use of similar connectors for interconnecting cables shall be minimized. When used, similar connectors shall utilize differences in insert arrangement or size, or keying, to prevent misconnections, unless the connectors are functionally interchangeable.

3.3.1.5.3 Toggle switch mounting. Toggle switches shall be mounted so that the handle of the switch operates up and down for vertical control panels (away from and toward the operator for horizontal panels). Any OFF position shall be in the bottom (toward the operator) position, except that switches with three positions shall use the center position for OFF. When clarification of a control function or convenience of operation would result, toggle switches may be mounted so that the handle of the switch operates as a left-right function when the control panel is viewed from the normal operating position.

3.3.1.5.4 Fastening of brittle materials. Fastening of brittle materials shall be in accordance with MIL-STD-454, Requirement 12.

3.3.1.6 Controls. Controls shall be in accordance with 3.3.1.6.1 through 3.3.1.6.3.1 and MIL-STD-454, Requirement 28.

3.3.1.6.1 Control circuitry. Control circuitry shall be as specified in 3.3.1.6.1.1 through 3.3.1.6.1.3.

3.3.1.6.1.1 Control function. The characteristics of each control shall be such as to provide the desired control action under all specified service conditions.

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

3.3.1.6.1.3 Interaction. The variation of any control shall produce only those changes for which the control was designed.

3.3.1.6.2 Operating controls. Dials, indicators, and controls shall be of the direct reading type, without need for calibration charts or curves.

3.3.1.6.3 Nonoperating controls. Adjustments or compensating devices shall be provided so that any function or parameter can be adjusted to within the specified limits after a combined shelf and usage time of 12 months.

3.3.1.6.3.1 Nonoperating accessibility. Nonoperating (adjustment) controls shall be grouped and marked with their required test points (see 3.10.1.1.6), unless precluded by design constraints.

3.3.1.7 Test provisions. Test provisions shall be in accordance with MIL-STD-454, Requirement 32 and a and b below:

a. Built-in calibration, self-test, and diagnostic capabilities shall be included in the design of the equipment.

b. Test points required for monitoring of signal or power adjustments shall be readily accessible and marked for use in conjunction with the specific adjustments or nonoperating control.

3.3.1.8 ATE. ATE shall be designed to operate from a calculator controller or computer, or from an integral programming medium. In the case of a calculator controller or computer, the method for automatic control, measurement, and limit compensation shall be fully disclosed.

3.3.1.8.1 Manual control. The extent of manual control over the conditions specified in a through d shall be as specified in the associated detail specification:

a. Setting the parameters of the ATE.
b. Direct access to specific test.
c. Repeat of test.

d. Test abort.

3.3.1.8.2 Preferred logic elements. Solid-state or microelectronic devices (see 6.4.2.21) shall be used as logic and switching elements where practical. The use of relays or stepping switches shall be held to a minimum.

3.3.1.8.3 Self-test capability. Self-test capability shall be included so that essential functional capabilities of the ATE normal to the conduct of the test programs may be determined to be operational and within the limits identified in the associated detail specification for the test programs. This capability shall include sensing of catastrophic conditions on the unit-under-test (UUT) that may cause failure of the ATE and provide for disconnection of the ATE from this connection. The associated detail specification may include additional self-test capabilities such as those specified in a through c:

a. Isolation of ATE faults to the replaceable module or assembly.

b. Further fault isolation on the module or assembly to the replaceable part.

c. Tests to preclude use of the wrong program or adapter with the UUT.

3.3.1.9 Electrical design and construction. Electrical design and construction shall be as specified in 3.3.1.9.1 through 3.3.1.9.4.5.

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

3.3.1.9.2 Corona and electrical breakdown prevention. Corona and electrical breakdown prevention shall be in accordance with MIL-STD-454, Requirement 45.

3.3.1.9.3 Wiring, internal. Internal wiring practices shall be in accordance with MIL-STD-454, Requirements 66 and 69 and as specified in 3.2.1.25, 3.3.1.9.3.1, and 3.3.1.9.3.2 below.

3.3.1.9.3.1 Metallic shielding. Metallic shielding shall be suitably bonded to the chassis, unless part of an above-ground system.

3.3.1.9.3.2 Printed wiring. Printed wiring shall be in accordance with MIL-STD-454, Requirement 17. Printed wiring boards shall be connected into the equipment by a mated pair of connectors, and shall not use the printed circuit pattern as one of the connectors.

3.3.1.9.4 Wiring, external. Provisions shall be made for external wiring in accordance with MIL-W-5088.

3.3.1.9.4.1 Cables, connectors, and cable assemblies. Cables, connectors, and cable assemblies (interconnecting) shall furnish satisfactory electrical connections

and shall be so arranged and wired that no energized leads are terminated in pins or other exposed contacts which might be accidentally shorted. The live or hot side of unmated connectors shall be socket rather than pin type.

3.3.1.9.4.2 Shielded cables. The shield shall be grounded within the equipment when the cable is an integral part thereof. The shield shall be grounded to the metal shell of the connector when a connector is used on the cable. Except for coaxial cable a ground lead shall be included in the cable rather than depending on the shield for ground connections. The shield shall be securely bonded to the ground lead at least at one point on the cable in a manner designed to minimize impedance between the shield and the ground lead, except when this requirement conflicts with the associated detail specification or the electromagnetic interference (EMI) requirements specified in 3.8.

3.3.1.9.4.3 Cables and waveguide for RF circuits. All pulsed or RF signals shall use coaxial cable or waveguides. The preferred impedance for termination of coaxial cable is 50 ohms.

3.3.1.9.4.4 Coding. Leads in multiconductor cable assemblies and harnesses shall be color coded. The color coding sequence shall be in accordance with MIL-STD-681. Types of marking other than color coding require approval from the procuring activity.

3.3.1.9.4.5 Cables, extra conductor. Equipment test cables, interconnecting cables, and patch cables which are of molded construction or terminate in molded or potted electrical connectors shall have extra unused conductors. The number of extra unused conductors shall be compatible with the extra unused contacts as specified for electrical connectors in MIL-STD-454, Requirement 10.

3.3.2 Design and construction, Type II. Unless otherwise specified in the associated detail specification, the design and construction requirements for Type II shall be the same as Type III.

3.3.3 Design and construction, Type III. The design and construction of Type III equipment shall permit the equipment to comply with applicable requirements of its class and those specified in 3.3.3.1 through 3.3.3.7.

3.3.3.1 Operator adjustments and controls. Operator adjustments and controls shall be as specified in 3.3.3.1.1 and 3.3.3.1.2.

3.3.3.1.1 Operator adjustments. Built-in adjustments or compensating devices which are capable of restoring the equipment to specified tolerance shall be included in the equipment for any function or parameter in which the combined time of shelf life and usage for a period of 12 months causes the equipment to exceed the calibration interval specified in 3.11. The variation of any adjustment or control shall produce the desired control action for which it was incorporated, under all specified service conditions.

3.3.3.1.2 Operator controls. Operating controls, dials, and indicators shall be located on the front panel of the unit. Operating controls, dials, and indicators shall be readily accessible and of the direct reading type.

3.3.3.2 Connectors, electric. Provision shall be made to ensure that connectors will be mated only with the appropriate counterparts. Where design considerations require close proximity of connectors of similar configuration, the mating connectors shall be suitably coded or marked. The live or hot side of unmated connectors shall be protected against electric shock or shorting by use of recessed guards or barriers.

3.3.3.3 Wiring, internal. Internal wiring practices shall be such that when assembling or disassembling the equipment for maintenance or calibration, the possibility of the internal wiring being damaged is minimal.

3.3.3.4 Internal cooling. The equipment shall be capable of operating continuously for 24 hours at the maximum continuous operating temperature for the applicable class.

3.3.3.4.1 Cooling devices. If adequate cooling requires an internal fan or blower, the requirements specified in a through f shall apply:

a. The device shall be a replaceable maintenance part.

b. The device shall not require an additional power source input.

c. The device shall not interfere with any operation of the instrument through noise, electrical interference, or vibration.

d. Brush type motors shall not be used.

e. Filters, if required to minimize dust intake, shall be externally accessible for cleaning or replacement.

f. The temperature of the device shall not exceed the specified limits of 3.9.3.5 even when mechanically stopped while energized. The use of thermal cut-outs is permitted.

3.3.3.5 Front panel display indicators. Front panel display indicators which are designed to present change-of-state information to the operator shall be distinguishable at a distance of 3 m (10 ft) in a maximum ambient light level of 100 foot-candles (fc) and a minimum light level of 1 fc. In-line horizontal single plane display characters shall be at least 10 mm (0.4 in) in height. Equipment specified for use at arm's length may use numeric readout characters of 3 mm (0.12 in). All display indicators shall be discernible at viewing angles from 0 degrees to 45 degrees.

3.3.3.6 Self-test capability. When specified in the associated detail specification, an automatic diagnostic self-test (see 6.4.2.29) capability shall be provided. A display resulting from the self-test shall indicate either proper operation or specific circuit board or major assembly failures.

3.3.3.7 Unsuitable design. The following design characteristics are unsuitable.

a. Integrated circuits soldered on top of one another.

b. Wires supported only by solder.

c. Inoperative controls.

d. Printed circuit boards that are modified by cutting a circuit run unless the cut is at least 3.2 mm (0.125 in) in length and marked by a permanent red "X". Circuit cuts shall be annotated in the equipment service manual.

3.3.4 Digital interface. When specified in the associated detail specification, a digital interface shall be provided in accordance with IEEE-STD-488.1 and as specified in 3.3.4.1 and 3.3.4.2 below.

3.3.4.1 Programming characteristics. The measurement information to be transferred by the digital interface shall be as specified in the associated detail specification. The digital interface shall have the programmable capability to control each device function including all ranges, modes, and levels. Primary power control and other nonmeasurement functions need not be bus programmable.

3.3.4.2 Interface requirements. The instrument shall comply with the capabilities of ANSI/IEEE-STD-488.2 required by the associated detail specification. The interface functions and subset identifications specified in a through j shall be considered for determining equipment requirements.

a. Source handshake SH1.
b. Acceptor handshake AH1.
c. Talker T1 or TE1.
d. Listener L1 or LE1.
e. Service request SR1.
f. Remote local RL1.
g. Parallel poll PP0.
h. Device clear DC1.
i. Device trigger DT1.
j. Controller C0.

3.4 Electrical power sources and connections. Electrical power sources and connections shall be as specified in 3.4.1 through 3.4.6.9.

3.4.1 Electrical power source, Type I. The equipment shall conform to the primary input power conditions specified in 3.4.1.1 through 3.4.1.2.8.1. Except as specified in 3.4.1.2a, the equipment shall operate within the required performance limits without the use of manually operated devices, such as tapped transformers (variable setting transformers) and other similar devices for compensation.

3.4.1.1 Power consumption, Type I. The maximum power required for operation shall be as specified in the associated detail specification.

3.4.1.2 Nominal and alternate power source, Type I. Equipment not powered from aircraft or the systems under test, and equipment not supporting aircraft multiphase systems, shall operate from a nominal 115 volt (V) single-phase 50 hertz (Hz), 60 Hz, and 400 Hz source. Alternate power source requirements which may be specified for equipment are specified in a through f. When operation is required with both external and internal power sources, the equipment shall conform to the requirements for operation from external power sources with the internal power source battery removed.

a. 50 Hz, 60 Hz, and 400 Hz single-phase 103.5 V to 126.5 V, selectable from any position of a 100/120/220/240 V range selector (see 3.4.1.2.4).

b. 400 Hz (only), single-phase 115 V (see 3.4.1.2.5).

c. 400 Hz (only), three-phase 115/200 V (see 3.4.1.2.5).

d. DC internal power source (see 3.4.1.2.6).

e. DC 28 V (see 3.4.1.2.7).

f. DC external battery pack (see 3.4.1.2.8).

3.4.1.2.1 Steady-state conditions, Type I. The equipment shall operate and maintain the specified performance and accuracy during any probable combination of a through c.

a. The steady-state voltage-tolerance band shall be 115 V ±10 percent. Variations in voltage within the steady-state voltage-tolerance band shall have no deleterious effect on the equipment performance.

b. The steady-state frequency-tolerance band shall be 50 Hz ±5 percent, 60 Hz ±5 percent, and 400 Hz ±5 percent. Variations in frequency within the steady-state frequency-tolerance band shall have no deleterious effect on the equipment performance.

c. The waveform characteristics of 1 through 4 shall have no deleterious effect on the performance of the equipment (see 6.4.1).

1. Waveform deviation factor of 10 percent or less.

2. Total harmonics of 10 percent or less.
3. Individual harmonics of 5 percent or less.
4. Crest factor of 1.27 to 1.56.

3.4.1.2.2 Transient-state conditions, Type I. There shall be no impairment of operation during transients and the transient shall not prevent resumption of normal operation. Alteration of equipment characteristics shall not occur due to the conditions specified in a through d after a maximum transient time of 500 milliseconds (ms) (at the specified limit) which recovers to within the steady-state band within 5 seconds (see figure 1). Equipment operation for transient-state conditions which persist longer than 5 seconds shall be as required for interruption of the power source. Transient values are derived from, and referenced to, the nominal values specified in a through d for voltage and frequency.

a. Voltage transients within the range of 10 percent to 30 percent shall have no deleterious effect on equipment performance. Operation may be momentarily impaired and false output signals may be generated, provided visual indication is given that the operation and signals are out of tolerance.

b. Voltage transients within the range of 30 percent to 40 percent may inhibit equipment performance and generate false output signals. Damage to the equipment shall not occur other than failure of externally accessible fuses. Normal operation shall be automatically resumed when any blown externally accessible fuses are replaced.

c. Frequency transients within the range of 5 percent to 10 percent shall have no deleterious effect on equipment performance.

d. Frequency transients within the range of 10 percent to 15 percent may inhibit equipment performance and generate false output signals. Normal operation shall be resumed when the transient has passed.

3.4.1.2.3 Interruption of power source, Type I. Voltage or frequency interruptions which are greater than the maximum transient values shall not cause damage to the equipment or alteration of equipment characteristics. Equipment performance is not specified during interruption of the power source in accordance with a and b.

a. During and after power interruptions of 500 ms or less, the equipment shall be fail-safe. The equipment shall automatically resume normal operation at the end of the interruption period.

b. During and after power interruptions of greater than 500 ms duration (outage) the equipment shall be fail-safe and suitable for normal operation. When specified in the associated detail specification, the equipment shall automatically resume normal operation after the power is restored.

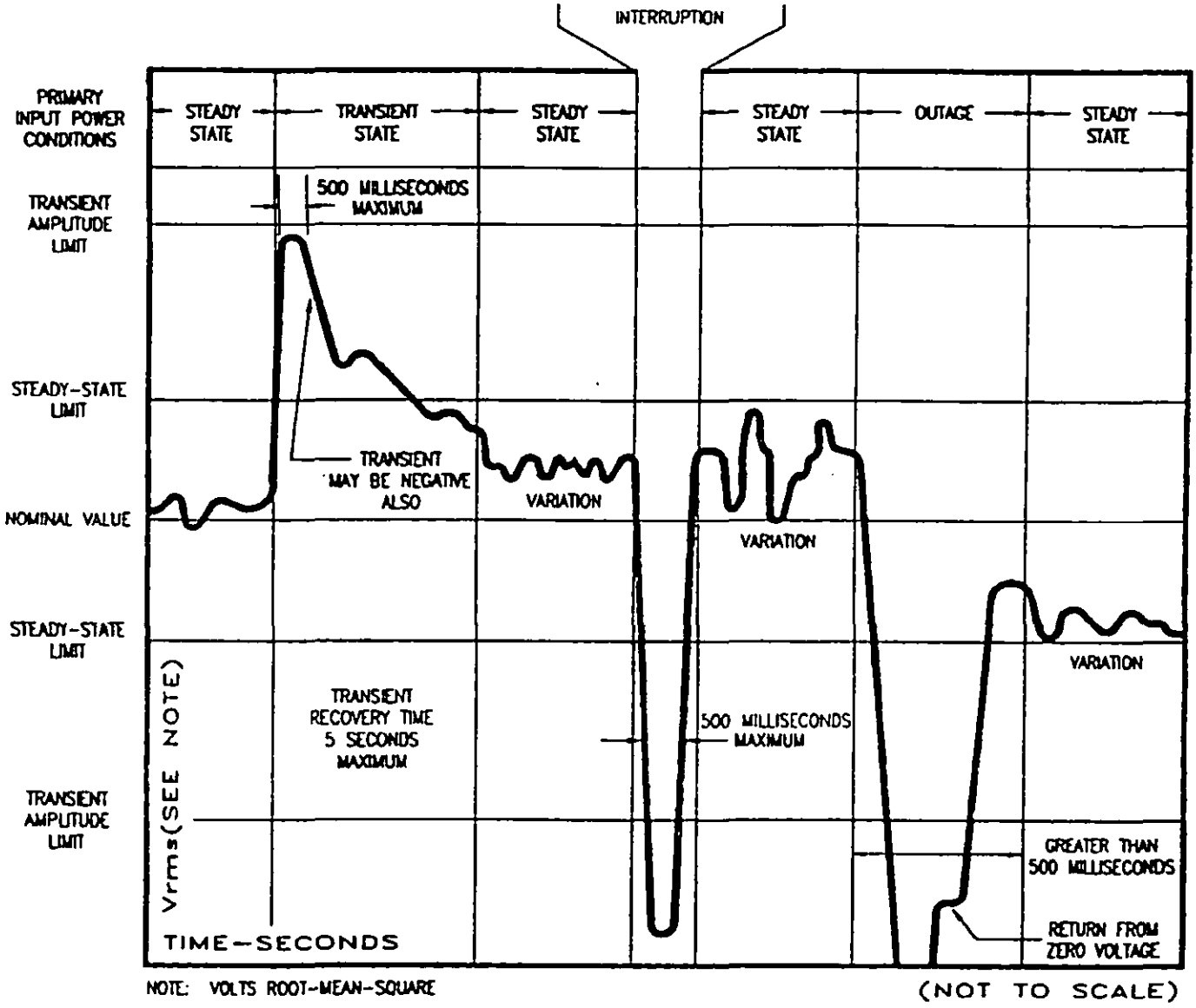


FIGURE 1. Examples of alternating current (ac) primary input voltage conditions.

3.4.1.2.4 Alternate single-phase source, Type I. Operation of the equipment shall be as required for nominal power, and conformance to all performance and accuracy requirements shall be achieved when the equipment is powered from an alternate voltage specified (such as 230 V of a 110/230 V source). The tolerance and times for steady-state, transient-state, interruption, and outage of power source requirements shall apply to the alternate power source.

3.4.1.2.5 Aircraft and shipboard power. Electrical power requirements for aircraft (airborne and flight line) and shipboard use shall be in accordance with MIL-STD-454, Requirement 25, as specified in a and b:

a. Class 2 equipment designed to be powered directly from the aircraft shall operate from 400-Hz single-phase, 115 V, or 28 Vdc as specified in the associated detail specification. Three-phase 115 V (line to neutral) power may be used when approved by the procuring activity.

b. For shipboard use, the electrical power source requirements shall be in accordance with DOD-STD-1399, Section 300.

3.4.1.2.6 DC internal power source, Type I. When specified in the associated detail specification, equipment shall be designed to operate from self-contained batteries.

3.4.1.2.6.1 Mercury and lithium batteries, Navy use of. Lithium electrochemical cells exceeding authorized size, power, and chemical makeup limitations and batteries containing mercury shall not be used in equipment for the Navy unless specifically required or approved by the procuring Navy activity and unless the presence of mercury or lithium is specified in that requirement or approval. When lithium batteries are approved, technical manuals shall reference substitute nonlithium battery types for applications where the use of lithium batteries is restricted. A label shall be affixed to the outside of the unit and shall contain the following caution and information:

THIS UNIT CONTAINS LITHIUM BATTERIES Battery Manufacturer: Battery Part Number:

3.4.1.2.6.2 Batteries, Type I. Batteries and battery warning labels for Type I equipment shall be in accordance with MIL-STD-454, Requirement 27 (see 3.10.1.1.7).

3.4.1.2.7 External DC power. Test equipment, except equipment powered from aircraft or the system under test, shall operate from a 28 ±2 Vdc source when dc operation is specified. The characteristics of the dc source shall be as specified in the associated detail specification.

3.4.1.2.8 External battery operation. When specified in the associated detail specification, the equipment shall operate from an external battery power source in accordance with a through d and 3.4.1.2.8.1.

a. The equipment shall not be damaged if the battery voltage drops below 10 V or increases to 35 V.

b. Equipment operation from the external battery power source shall not cause any internal batteries to be charged from the external source.

c. Battery leads shall not be connected to the case enclosure or safety ground of the powered test equipment.

d. The equipment power shall have polarity reversal protection.

3.4.1.2.8.1 External battery pack. When the equipment is required to operate from an external battery pack, the battery pack shall be as specified in the associated detail specification.

3.4.2 Electrical power connections, Type I. The requirements specified in 3.4.2.1 through 3.4.2.15 shall apply to Type I equipment rated at 10 amperes (A) root-mean-square (rms) or less. Power connectors and connections for equipment rated above 10A rms shall be as specified in the associated detail specification. When single-phase operation is specified, the equipment shall operate with a ground at the primary power source on either or neither side of the single-phase input power line.

3.4.2.1 Multiphase equipment, Type I. Except as specified for leakage current (see 3.9.1.1.2), equipment requiring multiphase power shall be as specified in the associated detail specification.

3.4.2.2 Air Force electrical power connections. Power connections for Air Force equipment shall be in accordance with MIL-C-28777, and as specified in 3.4.2.2.1 and 3.4.2.2.2.

3.4.2.2.1 Enclosures for Air Force flight line use, Style A. The input power cable shall be in accordance with MIL-C-28777 and the associated detail specification, as applicable. The mating receptacle specified to mate with the power cable shall be mounted on the front panel of the equipment. The cable shall be stowed in the enclosure cover.

3.4.2.2.2 Enclosures for Air Force use, Styles B through F. For Air Force use, the input power cable for Styles B through F enclosures shall be in accordance with MIL-C-28777 and the associated detail specification. The input power cable entry shall be through the rear panel.

3.4.2.3 Army electrical power connections. For Army use, the electrical power connections shall be as specified in MIL-P-11268.

3.4.2.4 Navy electrical power connections. For Navy use, the electrical power connections shall be as specified in a and b:

a. For Navy general purpose electronic test equipment (GPETE), the requirements for power source connections shall be in accordance with MIL-C-28777. Equipment specified for operation from a 115/230 V power source shall be provided with a removable 115 V power cable and provisions shall be incorporated for an optional 230 V power cable.

b. For Naval Air Systems Command use, except for GPETE, the primary power cables shall use flexible cable conforming to MIL-C-3432, as applicable, and shall be in accordance with MIL-STD-1653 for equipment with ratings up to 10A rms.

3.4.2.5 Power cable strain relief. Strain relief shall be provided for permanently attached power cables. The power cable entry for enclosure Styles B, C, D, and F shall be on the rear panel of the equipment. Equipment delivered in a Style A enclosure, with the input power receptacle mounted on the front panel, shall have strain relief provided at the cable connector.

3.4.2.6 Power switch. The equipment shall include a power switch to break all poles of the source except the safety grounding conductor when in the OFF (power source disconnected) position. The switch shall interrupt the power between the external source and any power line fuse. The switch shall be marked to identify its function and the ON position.

3.4.2.6.1 Power disconnect switch. Style A enclosures shall be provided with a switch which ensures that any battery source is disconnected when the cover of the enclosure is closed, or the cover shall be designed so that it is mechanically impossible for the cover to be closed and latched if the battery power switch is in the ON position.

3.4.2.7 Power selection switch. A switch for selecting the desired operating power and proper fuses shall be located on the front panel. The power selection switch shall be recessed below the front panel or shall have provisions incorporated to prevent accidental switching. A common screwdriver shall be used to change the position of the power selection switch. The equipment shall not be damaged if the power selection switch is placed in the wrong position while the equipment is operating. The switch positions shall be clearly marked to identify the source selected for operation.

3.4.2.8 Fuses. The input power line shall be fused in accordance with the requirements of 3.2.1.17. The fuses on Styles A, C, F, and all convertible enclosure styles, shall be externally accessible at the front panel. Except for convertible enclosures, the fuses on Styles B, D, and E shall be externally accessible at the front or rear panel. Fuses required for equipment internal circuitry protection shall be located as specified herein for the enclosure style.

3.4.2.8.1 Fuses, multiple source. Separate fuses shall be provided for each power source specified in the associated detail specification (ac, dc, internal battery, external battery). The power selection switch shall place the proper fuses in the input power circuit.

3.4.2.8.2 Circuit breakers. Circuit breakers may be used to conform to the fusing requirements of 3.4.2.8 and 3.4.2.8.1.

3.4.2.9 Indicator lamp, external power. A front panel indicator lamp shall be provided to indicate when the equipment is energized from the specified external power source.

3.4.2.10 Indicator, internal battery power. A visual indication shall be provided when the equipment is energized from an internal battery source. Visual indication of the ON state may be accomplished by digital displays, green lamps, or other means which clearly identify excitation from the power source.

3.4.2.11 Input power isolation. Except for charging the internal battery when operating from ac, isolation shall be provided between ac and dc input power sources.

3.4.2.12 Battery operation and recharge time, Type I. When battery operation is required, the operating and recharge time shall be as specified in the associated detail specification.

3.4.2.13 Battery charger, Type I. Equipment designed to operate from internal rechargeable batteries shall have an internal battery charger capable of charging the batteries when the equipment is connected to the specified ac power source. The charging circuit shall not load the internal battery(s) when the equipment is disconnected from the ac power source; if mechanical or electrical disconnection of the charging circuit is required by the design such disconnection shall be provided for by means other than manual switching. When rechargeable batteries and charger are required, an automatic protective device shall be included to prevent overcharging the batteries.

3.4.2.14 Battery compartment, Type I. An externally accessible battery compartment with a cover shall be provided on Styles A, B, and C to facilitate user removal and installation. The compartment shall not give access to any internal adjustments or parts that might give cause to recalibrate the equipment. The battery compartment shall be mechanically isolated and sealed against fumes, gasses, and electrolyte leakage to preclude damage to other parts of the equipment and shall provide for mechanical disassembly or accessibility to allow cleaning in the event of leaking or deteriorated batteries. The battery polarity, voltage, and type shall be marked in a prominent place on or adjacent to the battery compartment. When specified in the associated detail specification, the battery compartment specified for Styles A, B, and C shall be provided for any style.

3.4.2.15 Battery access, rack-mounted equipment. Nonrechargeable batteries used for primary power shall be accessible from the front panel on rack-mounted equipment.

3.4.3 Electrical power source, Type II. Unless otherwise specified in the associated detail specification, the power source requirements for Type II equipment shall be the same as for Type III equipment.

3.4.4 Electrical power connections, Type II. Unless otherwise specified in the associated detail specification, the power connection requirements for Type II equipment shall be the same as for Type III equipment.

3.4.4.1 Air Force electrical power connections, Type II. Power connections for Air Force equipment shall be in accordance with MIL-C-28777, and as specified herein.

3.4.5 Electrical power source, Type III. The equipment shall operate from the input power conditions specified in 3.4.5.1 through 3.4.5.2.6. When multiple power source requirements are invoked, the equipment shall operate within each required range without changing manually operated devices such as tapped transformers (variable setting transformers) and other similar devices for compensation. When multiple power source requirements are invoked, all selectable power setting controls shall be externally accessible.

3.4.5.1 Power consumption, Type III. The maximum power for operation shall be as specified in the associated detail specification.

3.4.5.2 Nominal and alternate power source, Type III. The equipment shall operate from a 103.5 V to 126.5 V single-phase 50 Hz and 60 Hz source (see table II). Alternate power source requirements which may be required for equipment are specified in a through e.

a. 50 Hz, 60 Hz, and 400 Hz single-phase 103.5 V to 126.5 V.

b. 50 Hz, 60 Hz, and 400 Hz single-phase 103.5 V to 126.5 V, selectable from any position of a 100/120/220/240 V range selector.

c. 50 Hz, 60 Hz, and 400 Hz single-phase 103.5 V to 126.5 V/207 V to 253 V (see 3.4.5.2.4).

d. DC internal power source (see 3.4.5.2.5).

e. DC external power source (see 3.4.5.2.6).

Equipment which is designed to operate from both external and internal power sources shall conform to specified performance and accuracy requirements when operated from the external source with the internal battery removed. There shall be an external indication of the selected power range.

TABLE II. Type III power source.

Voltage			
	Steady-state	Transient-state	Interruption
Nominal	103.5 to 126.5	80.5 to 103.5 126.5 to 149.5	0 to 80.5
Alternate (see 3.4.5.2.4)	207 to 253	161 to 207 253 to 299	0 to 161
Frequency (Hz)			
	Steady-state	Transient-state	Interruption
Nominal	47.5 to 52.5	45 to 47.5 52.5 to 57	0 to 45
	57 to 63	54 to 57 63 to 66	0 to 54
Alternate (see 3.4.5.2.4)	380 to 420	360 to 380 420 to 440	0 to 360

3.4.5.2.1 Steady-state conditions, Type III. The equipment shall operate in the specified performance and accuracy requirements during any probable combination of a through c:

a. The steady-state voltage-tolerance bands shall be 103.5 V to 126.5 V, and 207 V to 253 V. Variations in voltage at any point within the steady-state voltage-tolerance bands shall have no deleterious effect on the performance of the equipment.

b. The steady-state frequency-tolerance bands shall be 47.5 Hz to 52.5 Hz, 57 Hz to 63 Hz, and 380 Hz to 420 Hz. Variations in frequency at any point within the steady-state frequency-tolerance bands shall have no deleterious effect on the performance of the equipment. Limited frequency capability for 50 Hz, 60 Hz, or 400 Hz operation may be specified in the associated detail specification for equipment requiring a fan or blower.

c. The waveform characteristics of 1 through 4 shall have no deleterious effect on the performance of the equipment (see 6.4.1).

1. Waveform deviation factor of 10 percent or less.

2. Total harmonics of 10 percent or less.
3. Individual harmonics of 5 percent or less.
4. Crest factor of 1.27 to 1.56.

3.4.5.2.2 Transient-state conditions, Type III. Operation of the equipment during voltage and frequency transients shall be in accordance with a and b for transients which recover to within the steady-state tolerance band within 500 ms.

a. Voltage transients with maximum values of 80.5 V and 149.5 V may impair the equipment performance momentarily, but shall not prevent resumption of normal operation for longer than 30 seconds following the transient or cause loss of information stored in a volatile memory. Testing shall be in accordance with 4.5.5.6.3.

b. Frequency transients with maximum values of 54 Hz and 66 Hz may impair the equipment performance momentarily, but shall not prevent resumption of normal operation for longer than 30 seconds following the transient or cause loss of information stored in a volatile memory. Testing shall be in accordance with 4.5.5.6.4.

Transient values are derived from, and referenced to, the nominal values specified for voltage and frequency.

3.4.5.2.3 Interruption of power source, Type III. Voltage or frequency interruptions greater than the maximum transient amplitudes shall not cause damage to the equipment. Equipment performance is not required during interruption of the power source. After power interruptions of any duration, the equipment shall automatically resume operation at either the last operating condition before interruption, or a default power-up condition.

3.4.5.2.4 Alternate single-phase source, Type III. When the equipment is designed to operate from a 207 V to 253 V, or 380 Hz to 420 Hz alternate single-phase source, the tolerance and times of the steady-state, transient-state, and interruption of power source requirements shall apply to the alternate power source.

3.4.5.2.5 DC internal power source, Type III. When specified in the associated detail specification, equipment shall be designed to operate from self-contained batteries.

3.4.5.2.5.1 Battery restrictions, Type III. Battery restrictions shall be as in a and b:

a. For Army applications, maximum use will be made of standard, nomenclatured battery-power sources. The use of nonstandard, nonnomenclatured batteries requires the approval of the cognizant Army procuring activity.

b. For Navy applications, lithium electrochemical cells and batteries containing mercury shall not be used in equipment unless specifically required or

approved by the procuring Navy activity. When lithium batteries are approved, technical manuals shall reference substitute nonlithium battery types, and all necessary modifications, for applications where the use of lithium batteries is restricted. A label shall be affixed to the outside of the unit and shall contain the following caution and information:

THIS UNIT CONTAINS LITHIUM BATTERIES Battery Manufacturer: Battery Part Number:

3.4.5.2.5.2 Battery state indicator. An indicator shall be provided to indicate when the capacity of batteries used for primary power is low. The approximate remaining operating time shall be specified in the equipment operating manual.

3.4.5.2.5.3 External battery pack. When the equipment is required to operate from an external portable battery pack, the battery pack shall be as specified in the associated detail specification.

3.4.5.2.6 DC external power source. Equipment operation from an external dc source shall be as specified in the associated detail specification.

3.4.6 Electrical power connections, Type III. The requirements specified in 3.4.6.1 through 3.4.6.9 shall apply to Type III equipment rated at 10A rms, or less. Power connectors and connections for equipment rated above 10A rms shall be as specified in the associated detail specification. When single-phase operation is specified, the equipment shall operate with a ground at the primary power source on either or neither side of the single phase input power line.

3.4.6.1 Multiphase equipment, Type III. Except as specified for leakage current (see 3.9.3.1.2), equipment requiring multiphase power shall be as specified in the associated detail specification.

3.4.6.2 Input power cable. Input power cables shall be in compliance with MIL-C-28777, Type II. When equipment is specified for operation from 115V and 230V power sources, separate 115V and 230V power cables shall be provided.

3.4.6.3 Input power switch. A front panel actuated power switch shall be provided. A standby (see 6.4.2.31) switch may be used to activate and deactivate the equipment. If such a switch is used, suitable warnings shall be placed in the operating and service manuals and in the equipment to warn the operator of possible shock hazards during servicing due to partially activated power supplies.

3.4.6.4 Power selection switch. When the configuration of the equipment requires a power selection switch, the equipment shall be provided with the switch

set to the 115 V or 120 V position and with the correct fuse installed. The switch shall be configured to guard against accidental switching.

3.4.6.5 Fuses or circuit breakers. A fuse or circuit breaker shall be provided to automatically disconnect the equipment from the source in the event of excessive current drain. The fuse or circuit breaker shall be mounted on the front panel for Style A and on the front or rear panel for Styles B through F.

3.4.6.6 Indicators. Visual indication shall be provided on the front panel to indicate when the equipment is energized. Visual indication of the ON state may be accomplished by digital displays, lamps, or other means which clearly identify excitation from the power source.

3.4.6.7 Battery operating and recharge time, Type III. When battery operation is required, the operating and recharge time shall be as specified in the associated detail specification.

3.4.6.8 Battery charger, Type III. When specified in the associated detail specification, the equipment shall provide an internal battery charger capable of charging the internal batteries when the equipment is connected to the specified ac power source. The charging circuit shall not load the internal battery when the equipment is disconnected from the ac power source; if mechanical or electrical disconnection of the charging circuit is required by the design, such disconnection shall be provided for by means other than manual switching. When rechargeable batteries and charger are required, an automatic protective device shall be included to prevent overcharging the batteries.

3.4.6.9 Battery compartment, Type III. When specified in the associated detail specification, an externally accessible battery compartment with a cover shall be provided on equipment powered from internal batteries to facilitate user removal and installation of batteries. The compartment shall not give access to any internal adjustments or parts that might give cause to recalibrate the equipment. The battery compartment shall be mechanically isolated and sealed against fumes, gases, and electrolyte leakage to preclude damage to other parts of the equipment, and shall provide for mechanical disassembly or accessibility to allow cleaning in the event of leaking or deteriorated batteries. The battery polarity, voltage, and type shall be marked in a prominent place on or adjacent to the battery compartment.

3.5 Dimensions, weight, and mechanical stability. Dimensions, weight, and mechanical stability shall be as specified in 3.5.1 through 3.5.3.1.

3.5.1 Dimensions. Dimensions shall be as specified in the associated detail specification. The required dimensions for the height, width, and depth may be specified for both maximum and partial dimensions (see 6.4.2.14).

3.5.1.1 Maximum dimensions, Navy shipboard applications. For Navy use in shipboard applications, the maximum dimensions shall not exceed a size capable of passage through hatches 508 mm (20 in) wide by 965 mm (38 in) high, reduced further

by round corners on a 254 mm (10 in) radius and through circular openings 635 mm (25 in) in diameter.

3.5.2 Weight. The maximum weight shall be as specified in the associated detail specification.

3.5.3 Mechanical stability. The equipment shall be designed to preclude tipping during normal handling and operation. Testing shall be in accordance with 4.5.7.4. This requirement is not applicable to test equipment smaller than 2000 cc (122 in^3) with a weight less than 2.5 kg (5.5 lbs), and excludes equipment which has a depth of 4.5 or more times the height, or which has a height of less than 100 mm (4 in).

3.5.3.1 Enclosure attitude. Equipment of Styles A, B, C, and D shall be mechanically stable when positioned in its normal attitude on a bench for horizontal viewing of the front panel, and when placed in its alternate attitude on the floor or deck for vertical viewing of the front panel. The size and weight limitations of 3.5.3 apply to this requirement.

3.6 Enclosure requirements. The degree of protection provided by the enclosure shall allow the complete equipment to pass those environmental tests appropriate to the specified environmental class and enclosure style. Ventilation openings, when permitted by the enclosure style requirements specified herein, shall conform to the applicable safety requirements (see 3.9.1.3 and 3.9.3.3). Enclosures for Type I equipment shall have a ventilation opening as specified in 3.3.1.4.2.

3.6.1 Enclosures, Style A. When specified in the associated detail specification, the equipment shall be fitted with a Style A enclosure (ruggedized (see 6.4.2.26) combination case). The Style A enclosure shall provide protection for the contained test equipment from the specified environmental conditions (see 6.4.2.15).

3.6.1.1 Enclosure form, Style A. Style A enclosures shall consist of a main case and a cover which allows the equipment to be operated in bench-top or portable applications when the cover is opened or removed. Ventilation openings shall be located on the front panel of the equipment.

3.6.1.1.1 Cover, Style A. The Style A enclosure shall have a detachable cover which is tight-fitting when placed in position and latched. Cover latches shall be placed to prevent the cover from being fastened in the wrong position. Loading of the cover gasket shall be limited to that necessary to effect a seal.

3.6.1.1.2 Latches, Style A. The main case and cover shall be provided with quick-opening tension latches on each of two opposing sides. The latches shall be protected from damage by contact with other objects. Spring wire shall not be used as a mechanical hold down device. The main portion of the latch shall be on the cover and the smaller portion (hook) on the main case. The latches shall not interfere with cover removal when unlatched.

3.6.1.1.3 Stacking provisions, Style A. Style A enclosures shall have a geometric configuration which will permit stacking without harm to the enclosure or its contents. The maximum stacking height (expressed as a quantity of equipment in excess of one) shall be as specified in the associated detail specification.

3.6.1.1.3.1 Projections, Style A. The main case shall be provided with two sets of projections; one set on the bottom to facilitate stacking, and one set on the rear.

3.6.1.2 Enclosure provisions, Style A. Style A enclosure provisions shall be as specified in 3.6.1.2.1 through 3.6.1.2.10.

3.6.1.2.1 Material, Style A. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.1.2.2 Component protection, Style A. Panels shall be designed so that no control, indicator, or fuseholder protrudes beyond the protection provided by recess mounting or rigid handle guards.

3.6.1.2.3 Identification plate, Style A. The identification plate shall be located on the front panel.

3.6.1.2.4 Handles, Style A. Style A equipment shall include hinged metal handles with sufficient internal clearance to allow a block 44 mm (1.75 in) by 106 mm (4.18 in) in cross section with edges rounded to a 24 mm (0.93 in) radius to pass through them. The grip portion of the handles shall be of a nonmetallic material at least 89 mm (3.50 in) in length with a 19 mm (0.75 in) diameter or other approved cross section which is shaped to fit the hand comfortably. Handles shall stop open at 90 degrees, and shall be returned to a closed position by a spring-loaded or retaining mechanism when not in use. Handles shall be recessed or protected. A handle located on the top of the enclosure shall be recessed to facilitate stacking. The number and location of handles for each rectangular enclosure shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs), and shall be as evenly distributed as feasible for easy handling. Handles shall be installed above the equipment center of gravity to ensure carrying stability. When only one handle is provided, the handle shall be located on the top or side; when two handles are required, the handles shall be located on the sides.

3.6.1.2.5 Accessory stowage, Style A. The enclosure shall have provisions in the cover or main case for the stowage of all accessories, (see 6.4.2.1) technical manuals, removable power cables, signal leads, and designated spares. Stowage shall not adversely affect the carrying stability of the equipment, and shall be contained in a manner which prevents damage to the accessories or equipment during transit. Stowed items shall be available without disturbing enclosure seams where calibration seals would normally be placed.

3.6.1.2.6 Corners, Style A. All corners shall be rounded to preclude injury to personnel or damage to other material. All corners shall be adequately reinforced

to protect the instrument from damage during the environmental conditions specified for the enclosure.

3.6.1.2.7 Connections and controls, Style A. All external electrical connections and all operating controls shall be on the instrument panel.

3.6.1.2.8 Chassis fasteners, Style A. The chassis shall be securely fastened within the enclosure by captive screws or positive, rapid engagement fasteners through the panel.

3.6.1.2.9 Operating data, Style A. Where space permits, charts or similar data necessary for operating the test equipment shall be mounted on the front panel. Where space does not permit such mounting, the data shall be attached to the front panel by a cord or chain, or mounted inside the cover.

3.6.1.2.10 Pressure equalizing valve, Style A. A pressure equalizing valve shall be provided. The valve shall be accessible when the enclosure is closed, and shall be recess-mounted so that it does not protrude beyond the enclosure.

3.6.2 Enclosures, Style B. When specified in the associated detail specification, the equipment shall be fitted with a Style B enclosure (ruggedized equipment case). The enclosure shall be an integral part of the equipment and shall provide protection for the equipment without the benefit of a front cover (see 6.4.2.15).

3.6.2.1 Enclosure form, Style B. Style B enclosures shall be of the dripproof protected type (15 degrees) in accordance with MIL-STD-108, and shall be suitable for bench-top use.

3.6.2.1.1 Stacking provisions, Style B. Style B enclosures shall have a geometric configuration which will permit stacking without harm to the enclosure or it's contents. The maximum stacking height (expressed as a quantity of equipment in excess of one) shall be as specified in the associated detail specification.

3.6.2.1.1.1 Projections, Style B. The Style B enclosure shall be provided with two sets of projections; one set on the bottom to facilitate stacking, and one set on the rear.

3.6.2.1.1.2 Rack-mounting provisions, Style B. When rack-mounting is specified in the associated detail specification, rack-mounting conversion shall be in accordance with 3.6.11.1.1.

3.6.2.2 Enclosure provisions, Style B. Style B enclosure provisions shall be as specified in 3.6.2.2.1 through 3.6.2.2.6.

3.6.2.2.1 Material, Style B. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.2.2.2 Component protection, Style B. Panel mounted controls, indicators, and fuseholders shall conform to the bench handling requirements of 3.7.5.3 without damage. Protection may be provided by a recessed front panel or rigid handle guards. Bumper feet may be used on rear panels.

3.6.2.2.3 Identification plate, Style B. The identification plate shall be located on the front panel.

3.6.2.2.4 Handles, Style B. Style B equipment shall include hinged metal handles with sufficient internal clearance to allow a block 44 mm (1.75 in) by 106 mm (4.18 in) in cross section with edges rounded to a 24 mm (0.93 in) radius to pass through them. The grip portion of the handles shall be of a nonmetallic material at least 89 mm (3.50 in) in length, with a 19 mm (0.75 in) diameter or other approved cross section which is shaped to fit the hand comfortably. Handles shall stop open at 90 degrees, and shall be returned to a closed position by a spring-loaded or retaining mechanism when not in use. Handles shall be recessed or protected. If a handle is located on the top of the enclosure, the handle shall be recessed to facilitate stacking. The number and location of handles for each rectangular enclosure shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs), and shall be as evenly distributed as feasible for easy handling. Handles shall be installed above the equipment center of gravity to ensure carrying stability. When only one handle is provided, the handle shall be located on the top or side; when two handles are required, the handles shall be located on the sides.

3.6.2.2.4.1 Tilt bail handle. When specified in the associated detail specification, a tilt bail handle shall be used in lieu of hinged metal handles. The tilt bail handle assembly shall permit compliance with the enclosure attitude provisions as specified in 3.5.3.1. Removal of the handle or handle assembly with common tools is permitted in order to comply with maintainability as specified in 3.13.

3.6.2.2.5 Connections and controls, Style B. All external signal connections and all operating controls shall be on the front panel, except for the external power connections. The external power connections shall be on the rear panel.

3.6.2.2.6 Chassis fasteners, Style B. The chassis shall be securely fastened within the enclosure by screws or positive, rapid engagement fasteners.

3.6.3 Enclosures, Style C. When specified in the associated detail specification, the equipment shall be fitted with a Style C enclosure (semiruggedized combination case). The enclosure shall be an integral part of the equipment and shall provide additional environmental resistance required for portable use (see 6.4.2.15).

3.6.3.1 Enclosure form, Style C. Style C enclosures shall consist of a main case and a cover which allows the equipment to be operated in bench-top or portable applications when the cover is opened or removed. No openings are permitted in the top surface of the enclosure. Equipment with ventilation openings in the sides or rear shall conform to 3.7.6.3.

3.6.3.1.1 Cover, Style C. The Style C enclosure shall have a detachable cover which can be placed in position and latched. Cover latches shall be placed so that they prevent the cover from being fastened in the wrong position.

3.6.3.1.2 Latches, Style C. The main case and cover shall be provided with quick-opening tension latches on each of two opposing sides. The latches shall be protected from damage by contact with other objects. Spring wire shall not be used as a mechanical hold down device. The main portion of the latch shall be on the cover and the smaller portion (hook) on the main case. The latches shall not interfere with cover removal when unlatched.

3.6.3.1.3 Stacking provisions, Style C. Style C enclosures shall have a geometric configuration which will permit stacking without harm to the enclosure or its contents. The maximum stacking height (expressed as a quantity of equipment in excess of one) shall be as specified in the associated detail specification.

3.6.3.1.3.1 Projections, Style C. The main case shall be provided with two sets of projections, one set on the bottom to facilitate stacking, and one set on the rear. Four bumper feet of resilient material may be used in lieu of either set of projections.

3.6.3.1.4 Rack-mounting provisions, Style C. When rack-mounting is specified in the associated detail specification, rack-mounting conversion shall be in accordance with 3.6.11.1.1.

3.6.3.2 Enclosure provisions, Style C. Style C enclosure provisions shall be as specified in 3.6.3.2.1 through 3.6.3.2.8.

3.6.3.2.1 Material, Style C. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.3.2.2 Component protection, Style C. Panel-mounted controls, indicators, and fuseholders shall conform to the bench handling requirement of 3.7.5.3 without damage. Protection may be provided by a recessed front panel or rigid handle guards. Bumper feet may be used on any rear panels.

3.6.3.2.3 Identification plate, Style C. The identification plate shall be located on the outside of the enclosure main case.

3.6.3.2.4 Handles, Style C. Style C equipment shall include hinged metal handles with sufficient internal clearance to allow a block 44 mm (1.75 in) by 106 mm (4.18 in) in cross section with edges rounded to a 24 mm (0.93 in) radius to pass through them. The grip portion of the handles shall be of a nonmetallic material at least 89 mm (3.50 in) in length, with a 19 mm (0.75 in) diameter or other approved cross section which is shaped to fit the hand comfortably. The number and location of handles for each rectangular enclosure shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs), and shall be as evenly distributed as feasible for easy handling. Handles shall be installed above the equipment center

of gravity to ensure carrying stability. When only one handle is provided, the handle shall be located on the top or side; when two handles are required, the handles shall be located on the sides.

3.6.3.2.4.1 Tilt bail handle. When specified in the associated detail specification, a tilt bail handle shall be used in lieu of hinged metal handles. The tilt bail handle assembly shall permit compliance with the enclosure attitude provisions specified in 3.5.3.1. Removal of the handle or handle assembly with common tools is permitted to comply with maintainability as required in 3.13.

3.6.3.2.5 Accessory stowage, Style C. The Style C enclosure shall have provisions in the cover or main case for the stowage of the accessories (see 6.4.2.1), condensed operating instructions, removable power cables, signal leads, and designated spares. Stowage shall not adversely affect the carrying stability of the equipment, and shall be contained in a manner to prevent damage to the accessories or equipment during transit. Stowed items shall be available without disturbing enclosure seams where calibration seals would normally be placed.

3.6.3.2.6 Corners, Style C. All corners shall be rounded to preclude injury to personnel or damage to other material. All corners shall be adequately reinforced to protect the instrument from damage during the environmental conditions specified for the enclosure.

3.6.3.2.7 Connections and controls, Style C. All external signal connections and all operating controls shall be located on the front panel and external power connections shall be on the rear.

3.6.3.2.8 Chassis fasteners, Style C. The chassis shall be securely fastened within the enclosure by captive screws or positive rapid engagement fasteners.

3.6.4 Enclosures, Style D. When specified in the associated detail specification, the equipment shall be fitted with a Style D enclosure (combination case). The Style D enclosure shall be an integral part of the equipment and shall provide some environmental resistance required for portable use. Protection from falling water particles is not ensured. The Style D enclosure is of commercial design (see 6.4.2.15).

3.6.4.1 Enclosure form, Style D. Style D enclosures shall consist of a main case and cover which allows the equipment to be operated in bench-top or portable applications when the cover is opened or removed. No openings are permitted in the top surface of the enclosure.

3.6.4.1.1 Cover, Style D. The Style D enclosure shall have a cover which allows the equipment to be operated when the cover is opened or removed. The design shall permit the cover to be secured when in the closed position.

3.6.4.1.2 Latches, Style D. The Style D enclosure shall be provided with a means to securely hold the cover to the main case when the equipment (with cover

installed) is subjected to the bench handling test of 4.5.5.4.3. The cover latches shall be of the quick-opening type. Spring wire shall not be used as a mechanical hold down device. The latches shall not interfere with cover removal when unlatched. When the handle of 3.6.4.2.3 is located on the cover, the latches shall support the weight of the equipment and shall be designed to eliminate accidental opening.

3.6.4.1.3 Stacking provisions, Style D. Style D enclosures shall have a geometric configuration which will permit stacking without harm to the enclosure or its contents. The maximum stacking height (expressed as a quantity of equipment in excess of one) shall be as specified in the associated detail specification.

3.6.4.1.4 Rack-mounting provisions, Style D. When rack-mounting is specified in the associated detail specification, rack-mounting conversion shall be in accordance with 3.6.11.1.1.

3.6.4.2 Enclosure provisions, Style D. Style D enclosure provisions shall be as specified in 3.6.4.2.1 through 3.6.4.2.4.

3.6.4.2.1 Material, Style D. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.4.2.2 Component protection, Style D. Panel-mounted controls, indicators, and fuseholders shall conform to the bench handling requirements of 3.7.5.3 without damage. Protection may be provided by a recessed front panel or rigid handle guards. Bumper feet may be used on rear panels.

3.6.4.2.3 Handles, Style D. One or more handles shall be provided. The number and location of handles shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs). Handles shall be located above the equipment center of gravity to ensure carrying stability.

3.6.4.2.3.1 Tilt bail handle. When specified in the associated detail specification, a tilt bail handle shall be used in lieu of hinged metal handles. The tilt bail handle assembly shall permit compliance with the enclosure attitude provisions as specified in 3.5.3.1. Removal of the handle or handle assembly with common tools is permitted to comply with maintainability as specified in 3.13.

3.6.4.2.4 Accessory stowage, Style D. The enclosure shall have provisions in the cover or main case for the stowage of accessories (see 6.4.2.1), condensed operating instructions, removable power cables, signal leads, and designated spares. Stowage shall not adversely affect the carrying stability of the equipment, and shall be contained in a manner that prevents damage to the accessories or equipment during transit. Stowed items shall be available without disturbing enclosure seams where calibration seals would normally be placed.

3.6.5 Enclosures, Style E. When specified in the associated detail specification, the equipment shall be fitted with a Style E enclosure (equipment case). The

Style E enclosure shall be an integral part of the equipment and shall provide the environmental resistance required for use in protected service areas. The Style E enclosure is commercial design (see 6.4.2.15).

3.6.5.1 Enclosure form, Style E. Style E enclosures shall be designed for bench-top use. No openings are permitted in the top surface of the enclosure.

3.6.5.1.1 Rack-mounting provisions, Style E. When rack-mounting is specified in the associated detail specification, rack-mounting conversion shall be in accordance with 3.6.11.1.1.

3.6.5.2 Enclosure provisions, Style E. Style E enclosure provisions shall be as specified in 3.6.5.2.1 through 3.6.5.2.3.1.

3.6.5.2.1 Material, Style E. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.5.2.2 Component protection, Style E. Panel mounted controls, indicators, and fuseholders shall conform to the bench handling requirements of 3.7.5.3 without damage. Protection may be provided by a recessed front panel or rigid handle guards. Bumper feet may be used on rear panels.

3.6.5.2.3 Handles, Style E. One or more handles shall be provided. The number and location of handles shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs). Handles shall be located above the equipment center of gravity to ensure carrying stability.

3.6.5.2.3.1 Tilt bail handle. When specified in the associated detail specification, a tilt bail handle shall be used in lieu of hinged metal handles. The tilt bail handle assembly shall permit compliance with the enclosure attitude provisions as specified in 3.5.3.1. Removal of the handle or handle assembly with common tools is permitted to comply with maintainability as specified in 3.13.

3.6.6 Enclosures, Style F. When specified in the associated detail specification, the equipment shall be fitted with a Style F enclosure (rack-mount case). The Style F enclosure shall be an integral part of the equipment and shall provide the protection required for use in a Style G enclosure (see 6.4.2.15).

3.6.6.1 Enclosure form, Style F. Style F enclosures shall be designed for rack-mounting. Enclosures which are designed for bench-top or portable use, and which can be converted for rack-mount use by a conversion kit, shall meet all requirements for Style F enclosures. Ventilation openings are permitted for Style F.

3.6.6.1.1 Rack-mounting provisions, Style F. The panel size, clearance, and rack-mounting holes shall be in accordance with 3.6.11 through 3.6.11.1.1 as applicable.

3.6.6.2 Enclosure provisions, Style F. Style F enclosure provisions shall be as specified in 3.6.6.2.1 through 3.6.6.2.3.

3.6.6.2.1 Material, Style F. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.6.2.2 Component protection, Style F. Panel mounted controls, indicators, and fuseholders shall meet the bench handling requirements of 3.7.5.3 without damage. Protection may be provided by a recessed front panel or rigid handle guards except bumper feet may be used on rear panels. Bails or other suitable means shall be provided to protect components when the enclosure is inverted for servicing.

3.6.6.2.3 Handles, Style F. Two rigid metal handles shall be provided for removing the Style F enclosure from the rack enclosure (such as Style G).

3.6.7 Enclosures, Style G. When specified in the associated detail specification, the equipment shall be fitted with a Style G enclosure (console cabinet). The Style G enclosure shall provide protection for the contained equipment (Style F or other) from the specified environmental conditions (see 6.4.2.15).

3.6.7.1 Enclosure form, Style G. Style G enclosures shall be designed to house one or more Style F (or other) enclosures. Ventilation openings are permitted.

3.6.7.1.1 Rack-mounting provisions, Style G. The provisions for mounting Style F or convertible/rack-mountable enclosures in Style G enclosures shall be in accordance with 3.6.11.

3.6.7.1.2 Transportability, Style G. Style G enclosures shall be so designed that they can be lifted and transported by fork lift vehicles when the equipment is in its normal upright position. Enclosures designed for air transportability shall be in accordance with MIL-STD-1791.

3.6.7.1.3 Interior access, Style G. Access to the interior of the enclosure shall be by access doors or bolt-on or hinged panels. Doors and hinged panels shall have handles installed (see 3.6.7.2.2).

3.6.7.1.4 Work surfaces, Style G. Personnel work surfaces shall be constructed of nonconducting material. Any work surface that projects from the Style G enclosure in a cantilever fashion shall be attached to permit its retraction or removal for transport or shipping of the enclosure.

3.6.7.2 Enclosure provisions, Style G. Style G enclosure provisions shall be as specified in 3.6.7.2.1 through 3.6.7.2.4.

3.6.7.2.1 Material, Style G. The enclosure shall be constructed of aluminum, plastic, or fiberglass.

3.6.7.2.2 Handles, Style G. Door handles shall be installed flush with the exterior surface of the enclosure. The handles shall rotate to provide positive latching of the door or hinged panel in the closed position.

3.6.7.2.3 Accessory stowage, Style G. Drawers or similar space shall be provided for stowage of the necessary operator accessories (see 6.4.2.1), manuals, and operating spares required to perform test functions.

3.6.7.2.4 Equipment removal, Style G. Style F, convertible/rack-mountable, or other enclosures shall be removable from the enclosure without extensive disassembly. Channel guided construction using tracks, rollers, or pivots shall be provided to allow accessibility to components by withdrawal of the assembly toward the front. Automatic locks shall be provided to lock the assembly in the servicing position.

3.6.8 Enclosures, Style P. When specified in the associated detail specification, the equipment shall be provided with a Style P enclosure (transit case). The Style P enclosure shall provide protection for the contained test equipment from the specified environmental conditions (see 6.4.2.15).

3.6.8.1 Enclosure form, Style P. Style P enclosures shall consist of a main case and a cover. The design shall provide protection for the enclosed test equipment, but need not provide operational capability for the enclosed equipment.

3.6.8.1.1 Cover, Style P. The Style P enclosure shall have a cover which is tight-fitting when placed in position and latched. Loading of the cover gasket shall be limited to that necessary to effect a seal.

3.6.8.1.2 Latches, Style P. The main case and cover shall be provided with quick-opening tension latches on each of two opposing sides. The latches shall be protected from damage by contact with other objects. Spring wire shall not be used as a mechanical hold down device. The latches shall not interfere with cover removal when unlatched.

3.6.8.1.3 Stacking provisions, Style P. Style P enclosures shall have a geometric configuration which will permit stacking without harm to the enclosure or its contents. The maximum stacking height (expressed as a quantity of equipment in excess of one) shall be as specified in the associated detail specification.

3.6.8.2 Enclosure provisions, Style P. Style P enclosure provisions shall be as specified in 3.6.8.2.1 through 3.6.8.2.5.

3.6.8.2.1 Material, Style P. The enclosure shall be constructed of aluminum, plastic, fiberglass, or three-or-more ply combination resin-bonded material.

3.6.8.2.2 Identification plate, Style P. The identification plate shall be located on the outside of the enclosure main case.

3.6.8.2.3 Handles, Style P. One or more handles shall be provided. The number and location of handles shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs). Handles shall be located above the equipment center of gravity to ensure carrying stability.

3.6.8.2.4 Corners, Style P. All corners shall be rounded to preclude injury to personnel or damage to other material. All corners shall be adequately reinforced to protect the enclosure and the contained instrument from the environmental conditions specified for its style.

3.6.8.2.5 Accessory stowage, Style P. The enclosure shall have provisions for the stowage of accessories (see 6.4.2.1), condensed operating instructions, removable power cables, signal leads, and designated spares. Stowage shall not adversely affect the carrying stability of the equipment, and shall be contained in a manner that prevents damage to the accessories or equipment during transit.

3.6.9 Enclosures, Style S. When specified in the associated detail specification, the equipment shall be provided with a Style S enclosure (soft transit case) in addition to the enclosure specified as an integral part of the equipment. The Style S enclosure shall provide protection from the specified environmental conditions (see 6.4.2.15).

3.6.9.1 Enclosure form, Style S. Style S enclosures shall consist of a one-piece case and cover. The design shall provide protection for the enclosed equipment, but need not provide operational capability for the enclosed equipment.

3.6.9.1.1 Cover, Style S. The Style S enclosure cover may be fastened over the equipment with hook-and-loop fasteners, snaps, non-metallic zippers, or latches made of high-impact plastic.

3.6.9.2 Enclosure provisions, Style S. Style S enclosure provisions shall be as specified in 3.6.9.2.1 through 3.6.9.2.4.

3.6.9.2.1 Material, Style S. The enclosure shall be constructed of materials (such as nylon or vinyl) that are rip, tear, and puncture resistant. Construction shall also include a minimum of 1.6 mm (0.0625 in) of padding.

3.6.9.2.2 Construction, Style S. The Style S enclosure shall be constructed in such a manner that the enclosure, under normal conditions of use, can be expected to last the life of the equipment it is designed to contain.

3.6.9.2.3 Handles, Style S. One or more handles shall be provided. A shoulder strap may be provided in addition to the required handles. The number and location of handles and straps shall be such that the load distribution per handle or strap does not exceed 20 kg (44 lbs). Handles and straps shall be located above the equipment center of gravity to ensure carrying stability.

3.6.9.2.4 Accessory stowage, Style S. The enclosure shall have provisions for the stowage of accessories (see 6.4.2.1), condensed operating instructions, removable power cables, signal leads, and designated spares. Stowage shall not adversely affect the carrying stability of the equipment, and shall be contained in a manner that prevents damage to the accessories or equipment during transit.

3.6.10 Enclosures, Style T. When specified in the associated detail specification, the equipment shall be provided with a Style T enclosure (ruggedized transit case) in addition to the enclosure specified as an integral part of the equipment. The Style T enclosure shall provide protection for the contained test equipment from the specified environmental conditions (see 6.4.2.15).

3.6.10.1 Enclosure form, Style T. Style T enclosures shall consist of a main case and a cover. The design shall provide for only one orientation of the enclosed test equipment and need not provide for operational capability of the equipment when enclosed.

3.6.10.1.1 Cover, Style T. The enclosure shall have a detachable cover which is tight-fitting when placed in position and latched. Cover latches shall be so placed where they prevent the cover from being fastened in the wrong position. Loading of the cover gasket shall be limited to that necessary to effect a seal.

3.6.10.1.2 Latches, Style T. The main case and cover shall be provided with quick-opening tension latches on each of two opposing sides. The latches shall be protected from damage by contact with other objects. Spring wire shall not be used as a mechanical hold down device. The main portion of the latch shall be on the main case and the smaller portion (hook) on the cover. The latches shall not interfere with cover removal when unlatched.

3.6.10.1.3 Stacking provisions, Style T. Style T enclosures shall have a geometric configuration which will permit stacking without harm to the enclosure or its contents. The maximum stacking height (expressed as a quantity of equipment in excess of one) shall be as specified in the associated detail specification.

3.6.10.2 Enclosure provisions, Style T. Style T enclosure provisions shall be as specified in 3.6.10.2.1 through 3.6.10.2.6.

3.6.10.2.1 Material, Style T. The enclosure shall be constructed of aluminum, plastic, fiberglass, or a three-or-more ply combination resin-bonded material.

3.6.10.2.2 Identification plate, Style T. The identification plate shall be located on the inside of the enclosure cover.

3.6.10.2.3 Handles, Style T. Style T equipment shall include hinged metal handles that have enough internal clearance to allow a block 44 mm (1.75 in) by 106 mm (4.18 in) in cross section with edges rounded to a 24 mm (0.93 in) radius to pass through them. The grip portion of the handles shall be of a nonmetallic material at least 82 mm (3.25 in) in length with a 12 mm (0.50 in) diameter or other approved

cross section which is shaped to fit the hand comfortably. Handles shall stop open at 90 degrees and shall be returned to a closed position by a spring-loaded or retaining mechanism when not in use. Handles should be recessed or protected. If a handle is located on the top of the enclosure, the handle shall be recessed to facilitate stacking. The number and location of handles for each Style T enclosure, when loaded shall be such that the load distribution per handle shall not exceed 20 kg (44 lbs) and shall be as evenly distributed as feasible for easy handling. Handles shall be installed above the equipment center of gravity to ensure carrying stability.

3.6.10.2.4 Accessory stowage, Style T. Style T enclosures shall have provisions in the cover or main case for the stowage of all accessories (see 6.4.2.1), technical manuals, removable power cables, signal leads, and operating spares. Stowage shall not adversely affect the carrying stability of the enclosure, and shall be contained in a manner which prevents damage to the accessories or equipment during transit. Stowed items shall be available without disturbing enclosure seams where calibration seals would normally be placed.

3.6.10.2.5 Corners, Style T. All corners shall be rounded to preclude injury to personnel or damage to other material. All corners shall be adequately reinforced to protect the enclosure and contained instrument from the environmental conditions specified for its style.

3.6.10.2.6 Pressure equalizing valve, Style T. A pressure equalizing valve shall be provided. The valve shall be accessible when the enclosure is closed, and shall be recess-mounted so that the valve does not protrude beyond the enclosure.

3.6.11 Rack-mounting requirements. Enclosures which are required to be rack-mounted (including convertible/rack-mountable) and enclosures required to accommodate rack-mountable equipment shall be in accordance with a through c:

a. Type I equipment shall be in accordance with EIA RS-310-C-77.

b. Type II equipment shall be the same as for Type III.

c. Type III equipment shall be in accordance with EIA RS-310-C-77 for 482.6 mm (19 in) standard panel width.

3.6.11.1 Convertible/rack-mountable equipment. When specified in the associated detail specification, enclosures of Styles B, C, D, and E shall be capable of being rack-mounted. All convertible/rack-mountable equipment shall conform to the requirements of its class and style when configured for rack-mounting use in accordance with 3.6.11.1.1.

3.6.11.1.1 Rack-mount conversion. Conversion shall be accomplished by use of a kit which will easily convert the enclosure for rack-mounting, but will not prevent return to the original configuration. The rack-mount conversion kit shall include all hardware required to configure the equipment for rack-mounting. When the height

of the front panel is not a multiple of the preferred panel height increment, or when the width is less than rack-width, the conversion kit shall include filler panels to provide the preferred height and width in accordance with 3.6.11. No part of the equipment shall protrude above or below the front panel when the enclosure is rack-mounted.

3.7 Environmental requirements. Where reference is made to Class 1 in previously prepared associated detail specifications, the requirements of Class 2 shall apply. Where reference is made to Class 4 in previously prepared associated detail specifications, the requirements of Class 3 shall apply (see 1.2.2 and 6.4.2.13).

3.7.1 Environmental conditions. Equipment shall conform to the specified performance and other requirements when subjected to the environmental conditions of this specification. The specified accuracies shall be achieved under all required operating environments. Combinations of environments beyond those covered by the specified test procedures (see 4.5) shall be as specified in the associated detail specification.

3.7.1.1 Warm-up. The equipment shall comply with the specified performance requirements after a 20 minute warm-up period preceded by a 2-hour nonoperating temperature stabilization period, or as specified in the applicable test method.

3.7.2 Temperature and humidity. The temperature ranges and humidity limits shall be as specified in table III. An RH of 95 percent (with the applicable tolerance) does not include conditions of precipitation. Class 7 equipment shall be as specified in the associated detail specification.

3.7.2.1 Temperature-humidity (T/H). Equipment of Classes 2, 3, 5, and 6 shall conform to the requirements for T/H as specified in a and b when tested in accordance with 4.5.5.1.1. Class 7 equipment shall be as specified in the associated detail specification.

a. Nonoperating. Test equipment shall conform to the specified performance and accuracy requirements after being stored under the nonoperating conditions specified for the applicable class in table III. When the specified humidity is 95 ±5 percent, the equipment shall withstand the effects of humidities up to 100 percent, including conditions wherein condensation occurs in and on the test equipment.

b. Operating. Test equipment shall conform to the specified performance and accuracy requirements under the conditions of table III within the T/H limits of the class, and for the T/H ranges specified.

TABLE III. Temperature and humidity limits.

Class	Temperature (°C)		RH for operating range (percent)
	Nonoperating 1/	Operating	
2	-51 to 71	-40 to 55 2/	95 ±5
3	-51 to 71	-10 to 55	95 ±5
5	-40 to 71	0 to 10	1/
		11 to 30	95 ±5
		31 to 40	75 ±5
		41 to 50	45 ±5
6	-40 to 71	10 to 30	95 ±5
		31 to 40	75 ±5
7	see 3.7.2		

1/ RH not controlled.
2/ 20 minute intermittent operation (see 6.4.2.19) at 71°C after the specified warm-up period.

3.7.2.2 Temperature shock. When specified in the associated detail specification, the equipment shall conform to the specified performance and accuracy requirements before and after temperature shock conditions when tested in accordance with 4.5.5.1.2. The temperature values shall be the operating limits specified for the applicable class in table III. Temperature shock for Class 7 shall be as specified in the associated detail specification.

3.7.3 Altitude. Test equipment of Classes 2, 3, 5, and 6 shall conform to the specified performance and accuracy requirements after return from the nonoperating altitude, and during the operating altitude specified for the applicable class in table IV, when tested in accordance with 4.5.5.2. Class 7 shall be as specified in the associated detail specification.

3.7.4 Vibration. Vibration shall be as specified in 3.7.4.1 or 3.7.4.2 and 3.7.4.3.

TABLE IV. Altitude.

Class	Altitude in meters (ft)	
	Nonoperating	Operating
2, 3	4570 (15,000)	4570 (15,000)
5, 6	4570 (15,000)	3050 (10,000)
7	see 3.7.3	

3.7.4.1 Vibration, sinusoidal. Test equipment of Classes 2, 3, 5, and 6 shall conform to the specified performance and accuracy requirements during the vibration conditions specified for the applicable class in table V, when tested in accordance with 4.5.5.3.1. Class 7 shall be as specified in the associated detail specification.

TABLE V. Vibration.

	Vibration (5 Hz to 55 Hz)				
		Time per axis (minutes)			
Class	Frequency (Hz)	Resonance search	Cycling	Resonance dwell	G level at maximum frequency
2, 3	5 through 15 16 through 25 26 through 55	5 5 5	15	10	0.7 at 15 Hz 1.3 at 25 Hz 3 at 55 Hz
5, 6	5 through 55	15	15	10	2 at 55 Hz
7	see 3.7.4.1				

3.7.4.2 Vibration, random. When specified in the associated detail specification, test equipment of Classes 2, 3, 5, and 6 shall conform to specified performance and accuracy requirements when tested in accordance with 4.5.5.3.2. The MIL-STD-810 category and procedure required for the test equipment class shall be as specified in the associated detail specification. Class 7 shall be tested for random vibration as specified in the associated detail specification.

3.7.4.3 Bounce, loose cargo. When specified in the associated detail specification, the equipment shall conform to the specified performance and accuracy requirements after being tested in accordance with 4.5.5.3.3.

3.7.5 Shock, mechanical. The mechanical shock requirements shall be as specified in 3.7.5.1 through 3.7.5.4.

3.7.5.1 Shock, functional. Classes 2, 3, 5, and 6 shall conform to the specified performance and accuracy requirements after being subjected to the 30g half-sine shock test of 4.5.5.4.1. Class 7 shall be as specified in the associated detail specification.

3.7.5.2 Transit drop, Styles A, B, C, P, S, and T. Equipment in the enclosures of Styles A, B, C, P, S, and T shall conform to the specified performance and accuracy requirements after being tested in accordance with 4.5.5.4.2. For Style S enclosures, only those with shoulder straps shall be subjected to this test. The equipment shall remain inside the transit case throughout this test.

3.7.5.3 Bench handling. The equipment shall conform to the specified performance and accuracy requirements and there shall be no damage to any controls, indicators, or fuseholders, after being tested in accordance with 4.5.5.4.3.

3.7.5.4 Shock, high impact. When specified in the associated detail specification, equipment intended for Navy shipboard applications shall be subjected to the high impact shock test of 4.5.5.4.4.

3.7.6 Water resistance. Water resistance shall be as specified in 3.7.6.1 through 3.7.6.3.

3.7.6.1 Watertight, Styles A and T. Equipment with enclosures of Style A, and equipment installed in Style T enclosures, shall conform to the specified performance and accuracy requirements after being tested in accordance with 4.5.5.5.1 under the conditions specified for the applicable style in table VI.

TABLE VI. Water resistance.

Style	Watertight	Splashproof	Dripproof
A	Submergence 0.9 m (3 ft)	Cover off	N/A
B	N/A	N/A	Yes
C	N/A	N/A	Cover on
D through G	N/A	N/A	N/A
P and S	N/A	N/A	N/A
T	Submergence 0.9 m (3 ft)	N/A	N/A

3.7.6.2 Splashproof, Style A. Equipment with enclosures of Style A shall conform to the specified performance and accuracy requirements after being tested in accordance with 4.5.5.5.2 under the conditions specified for the applicable style in table VI.

3.7.6.3 Dripproof, Styles B and C. Equipment with enclosures of Styles B and C shall conform to the specified performance and accuracy requirements after being tested in accordance with 4.5.5.5.3 under the conditions specified for the applicable style in table VI.

3.7.7 Fungus resistance. Equipment shall be inherently fungus-inert through selection of materials. General moisture or fungus-resistant coating of assembled parts, wires, or solder joints is not acceptable as a means of achieving fungus resistance. When required by the associated detail specification, verification of fungus resistance and fungus-inert material shall be in accordance with 4.5.6.1.

3.7.8 Salt atmosphere. Salt atmosphere shall be as specified in 3.7.8.1 and 3.7.8.2.

3.7.8.1 Exposure, structural parts. Material used for the fabrication of panels and structural parts shall conform to all applicable requirements after being exposed to salt atmosphere in accordance with table VII. The conditions of a and b shall apply:

a. Styles A and B. Testing of samples of panels and structural parts, of Style A and Style B enclosures shall be performed in accordance with 4.5.6.2.1.

b. Styles C through G. When specified in the associated detail specification, testing of samples of panels and structural parts of Styles C through G enclosures shall be tested in accordance with 4.5.6.2.1.

3.7.8.2 Exposure, enclosure. When specified in the associated detail specification, the equipment shall conform to the performance and accuracy requirements after being tested for exposure in accordance with 4.5.6.2.2.

TABLE VII. Salt atmosphere exposure, structural parts.

	Structural parts	
Style	Time (hours)	Salt solution
A through G P, S, and T	48 N/A	5 percent N/A

3.7.9 Explosive atmosphere. The operation of Class 2 equipment shall not cause ignition of an ambient-explosive-gaseous mixture with air when tested in accordance with 4.5.6.3.

3.7.10 Dust exposure, Class 2 and Styles A, P, and T. Styles A, P, and T enclosures and all Class 2 equipment shall conform to all requirements after exposure to dust when tested in accordance with 4.5.6.4.

3.7.11 Magnetic environment, DC field (Navy). For Navy use, when specified in the associated detail specification, test equipment shall be tested in accordance with the 20 Oersted dc test of 4.5.6.6.

3.7.12 Acoustic noise. Equipment containing a motor (such as a fan or blower) or other audible noise source shall not generate acoustic noise in excess of the values specified in table VIII when measured in accordance with 4.5.7.2.

TABLE VIII. Noise level limits.

Octave band center frequencies (Hz)	Octave band sound pressure levels (dB reference: 0.0002 dyne/cm^2)	
	0.3 m (1 ft) radius from operator's position	7.6 m (25 ft) radius from equipment geometric center
63	76	66
125	70	60
250	64	54
500	60	50
1000	57	47
2000	55	45
4000	53	43
8000	52	42

3.7.13 Solar radiation. When specified in the associated detail specification, Class 2 and Class 3 equipment shall conform to the applicable requirements after exposure to solar radiation when tested in accordance with 4.5.6.8.

3.8 EMI. EMI shall be as specified in 3.8.1 through 3.8.3.

3.8.1 EMI, Type I. EMI control for Type I equipment shall be in accordance with MIL-STD-461, Part 1, and Parts 2 through 7, as applicable, and the associated detail specification when tested in accordance with 4.5.6.5.

3.8.2 EMI, Type II. The EMI requirements for Type II equipment shall be the same as those for Type III, except that, when shipboard EMI compatibility is required by the associated detail specification, the requirement for RS03 shall be MIL-STD-461, Part 5, 30 MHz to 1 GHz and 25 V/m.

3.8.3 EMI, Type III. EMI control for Type III equipment of Classes 2, 3, 5, and 6 shall be in accordance with MIL-STD-461 as modified in table IX when tested in accordance with 4.5.6.5. Class 7 test equipment shall be as specified in the associated detail specification. The limits specified in table IX are not subject to further relaxation based on equipment classifications in MIL-STD-461.

TABLE IX. Type III equipment EMI requirements.

MIL-STD-461 requirement	Description of requirement	MIL-STD-461 limit 1/
CE01	Conducted emissions, power and interconnecting leads, low frequency (up to 15 kHz)	Part 2 2/
CE03	Conducted emissions, power and interconnecting leads, 0.015 MHz to 50 MHz	Part 2
CS01	Conducted susceptibility, power leads, 30 Hz to 50 kHz	Part 2
CS02	Conducted susceptibility, power leads, 0.05 MHz to 400 MHz	Part 2, limited to 100 MHz
CS06	Conducted susceptibility, power leads, spikes	Part 5
RE01	Radiated emissions, magnetic field, 0.03 kHz to 50 kHz, test probe at 15 cm (6 in)	Part 5 3/
RE02	Radiated emissions, electric field, 14 kHz to 10 GHz	Part 2, curve #2 + 10 dB
RS03	Radiated susceptibility, electric field, 14 kHz to 40 GHz	Part 2, limited to 1 GHz 4/

1/ The limit in the part specified below shall be used.
2/ Fundamental frequency search excluded.

3/ Front and rear panel search excluded.
4/ Limited to 1 V/m for Classes 5 and 6, and 5 V/m for Classes 2 and 3.

3.9 Safety. Protection shall be provided from, but shall not be limited to, the hazards of 3.9.1 through 3.9.1.5 for Type I requirements and 3.9.3 through 3.9.3.10.1 for Type III requirements. Type II protection shall be in accordance with 3.9.2. Personnel safety considerations shall conform to the appropriate requirements of the OSHA as specified in Title 29, Part 1910 of the Code of Federal Regulations (CFR). The design of each equipment for which a Federal standard exists under the CFR, Title 21, Chapter I, Subchapter J, of the Radiation Control for Health and Safety Act of 1968, shall conform to the appropriate Federal standard.

3.9.1 Protection, Type I. Safety shall be in accordance with MIL-STD-454 Requirement 1, and as specified herein.

3.9.1.1 Accessible potentials, Type I. Operating and maintenance personnel shall be protected from hazardous potentials by shielding, marking, or other suitable measures in accordance with a through e:

a. External terminals connected to hazardous potentials shall be labeled with appropriate markings.

b. Protection shall be provided from high frequency (HF) voltages or current capable of causing burns.

c. While test equipment is operating, shock protection shall be provided if the open circuit voltage between any accessible part of the test equipment and ground or any other simultaneously accessible part exceeds 30 Vrms (42.4 V peak), 60 Vdc, or 24.8 Vdc interrupted at a rate of 10 Hz to 200 Hz. Suitable measures shall be incorporated to protect maintenance personnel from all internal hazardous potentials. Capacitors shall be discharged to less than 42.4 V peak within 2 seconds after power interruption unless markings indicate a longer discharge interval.

d. Probes provided as part of or as accessories to equipment which is designed to measure voltages in excess of the values specified in c shall incorporate safety guards or barriers which are located on the probe body to prevent the operator's hand from inadvertently contacting the probe tip. The maximum exposed portion of the metal tip shall not exceed 19 mm (0.75 in).

e. Parts of equipment which become accessible upon removing a cover, opening a door, adjusting a control, setting a supply circuit voltage mechanism, replacing a fuse, attaching and detaching an interconnecting cable assembly, etc., and are intended for access by the operator during normal use, shall not render an electric shock.

3.9.1.1.1 Open circuit voltage protection, Type I. The open circuit potential between any accessible part and either ground or any other simultaneously accessible

part shall not exceed the limits specified in 3.9.1.1 when the open circuit voltage test of 4.5.3.2.1 is performed. For this requirement, accessible parts shall include control shafts with knobs removed and recessed calibration or adjustment controls.

3.9.1.1.2 Leakage current protection, Type I. If the open circuit potential between an accessible part and either ground or any other simultaneously accessible part exceeds the limits specified in 3.9.1.1, when measured in accordance with 4.5.3.2.1, the leakage current between the voltage points shall be measured. The measured value shall not exceed 3.5 milliamperes (mA) when tested in accordance with 4.5.3.2.2.

3.9.1.2 Grounding, Type I. The input power cable safety ground conductor provided for personnel safety shall be configured to assure that the ground connection is the last to disconnect when the input power cable is mechanically stressed to failure. Safety grounding shall be in accordance with the requirements of a and b:

a. Radio frequency interference (RFI). When RFI filters are used, and are referenced to other than the power line, the common reference shall be safety ground. When RFI filters are referenced to the safety ground, the filters shall contain only components (such as capacitors and inductors) between each side of the power line and safety ground which allow 3.5 mA rms or less total current to flow to the chassis under the most adverse conditions of maximum power frequency and maximum voltage permitted by the associated detail specification. Any capacitor used in RFI filters shall be rated for at least 4.2 times the operating voltage of the circuit location.

b. Input power cables. All input power cables and interconnecting cables to other equipment being tested (with the exception of RF cables and signal test cables) shall be provided with a grounding wire. Power return wires shall not be used as grounding wires.

3.9.1.3 Ventilation openings, Type I. Ventilation openings, when permitted by the enclosure requirements, shall be designed to prevent accidental contact with live electrical circuits and mechanical moving parts.

3.9.1.4 Equipment emanations, Type I. When specified in the associated detail specification, test equipment shall be tested for emanations in accordance with 4.5.7.5. Protection shall be provided from levels of ionizing radiation, microwave radiation, the liberation of ozone, and ultrasonic pressure in excess of the limits specified in a through d. This protection shall be in accordance with ANSI/ISA-S82.01-1988 or ANSI/ISA-S82.02-1988 or both as applicable. Any accessible area normally inhabited by personnel during installation, calibration, maintenance, repair, and operation of the test equipment shall be within the scope of this requirement.

a. X-radiation. X-radiation shall be limited to 0.5 milliroentgen per hour at 5 cm (2 in) from the radiating source, for a target area of 10 cm^2 (1.55 in^2), which has the greatest dimension limited to 5 cm (2 in).

b. Microwave radiation, 10 MHz to 100 GHz. The power density of microwave radiation shall be limited to 10 mW/cm^2 at any point 5 cm (2 in) or more from any surface of the test equipment.

c. Ozone liberation. Ozone liberated from the test equipment during normal operation shall be limited to a time weighted average (TWA) concentration of 0.1 parts per million (ppm) based upon a normal 8-hour workday and a 40-hour workweek. Workers may be exposed to a short-term exposure limit (STEL) of 0.3 ppm provided that daily TWA is not exceeded. A STEL is a 15-minute TWA exposure which shall not be exceeded at any time during a workday even if the 8-hour TWA is equal to, or less, then 0.1 ppm. Exposures at the STEL shall not be longer than 15 minutes and shall not be repeated more than 4 times each day. There shall be at least 60 minutes between successive exposures at the STEL.

d. Ultrasonic pressure. During normal operation, the test equipment shall not produce a sound-pressure level exceeding 110 dB above a reference level of 20 micronewtons per square meter (2 x 10^{-4} microbar or 2 Pascals (Pa)). Compliance is checked by measuring the sound pressure level over a frequency range of 20 kHz to 100 kHz.

3.9.1.5 Equipment safety, Type I. Materials shall not be used which, through outgassing or other physical phenomena, cause the deterioration of other materials, degradation of performance in equipment systems, or exposure to potentially hazardous or toxic materials.

3.9.2 Protection, Type II. Unless otherwise specified in the associated detail specification, the protection requirements for Type II shall be the same as those for Type III.

3.9.3 Protection, Type III. When Type III test equipment is provided, Protection shall be provided from, but shall not be limited to, safety hazards as specified herein.

3.9.3.1 Accessible potentials, Type III. Operating and maintenance personnel shall be protected from hazardous potentials by shielding, marking, or other suitable measures in accordance with a through e:

a. External terminals connected to hazardous potentials shall be labeled with appropriate markings.

b. Protection shall be provided from HF voltages or currents capable of causing burns.

c. While test equipment is operating, shock protection shall be provided if the open circuit voltage between any accessible part of the test equipment and ground or any other simultaneously accessible part exceeds 30 Vrms (42.4 V peak), 60 Vdc, or 24.8 Vdc interrupted at a rate of 10 Hz to 200 Hz. Suitable measures shall be incorporated to protect maintenance personnel from internal hazardous potentials. Capacitors shall be discharged to less than 42.4 V peak within 10 seconds after power interruption unless markings indicate a longer discharge interval.

d. Probes provided, as part of or as accessories to, equipment which is designed to measure voltages in excess of the values specified in c shall incorporate safety guards or barriers located on the probe body to prevent the operator's hand from inadvertently contacting the probe tip. The maximum exposed portion of the metal tip shall not exceed 19 mm (0.75 in). Probes designed for applications which do not permit compliance with this requirement shall have procuring activity approval.

e. Parts of equipment which become accessible upon removing a cover, opening a door, adjusting a control, setting a supply circuit voltage mechanism, replacing a fuse, attaching and detaching an interconnecting cable assembly, etc., and are intended for access by the operator during normal use, shall not render an electric shock.

3.9.3.1.1 Open circuit voltage protection, Type III. The open circuit potential between an accessible part and either ground or any other simultaneously accessible part shall not exceed the limits specified in 3.9.3.1. The open circuit voltage test of 4.5.3.2.1 shall be performed. For this requirement, accessible parts shall include control shafts with knobs removed and recessed calibration or adjustment controls. Failure of this test shall constitute failure of the equipment only if the leakage current value of 3.9.3.1.2 is exceeded.

3.9.3.1.2 Leakage current protection, Type III. If the open circuit potential between an accessible part and either ground or any other simultaneously accessible part exceeds the limits specified in 3.9.3.1, when measured in accordance with 4.5.3.2.1, the leakage current between the voltage points shall be measured. The measured value shall not exceed 3.5 mA when tested in accordance with 4.5.3.2.2.

3.9.3.2 Grounding, Type III. The design and construction of the test equipment shall ensure that, during operation of the fully assembled test equipment, all electrically conductive external surfaces except trim and identification plates, but including enclosures, guards, barriers, shields, flanges, metal cased readouts, shafts, and bushings, shall be at earth ground potential. Provisions for the external ground connection to the test equipment shall ensure continuous and permanent connection with sufficient mechanical strength to minimize the possibility of ground disconnection. Such ground path shall have sufficiently low impedance and ample capacity to conduct safely any operating or fault currents imposed on it including the operation of overcurrent devices in the circuit. Safety grounding shall be in accordance with the requirements of a and b:

a. RFI. When RFI filters are used, and are referenced to other than the power line, the common reference shall be safety ground. When RFI filters are referenced to the safety ground, the filters shall contain only components (such as capacitors and inductors) between each side of the power line and safety ground which allow 3.5 mA rms, or less, total current to flow to the chassis under the most adverse conditions of maximum power frequency and maximum voltage permitted by the associated detail specification. Capacitors used in RFI filters shall conform to the test voltage and endurance tests specified in UL 1414, CAN/CSA-C22.2 No. 231 Series-M89, or IEC-1010, as applicable.

b. Input power cables. Cable grounding for any external interconnecting cable, in which a ground is part of the circuit shall include a ground wire which is terminated at both ends in the same manner as the other conductors. Except for coaxial cables, the cable shield shall not be used as a current-carrying ground connection. Shielded cable shall be secured to prevent the shield from contacting any conducting surface other than the ground termination. When a cable shield is intended to operate ungrounded (floating), insulation and support shall be provided to ensure that no conduction path exists to other than the intended circuits. Shielding shall terminate far enough from the exposed cable conductor to prevent shorting or arcing between the conductor and the shield.

3.9.3.3 Ventilation openings, Type III. Ventilation openings, when permitted by the enclosure requirements, shall be designed to prevent accidental contact with live electrical circuits and mechanical moving parts (see 3.6).

3.9.3.4 Equipment emanations, Type III. Protection shall be provided from levels of ionizing radiation, microwave radiation, the liberation of ozone, and ultrasonic pressure in excess of the limits specified in a through d. This protection shall be in accordance with ANSI/ISA-S82.01-1988 or ANSI/ISA-S82.02-1988 or both as applicable. Any accessible area normally inhabited by personnel during installation, calibration, maintenance, repair, and operation of the test equipment shall be within the scope of this requirement. When specified in the associated detail specification, test equipment shall be tested for emanations in accordance with 4.5.7.5.

a. X-radiation. X-radiation shall be limited to 0.5 milliroentgen per hour at 5 cm (2 in) from the radiating source, for a target area of 10 cm^2 (1.55 in^2) which has the greatest dimension limited to 5 cm (2 in).

b. Microwave radiation, 10 MHz to 100 GHz. The power density of microwave radiation shall be limited to 10 mW/cm^2 at any point 5 cm (2 in) or more from any surface of the test equipment.

c. Ozone liberation. Ozone liberated from the test equipment during normal operation shall be limited to a TWA concentration of 0.1 ppm based upon a normal 8-hour workday and a 40-hour workweek. Workers may be exposed to a STEL of 0.3 ppm provided that the daily TWA is not exceeded. A STEL is a 15-minute TWA exposure which shall not be exceeded at any time during a workday even if the 8-hour

TWA is equal to, or less than, 0.1 ppm. Exposures at the STEL shall not be longer than 15 minutes and shall not be repeated more than 4 times each day. There shall be at least 60 minutes between successive exposures at the STEL.

d. Ultrasonic pressure. During normal operation, the equipment shall not produce a sound-pressure level exceeding 110 dB above a reference level of 20 micronewtons per square meter (2×10^{-4} microbar or 2 pascals). Compliance is checked by measuring the sound pressure level over a frequency range of 20 kHz to 100 kHz.

3.9.3.5 Thermal hazard protection, Type III. Protection shall be provided from equipment temperatures which could constitute a hazard to personnel. During normal operation the temperature rise above ambient shall not exceed the values of a through d. Example: Ambient (37°C) plus temperature rise (35°C) equals 72°C (maximum allowable temperature permitted for outer surfaces of enclosures located in a 37°C environment).

a. 100°C for interior parts of the equipment, such as heat radiators
b. 35°C for outer surfaces of enclosures
c. 25°C for nonmetallic knobs and handles
d. 20°C for metallic knobs and handles

3.9.3.6 Warning markings, Type III. Warning markings in accordance with 3.10.3.1.2 shall warn of the location, the nature, and the extent of a hazard.

3.9.3.7 Guards and shields, Type III. Personnel protection from hazards shall be provided by the use of guards, barriers, enclosures, or shields. Physical protection from items within the enclosure shall be provided for personnel outside the enclosure. Type III guards and shields shall have no sharp projections and edges.

3.9.3.8 Meter safety, Type III. Meters shall have provision for overload bypass or alternate protection to eliminate high voltage at the meter terminals in the event of meter failure.

3.9.3.9 Toxic material, Type III. Toxic materials shall not be contained in the equipment or generated under normal or fault conditions in accordance with a through c:

a. Decomposition or deterioration of materials contained in the equipment shall not liberate toxic, corrosive, or explosive fumes.

b. Combination of materials contained in the equipment with surrounding materials, including the atmosphere, shall not be detrimental to the health of the equipment operator due to the generation of toxic materials.

c. Explosion or implosion of any part of the equipment shall not release toxic materials.

3.9.3.10 Equipment safety, Type III. Materials shall not be used which through outgassing or other physical phenomena cause the deterioration of other materials, or degradation of performance in the equipment or systems.

3.9.3.10.1 Mechanical hazards, Type III. The design of the equipment shall be such as to provide maximum access and safety to personnel while installing, operating, and maintaining the equipment. Suitable protection shall be provided to prevent contact with moving mechanical parts such as gears, fans, and belts when the equipment is complete and operating. Sharp projections on cabinets, doors, enclosures, and similar parts shall be avoided. Doors or hinged covers shall be rounded at the corners and provided with stops to hold them open. Design of rack-mounted equipment shall maintain the center of gravity as low as possible to minimize tipping.

3.10 Marking and identification. Identification and marking shall be as specified in 3.10.1 through 3.10.4.

3.10.1 Marking and identification, Type I. Marking and identification of Type I equipment shall be as specified in 3.10.1.1 through 3.10.1.2.3.

3.10.1.1 Marking, Type I. Items shall be marked in accordance with MIL-STD-454, Requirement 67, and as specified herein.

3.10.1.1.1 Engineering design changes. To identify modifications properly in articles of equipment resulting from engineering change proposals prepared by the contractor and approved by the procuring activity, marking in one of the categories specified in a and b will be assigned for use on each major or minor assembly in which the change has been incorporated.

a. A change in the type designation of the article as included in a nameplate or other marking.

b. The use of a modification symbol imprinted or affixed adjacent to but never on or to the right of the nameplate. A series of modification symbols will be used for successive minor engineering changes not justifying a change in type designation.

3.10.1.1.2 Information plates. Information plates or labels used to present information other than identifying, shall be as specified in the associated detail specification.

3.10.1.1.3 Diagram, schematic, and special instruction sheet. Test equipment shall have a legible schematic diagram and brief operating information affixed to the inside of the cover or to the chassis in a free space to which ready reference can be made at all times during servicing and operation. The backs of removable panels or covers are recommended places for such mountings. The diagram shall contain the actual values of the parts used, such as resistors in ohms and capacitors in microfarads. The issue of each diagram shall be identified. The diagram

shall use electrical graphic symbols in accordance with ANSI Y32.2-1975. Whenever the complexity of the test equipment warrants the need for a technical manual for operation, maintenance, and calibration, the requirements for brief operating instructions and schematic diagrams being affixed to the case are waived.

3.10.1.1.4 Panel markings, Type I. The visible surface adjacent to panel facilities, such as controls, indicators, jacks, sockets, and fuseholders, shall be marked with a suitable word, phrase, or abbreviation thereof, indicating the use or purpose of the part. Continuously variable operating controls shall be provided with markings which will permit the operator to set the controls easily and correctly to a predetermined point. Abbreviations shall be in accordance with MIL-STD-783, MIL-STD-411, and MIL-STD-12 in that order of precedence.

3.10.1.1.4.1 Marking processes, panel. The marking shall be etched, engraved, molded, or metal-stamped to a depth of not less than 0.127 mm (0.005 in) directly into the panel, except that when plastic panels are used, the markings shall be molded or engraved to a depth of not less than 0.254 mm (0.010 in). The markings shall provide good legibility and shall be filled with a material of contrasting color.

3.10.1.1.4.2 Alternate marking processes. Marking processes other than those specified in 3.10.1.1.4.1 may be used if the processes conform to the requirements of the front panel marking test specified in 4.5.7.6. When specified in the associated detail specification, a sample of the front panel (with marking) shall be tested in accordance with 4.5.7.6.

3.10.1.1.5 Fuse marking. Fuseholders or the panel adjacent to the fuseholder shall be permanently marked in accordance with MIL-STD-454, Requirement 39. Where slow-blow type fuses are used the equipment shall be so marked in addition to the current rating.

3.10.1.1.6 Adjustment control marking. Nonoperating (adjustment) controls shall be marked with both the component part symbol and the control function to be calibrated or aligned. On subminiature assemblies where space is at a premium, the reference designations need not be marked.

3.10.1.1.7 Warning markings, Type I. Type I warning markings shall be as specified in a and b:

a. Warning markings in accordance with MIL-STD-454, Requirement 1, shall warn of potentials in excess of 500 V.

b. Battery warning labels shall be in accordance with MIL-STD-454, Requirement 27.

3.10.1.1.8 Receptacles. The name or abbreviation denoting the function of the cable attached to the receptacle shall be included as part of the receptacle identification.

3.10.1.1.9 Size and weight. Volume and loaded case weight of Styles A and T enclosures shall be marked on three external surfaces.

3.10.1.1.10 Methods of marking. Methods of marking, for other than identification plates and panels, shall be in accordance with MIL-STD-130 and as specified in a through e:

a. For accessories, including cords and cables, the markings shall be stamped or etched on the item, or, where necessary, on a durable nonmetallic band or tag. The band or tag shall be securely attached to the cord or cable so that it cannot slip off. The band or tag shall conform to MIL-P-15024.

b. When the item or part is supplied in a paper or cloth container, the marking shall be indelibly marked on the container in large, conspicuous characters.

c. On the inside of the cover of the Style A or T enclosure, a list shall be provided to show all items (by nomenclature, part name or number, and overall nomenclature) that are required to make a complete unit. The list shall include all operating maintenance parts. The quantity and type of batteries required shall also be listed. If the enclosure includes no items with AN nomenclature, the nomenclature of the group shall appear at the top of the list. Operating and nonoperating accessories shall be identified in separate lists.

d. The type designation of the AN nomenclature (or other equipment identification) of the complete test equipment shall be placed (by stencil, decals, or other approved method of marking) on the exterior of each Style A or T enclosure on at least three adjacent surfaces and once on the cover. Marking shall be in black block letters as large as possible, but not exceeding 50 mm (2 in) in height.

e. When there are two or more enclosures (Style A or T) for the test equipment, the procedure specified in c and d shall be used, with the following additions specified in 1 through 3 (see 6.4.2.15):

1. The type designation of the AN nomenclature of the complete test equipment shall be stenciled on the exterior of each of the enclosures (cases).

2. There shall be marked on the exterior of each enclosure (case) that it is Case n of m, where n is the particular case number and m is the total number of cases in the test equipment.

3. The contents of all enclosures (cases) shall be listed by case number on the inside of the lid of each case.

3.10.1.2 Identification plate, Type I. A metal identification plate shall be affixed by means of rivets or screws to the front panel unless adhesive-backed plates are used as specified in 3.10.1.2.1.

3.10.1.2.1 Identification plate type and composition. For Class 2, the identification plate shall be a Type A, B, C, or D in accordance with MIL-P-15024, except that a plastic plate shall not be used. Classes 3, 5, 6, and 7 equipment may use a Type G photosensitive, adhesive-backed metal identification plate.

3.10.1.2.2 Identification plate marking. Except for the marking data, the identification plate shall be marked as specified in MIL-P-15024. The marking data shall be as specified in a through j:

a. Nomenclature.

b. Manufacturer's part number.

c. Input power requirements. The equipment power requirements shall be displayed on the identification plate in terms of voltage and full load amperes and, if applicable, in terms of frequency and phase requirements.

d. National stock number.

e. Contract number.

f. Serial number (s/n).

g. Associated detail specification number.

h. Manufacturer's name or Federal Supply Code.

i. Weight.

j. US.

3.10.1.2.3 Identification plate design. The design of the identification plate shall be as specified in the associated detail specification or the contract.

3.10.2 Marking and identification, Type II. Unless otherwise specified in the associated detail specification, the marking and identification requirements for Type II test equipment shall be the same as Type III.

3.10.3 Marking and identification, Type III. Marking and identification of Type III test equipment shall be as specified in 3.10.3.1 through 3.10.3.2.3.

3.10.3.1 Marking, Type III. Type III test equipment shall be marked in a manner that does not adversely affect the leakage path between conductors or any other factor of performance.

3.10.3.1.1 Reference designations, Type III. Reference designations shall be employed to identify each part for its particular circuit application. On subminiaturized assemblies, such as printed or etched boards or other forms of assem-

bly, where space is at a premium, reference designations need not be marked. The parts of nonrepairable assemblies need not be marked with reference designations. Reference designator usage shall be in accordance with ANSI Y32.2-1975 and ANSI Y32.16 or MIL-STD-130.

3.10.3.1.2 Warning markings, Type III. Warning markings shall warn of the location, the nature, and the extent of a hazard. Letters of warning markings shall be of clearly legible gothic capitals. Warning markings shall have high contrast between the letter and background colors. The markings shall be as permanent as normal life expectancy of the test equipment, and located as close as possible to the point of danger. Warning markings indicating circuits of more than 500 Vdc or Vrms shall read substantially:

DANGER HIGH VOLTAGE (maximum applicable voltage) VOLTS

Markings of noncontrasting colors shall be in accordance with the requirements of ANSI/ISA-S82.01-1988 or ANSI/ISA-S82.02-1988 or both as applicable, which requires the warning and caution markings specified in a through c:

a. The precautionary signal word shall be at least 2.5 mm (0.125 in) high.

b. The text shall be at least 1.5 mm (0.062 in) high and contrasting in color to background.

c. If molded or stamped in a material, the text shall be at least 2.0 mm (0.078 in) high and, if not contrasting in color, a depth or raised height of at least 0.5 mm (0.02 in).

3.10.3.1.3 Battery warning label, Type III. Type III equipment containing batteries shall be provided with a battery warning label. Battery warning labels shall be:

WARNING

REMOVE BATTERIES BEFORE SHIPMENT OR INACTIVE STORAGE OF 30 DAYS OR MORE
NOTE: DO NOT REMOVE INTERNAL MEMORY BACKUP BATTERIES.

3.10.3.1.3.1 Battery warning label disposition. The battery warning label shall be placed on the equipment by the manufacturer prior to delivery to the Government.

3.10.3.1.4 Panel markings and processes, Type III. Functional panel markings of words or abbreviations shall indicate the use or purpose of controls, indicators, connectors, receptacles, fuseholders, and so forth. Panel markings shall enable the

operator to identify the function of the variable operator controls. Marking processes shall be used which can conform to the front panel marking test specified in 4.5.7.6.

3.10.3.2 Identification plate, Type III. Type III equipment identification plates shall be as specified in MIL-STD-130 and 3.10.3.2.1 and 3.10.3.2.2 below.

3.10.3.2.1 Identification plate information, Type III. Type III equipment identification plates shall contain the information specified in a through h. The model number shall be as designated by the manufacturer. The identification plate shall be metal and shall be affixed by rivets or screws to any exterior surface of the equipment except removable covers. In lieu of the metal identification plate, a Type G photosensitive, adhesive-backed metal identification plate in accordance with MIL-P-15024 shall be placed on the test equipment. The identification plate shall be affixed by the manufacturer prior to delivery to the Government.

a. Manufacturer name.
b. Equipment model number.
c. Equipment name.
d. Joint Equipment Type Designation System (JETDS) nomenclature (when assigned).
e. Place of manufacture.
f. Serial number.
g. National stock number.
h. Contract number.

3.10.3.2.2 Identification plate supplemental information, Type III. When accessories are required to make the equipment meet the requirements of the associated detail specification and the combination is given a part or model number designation that differs from that of the main unit, the identification plate shall also contain the information in a and b. Whether a configuration model designation is assigned or not, all major accessories shall be marked as in c:

a. Consists of: [part number of main unit and all accessories (excluding cables and adapters) comprising the equipment configuration].

b. Model configuration number: (Model number assigned to the equipment configuration).

c. Part of (or p/o): (Model number assigned to the equipment configuration, or main unit model number, as applicable), s/n: (serial number assigned to the equipment comprising the set or the serial number of the primary instrument if a separate s/n is not assigned to the set).

3.10.3.2.3 Reusable pouch or container. When specified in the associated detail specification, a reusable pouch or container shall be provided in accordance with 3.13.3.4. Containers shall be marked "accessories for use with" (test equipment nomenclature or model number), or, "maintenance aids for use with" (test equip-

ment nomenclature or model number), as applicable. The test equipment nomenclature shall be used in lieu of the model number, if assigned.

3.10.4 Nomenclature assignment. When specified in the associated detail specification, nomenclature assignment shall be in accordance with MIL-STD-454, Requirement 34.

3.11 Calibration interval. The minimum interval between calibrations shall be 12 months. At the end of this interval a minimum of 85 percent of the units shall remain in tolerance.

3.12 Reliability. Reliability shall be as specified in 3.12.1 through 3.12.3.1.

3.12.1 Reliability, Type I. The upper test mean-time-between-failures (MTBF), θ_0, for continuous and intermittent operation (see 6.4.2.19), in accordance with MIL-STD-781, shall be 1500 hours under the environmental conditions specified for the test equipment class, when tested in accordance with 4.5.8.1.1. A failure, as used herein, shall be as defined in 6.4.2.17.

3.12.1.1 Burn-in, Type I. Burn-in, if used, shall be as specified in MIL-STD-781 and as specified in 3.12.3.1.

3.12.2 Reliability, Type II. Unless otherwise specified in the associated detail specification, the reliability requirements for Type II shall be the same as those for Type III.

3.12.3 Reliability, Type III. When Type III reliability is specified in the associated detail specification the upper test MTBF, θ_0, for continuous and intermittent operation shall be 1500 hours under the environmental conditions specified for the test equipment, when tested in accordance with 4.5.8.1.3. A failure, as used herein, shall be as defined in 6.4.2.17.

3.12.3.1 Burn-in, Type III. Reliability sample units shall receive no burn-in other than that received by all test equipment submitted for acceptance. When specified in the associated detail specification, burn-in for each unit shall last at least 100 hours at a minimum of 40°C. The last 30 hours shall be failure free. The RH need not be controlled. If a failure occurs within the period specified to be failure-free, burn-in on that equipment shall be stopped and repairs accomplished prior to initiating a complete 30 hour failure-free period. Additional failures shall result in additional burn-in extensions until the final 30 hours of burn-in are failure-free.

3.13 Maintainability. Maintainability shall be as specified in 3.13.1 through 3.13.3.5.

3.13.1 Maintainability, Type I. Type I maintainability shall be as specified in 3.13.1.1 through 3.13.1.5 (see 4.5.7.1).

3.13.1.1 Fault isolation, Type I. The design of the equipment shall permit isolation of faults, and repair down to the lowest discrete component (resistor, switch, transistor, capacitor, nonrepairable assembly (see 6.4.2.22), and so forth), with the maintenance provisions furnished as part of the equipment.

3.13.1.2 Maintainability demonstration, Type I. A maintainability demonstration shall be performed on the equipment when specified in the contract. The mean corrective maintenance time (M_{ct}) (M_0 in MIL-STD-471) shall be 90 minutes. The maximum tolerable mean corrective maintenance time (M_1 in MIL-STD-471) shall be 115 minutes. The maximum corrective maintenance time (M_{max}) shall not exceed 270 minutes. The M_{ct} and the M_{max} shall include all time required to troubleshoot, fault isolate, repair, and calibrate the equipment for any malfunction down to the lowest discrete component (resistor, switch, transistor, integrated circuit, nonrepairable assembly, and so forth), of the equipment, but does not include certification time (see 6.4.2.8). Certification time shall be as specified in the associated detail specification. The producer's risk shall be not greater than 0.20, and the consumer's risk shall be not greater than 0.10.

3.13.1.3 Preventive maintenance, Type I. Preventive maintenance (for example, motor oiling and filter cleaning) shall not require more than 15 minutes per 30 day period. Preventive maintenance shall not require breaking of the equipment seams where calibration seals would normally be placed.

3.13.1.4 Maintenance provisions, Type I. Type I test equipment shall conform to the requirements of a through j to facilitate maintenance:

a. Use of equivalent parts. In order to facilitate the procurement of replacement parts, the design shall not be based on the use of parts of special manufacture where suitable units of standard manufacture are available. Similarly, the design shall not be based upon the use of parts provided by only one manufacturer where equivalent parts available from several manufacturers may be employed.

b. Selection of plug-in parts. The design of the test equipment shall be such that operation will not depend upon special selection of replacement plug-in parts, such as tubes, vibrators, crystals, and solid-state devices.

c. Accessibility of lamps and fuses. Indicator lamps (other than light emitting diodes) and fuses shall be replaceable from the exterior.

d. Enclosure attitude. The equipment shall be constructed so that no damage to any component, or permanent distortion to any structural member, shall be caused by placing any of the six sides of the equipment on a flat surface. The equipment shall be capable of standing without additional support on any of the six sides.

e. The chassis attitude. The chassis shall be constructed so that when removed from its enclosure there shall be no damage to any component part nor any

permanent distortion of any structural member either during removal from the enclosure or when the chassis is placed on a flat surface on any of the six sides.

f. Accessory stowage. Special adapters, circuit board extenders, special tools (see 6.4.2.30), and patch cables required for maintenance and calibration of the equipment shall be provided as part of the equipment, and shall be stowed within the equipment case.

g. Accessibility of accessories. The calibration accessories of 3.13.1.4f shall be available without disturbing the enclosure seams where calibration seals would normally be placed.

h. Circuit penetration. Calibration shall not require the disconnection and reconnection of leads or components by soldering processes.

i. Accessibility for repair. The equipment shall be designed so that subassemblies and chassis components can be removed without removing other hardwired subassemblies or components. Printed circuit cards shall be removable without the need to unsolder cables and interconnecting wiring. Printed circuit cards (mother boards), designed primarily to distribute power and signals to other printed cards (daughter boards), are excluded from this requirement. When mother boards are used the boards shall be accessible from both sides to facilitate troubleshooting or repair.

j. Accessibility for adjustment. The equipment design shall permit adjustments to be made without removing any component, printed circuit card, or subassembly; however, the use of extender cards is permitted.

3.13.1.5 Washability, Type I. When specified in the associated detail specification, the equipment shall conform to all requirements after being washed, and there shall be no loss of finishes or markings, deformation of parts, or other evidence of deterioration when tested in accordance with 4.5.7.1.2.

3.13.2 Maintainability, Type II. Unless otherwise specified in the associated detail specification, maintainability requirements for Type II shall be the same as Type III.

3.13.3 Maintainability, Type III. Type III maintainability shall be as specified in 3.13.3.1 through 3.13.3.5 (see 4.5.7.1).

3.13.3.1 Fault isolation, Type III. The design of the equipment shall permit isolation of faults, and repair down to the lowest discrete component (resistor, switch, transistor, capacitor, nonrepairable assembly, and so forth), with the maintenance provisions furnished as part of the equipment (see 6.4.2.22).

3.13.3.2 Maintainability demonstration, Type III. A maintainability demonstration shall be performed on the equipment when specified in the contract. The M_{ct} (H_0 in MIL-STD-471) shall be 90 minutes. The maximum tolerable M_{ct} (H_1 in

MIL-STD-471) shall be 115 minutes. The M_{max} shall not exceed 270 minutes. The M_{ct} and M_{max} shall include all time required to troubleshoot, fault isolate, repair, and calibrate the equipment for any malfunction down to the lowest discrete component (resistor, switch, transistor, integrated circuit, nonrepairable assembly, and so forth), of the equipment, but does not include certification time (see 6.4.2.8). Certification time shall be as specified in the associated detail specification. The producer's risk shall be not greater than 0.20, and the consumer's risk shall be not greater than 0.10.

3.13.3.3 Preventive maintenance, Type III. Preventive maintenance (for example, motor oiling and filter cleaning) shall not require more than 15 minutes per a 30-day period. Preventive maintenance shall not require breaking of the equipment seams where calibration seals would normally be placed.

3.13.3.4 Maintenance provisions, Type III. Type III equipment shall be as specified in a through i to facilitate maintenance:

a. Accessibility for maintenance. The equipment shall be designed so that the chassis may be removed from the enclosure, and rack-mountable equipment may be removed from the equipment rack, with ordinary tools.

b. Enclosure attitude. The equipment shall be constructed so that no damage to any component shall occur, and no permanent distortion to any structural member shall be caused, by placing the complete equipment on a flat horizontal surface using any of the six sides necessary to support it during maintenance and calibration.

c. Chassis removal. The equipment shall be constructed so that the chassis can be removed from the enclosure with no damage to any component part and with no distortion of structural member.

d. Chassis attitude. The chassis when removed from the enclosure shall be capable of standing on a flat horizontal surface in the attitude required to provide access to components and adjustments during maintenance and calibration.

e. Bench handling provisions. Bench handling provisions shall be in accordance with 3.7.5.3.

f. Accessibility of accessories. Detachable cords, operator's manuals, spare fuses, and other accessories required for Styles A, C, and D equipment operation shall be stowed in the equipment front cover or main case. Operating accessories for Styles P, S, and T shall be stowed in the transit case. Equipment of other styles shall have the operating accessories stowed in a reusable pouch or container marked in accordance with 3.10.3.2.3.

g. Maintenance and calibration aids. Circuit board extenders, special adapters, special tools (see 6.4.2.30), and patch cables required for maintenance or calibration shall be provided and shall be identified as a set with a unique part

number and national stock number. Stowage shall be in a reusable pouch or container marked in accordance with 3.10.3.2.3. The quantity of maintenance and calibration aid sets required shall be as specified by the procuring activity. Maintenance and calibration aids shall be procured as a separate line item in contracts and only for those activities authorized to perform component level maintenance on the equipment.

h. Accessibility for repair. The equipment shall be designed so that subassemblies and chassis components can be removed without removing other hardwired subassemblies or components. Printed circuit cards shall be removable without the need to unsolder cables and interconnecting wiring. Printed circuit cards (mother boards) designed primarily to distribute power and signals to other printed cards (daughter boards) are excluded from this requirement. When mother boards are used they shall be accessible from both sides to facilitate troubleshooting or repair.

i. Accessibility for adjustment. The equipment design shall permit adjustments to be made without removing any component, printed circuit cards, or subassembly; however, the use of extender cards is permitted.

3.13.3.5 Washability, Type III. When specified in the associated detail specification, the equipment shall conform to all requirements after being washed, and there shall be no loss of finishes or markings, deformation of parts, or other evidence of deterioration when tested in accordance with 4.5.7.1.2.

3.14 Environmental stress screening. When specified in the associated detail specification, the equipment shall be subjected to the environmental stress screening requirements of a and b:

a. Random vibration. Random vibration shall be performed in accordance with the process specified in 4.5.3.1c.

b. Temperature cycling. Temperature cycling shall be performed in accordance with the process specified in 4.5.3.1d.

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

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All equipment shall meet the applicable requirements of sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Government verification. All quality assurance operations performed by the contractor will be subject to Government verification at any time. Verification will consist of, but is not limited to, a) surveillance of the operations to determine that practices, methods, and procedures of the written quality assurance program are being properly applied, b) Government product inspection to measure quality of the product to be offered for acceptance, and c) Government inspection of delivered products to assure compliance with all inspection requirements of this specification.

4.1.3 Quality assurance terms and definitions. Quality assurance terms used herein shall be as defined in MIL-STD-109.

4.2 Classification of inspections. The inspections specified herein are classified as specified in a through c:

a. First article inspection (see 4.2.1).
b. Bid sample inspection (see 4.2.2).
c. Quality conformance inspection (see 4.2.3).

4.2.1 First article inspection groups. First article examinations and tests are classified into groups in accordance with table X, 4.3, and a through f.

a. First article inspection, Group A (see 4.3.1.1).
b. First article tests, Group B (see 4.3.1.2).
c. First article tests, Group C (see 4.3.1.3).
d. First article tests, Group D (see 4.3.1.4).
e. First article tests, Group E (see 4.3.1.5).
f. First article tests, Group F (see 4.3.1.6).

4.2.2 Bid sample inspection groups. Bid sample examinations and tests are classified into groups in accordance with table X, 4.3, and a through f:

a. Bid sample inspection, Group A (see 4.3.2.1).
b. Bid sample tests, Group B (see 4.3.2.2).
c. Bid sample tests, Group C (see 4.3.2.3).
d. Bid sample tests, Group D (see 4.3.2.4).

e. Bid sample tests, Group E (see 4.3.2.5).
f. Bid sample tests, Group F (see 4.3.2.6).

TABLE X. Examinations and tests.

Examination or test	Requirement paragraph	Inspection paragraph	
Group A:			
Preoperational inspection	3	4.5.3.1	1/
Level A performance	3.3	4.5.3.2	1/
Open circuit voltage	3.9.1.1.1, 3.9.3.1.1	4.5.3.2.1	1/
Leakage current	3.9.1.1.2, 3.9.3.1.2	4.5.3.2.2	1/
Group B:			
Level B performance	As required in the detail specification	4.5.4	2/
Group C:			
Temperature and humidity	3.7.2	4.5.5.1	1/
T/H	3.7.2.1	4.5.5.1.1	
Temperature shock	3.7.2.2	4.5.5.1.2	3/
Altitude	3.7.3	4.5.5.2	1/
Vibration	3.7.4	4.5.5.3	
Vibration, sinusoidal	3.7.4.1	4.5.5.3.1	1/
Vibration, random	3.7.4.2	4.5.5.3.2	13/
Bounce, loose cargo	3.7.4.3	4.5.5.3.3	13/
Shock, mechanical	3.7.5	4.5.5.4	
Shock, functional	3.7.5.1	4.5.5.4.1	1/
Transit drop, Styles A, B, C, P, S and T	3.7.5.2	4.5.5.4.2	4/
Bench handling	3.7.5.3	4.5.5.4.3	1/
Shock, high impact	3.7.5.4	4.5.5.4.4	13/
Water resistance	3.7.6	4.5.5.5	
Watertight, Styles A and T	3.7.6.1	4.5.5.5.1	5/
Splashproof, Style A	3.7.6.2	4.5.5.5.2	6/
Dripproof, Styles B and C	3.7.6.3	4.5.5.5.3	7/
Electrical power	3.4	4.5.5.6	
Input power consumption	3.4.1.1, 3.4.5.1	4.5.5.6.1	1/
Voltage and frequency variation	3.4.1.2.1, 3.4.5.2.1	4.5.5.6.2	1/
Voltage-transient	3.4.1.2.2, 3.4.5.2.2	4.5.5.6.3	1/
Frequency-transient	3.4.1.2.2, 3.4.5.2.2	4.5.5.6.4	1/
Power source interruption	3.4.1.2.3, 3.4.5.2.3	4.5.5.6.5	1/
Verification, Group C	3.7.1	4.5.5.7	1/

TABLE X. Examinations and tests. (continued)

Examination or test	Requirement paragraph	Inspection paragraph
Group D:		
Fungus resistance	3.7.7	4.5.6.1 3/
Salt fog	3.7.8	4.5.6.2
Exposure, Structural parts	3.7.8.1	4.5.6.2.1 8/
Exposure, enclosure	3.7.8.2	4.5.6.2.2 3/
Explosive atmosphere	3.7.9	4.5.6.3 9/
Dust	3.7.10	4.5.6.4 10/
EMI	3.8	4.5.6.5 1/
Magnetic environment	3.7.11	4.5.6.6 11/
Verification, Group D	3.7.1	4.5.6.7 1/
Solar radiation	3.7.13	4.5.6.8 12/
Group E:		
Maintainability 1/	3.13.1, 3.13.3	4.5.7.1
Washability	3.13.1.5, 3.13.3.5	4.5.7.1.2 3/
Acoustic noise	3.7.12	4.5.7.2 1/
Dimensions	3.5.1	4.5.7.3 1/
Weight	3.5.2	4.5.7.3 1/
Mechanical stability	3.5.3	4.5.7.4 1/
Equipment emanations	3.9.1.4, 3.9.3.4	4.5.7.5 3/
Front panel marking	3.10.1.1.4, 3.10.3.1.4	4.5.7.6 3/
Packaging	5.1	4.5.7.8 1/
Group F:		
Reliability 1/	3.12.1, 3.12.3	4.5.8.1.1, 4.5.8.1.3 13/

1/ Shall be performed on all equipment.
2/ Tests are to be detailed in the associated detail specification if required.
3/ To be performed only when the test is required by the associated detail specification.
4/ Required for equipment in Styles A, B, C, P, S, and T enclosures only.
5/ Required for equipment in Styles A and T enclosures only.
6/ Required for equipment in Style A enclosures only.
7/ Required for equipment in Styles B and C enclosures only.
8/ Testing required for Styles A and B. For Styles C thru G, see Note 3/.
9/ Class 2 only.
10/ Class 2 any Style, and any Class with Styles A, P, or T enclosures.
11/ For Navy equipment only. Also, see Note 13/.
12/ Classes 2 and 3 all Styles. Also, see Note 13/.
13/ Testing is to be performed only when the requirement is invoked by the associated detail specification.

4.2.3 Quality conformance inspection groups. Quality conformance examinations and tests are classified into groups in accordance with table X, 4.4, and a through f.

a. Production inspection, Group A (see 4.4.1).
b. Production control tests, Group B (see 4.4.2).
c. Environmental and electrical power tests, Group C (see 4.4.3).
d. Environmental tests, Group D (see 4.4.4).
e. Other tests, Group E (see 4.4.5).
f. Reliability tests, Group F (see 4.4.6).

4.3 First article or bid sample inspection. The first article inspection shall be performed on five units, and, when front panel marking test requirements are invoked, on a sample of the front panel. Bid sample testing shall be performed on two units, and, when front panel marking test requirements are invoked, on a sample of the front panel (see 6.4.2.18). The test methods, procedures, and conditions used for first article or bid sample inspection shall be performed on the units as specified in 4.5 and a through c:

a. Failure criteria. Failure of any Group A through Group E test shall be counted as a major defect(see 6.4.2.17). Failures during Group F testing shall be in accordance with 4.5.8.2.

b. Test sequence. The test sequence shall be as specified in 4.3.1 and 4.3.2 for Groups A through F. If the associated detail specification does not specify Group B testing, the test sequence shall proceed from Group A to Groups C and D to Group E. The Group D testing may be performed concurrently with, or sequentially after, the Group C testing. First article operating time accumulated during the testing of Groups A through D may be considered toward the Group F reliability test time in accordance with the restrictions specified in 4.3.1.6.

c. Test conditions and control settings. The test conditions and control settings shall be in accordance with 4.5.2.

4.3.1 First article inspection. First article inspection shall be in accordance with 4.3.1.1 through 4.3.1.6.

4.3.1.1 First article inspection, Group A. The five units shall be subjected to the inspection specified in 4.5.3.

4.3.1.2 First article tests, Group B. The five units that have satisfactorily passed the Group A inspection shall be subjected to the Group B tests of 4.5.4. If the associated detail specification does not specify Group B testing, the test sequence shall proceed from Group A to Groups C and D, as applicable, in accordance with 4.3b.

4.3.1.3 First article tests, Group C. Three units that have satisfactorily passed the required tests in accordance with 4.3.1.2 shall be subjected to the Group C tests of 4.5.5.

4.3.1.4 First article tests, Group D. Two units that have satisfactorily passed the required tests in accordance with 4.3.1.2 shall be subjected to the Group D tests of 4.5.6.

4.3.1.5 First article tests, Group E. Units that have satisfactorily passed the Group D tests shall be subjected to the Group E tests of 4.5.7. When the number of units required for Group E testing exceeds the number required for Group D, the additional units shall be selected from units which have passed the Group C tests. The number of units tested shall be as specified in a through g:

a. Maintainability. One unit shall be tested. When the washability test is invoked, the test shall be performed on the unit prior to the maintainability demonstration.

b. Acoustic noise. Two units shall be tested only if the equipment contains a motor (such as a fan or blower) or other audible noise source.

c. Dimensions and weight. Two units shall be tested.

d. Mechanical stability. Two units shall be tested, except that units smaller than 2000 cc (122 in^3) with a weight less than 2.5 kg (5.5 lbs) need not be tested.

e. Equipment emanations. Two units shall be tested, except X-radiation tests need not be performed unless the equipment is designed to have operating potentials of 10 kilovolts (kV) or greater, or could have potentials of 10 kV or greater due to the failure of any one component.

f. Front panel marking. One 100 mm (4 in) by 100 mm (4 in) sample which is representative of the equipment front panel and marking shall be tested.

g. Additional tests. Additional Group E tests shall be as specified in the associated detail specification.

4.3.1.6 First article tests, Group F. The Group F reliability demonstration tests of 4.5.8.1.1.1 or 4.5.8.1.3.1 (as applicable) shall be conducted on at least five models. The use of 10 models for reliability demonstration is encouraged, but not more than 10 models shall be used. The tests shall be performed on units that have satisfactorily passed the Group A tests and (when specified) Group B tests. When these tests are performed on units that have satisfactorily passed the Groups A, B (when specified), C, D, and E tests, the test time (equipment operating time) accumulated during the Groups A, B, C, and D tests may be included as part of the required reliability test time in accordance with the restrictions of a and b:

a. The total of Groups A, B, C, and D test time (equipment operating time) included as reliability test time shall not be greater than 25 percent of the required total reliability test time at the accept or reject decision points of the specified MIL-STD-781 Test Plan.

b. All failures occurring during the Groups A, B, C, and D tests shall count as reliability failures.

4.3.2 Bid sample inspection. Procurement of equipment by the bid sample method requires the submission of a bid sample to the procuring activity when required in the solicitation. The bid sample shall consist of two units with accessories and instruction manuals, and clear and concise rationale showing how the reliability and maintainability characteristics of the equipment comply with the requirements of the solicitation. If readjustment of the equipment is anticipated at the conclusion of any environmental test and prior to the resumption of environmental testing, the rationale for readjustment should identify the environmental tests which should be followed by such readjustment. When the front panel marking test requirements are invoked, a 100 mm (4 in) by 100 mm (4 in) sample of the front panel shall be provided as part of the bid sample (see 6.4.2.18). The bid sample shall be representative of equipment specified by the requirements of the solicitation.

4.3.2.1 Bid sample inspection, Group A. The two bid sample units shall be subjected to the inspection specified in 4.5.3.

4.3.2.2 Bid sample tests, Group B. The two bid sample units that have satisfactorily passed the Group A inspection shall be subjected to the Group B tests of 4.5.4. If Group B testing is not required, the test sequence shall proceed from Group A to Groups C and D as applicable, in accordance with 4.3b.

4.3.2.3 Bid sample tests, Group C. One bid sample unit that has satisfactorily passed the required tests in accordance with 4.3.2.2 shall be subjected to the Group C tests of 4.5.5.

4.3.2.4 Bid sample tests, Group D. One bid sample unit that has satisfactorily passed the required tests in accordance with 4.3.2.2 shall be subjected to the Group D tests of 4.5.6.

4.3.2.5 Bid sample tests, Group E. The unit that has satisfactorily passed the Group C test and the unit that has satisfactorily passed the Group D tests shall be subjected to the Group E tests of 4.5.7. The number of units tested shall be as specified in a through g:

a. Maintainability. When specified in the solicitation, one unit shall be tested.

b. Acoustic noise. Two units shall be tested, except that equipment that does not contain a motor (such as a fan or blower) or other audible noise source will not be tested.

c. Dimensions and weight. Two units shall be tested.

d. Mechanical stability. Two units shall be tested, except that units smaller than 2000 cc (122 in^3) with a weight less than 2.5 kg (5.5 lbs) shall not be tested.

e. Equipment emanations. Two units shall be tested, except X-radiation tests shall not be performed unless the equipment is designed to have operating potentials of 10 kV or greater, or could have potentials of 10 kV or greater due to the failure of any one component.

f. Front panel marking. One sample of the front panel shall be tested.

g. Additional tests. Additional tests shall be performed when specified in the solicitation.

4.3.2.6 Bid sample tests, Group F. When specified in the solicitation, Group F reliability testing shall be performed. The number of units used for reliability testing shall be specified in the solicitation.

4.4 Quality conformance inspection. The test methods, procedures, and conditions specified in a through c and in 4.5 are required for quality conformance inspection.

a. Failure criteria. Failure of any Group A through Group E test shall be counted as a major defect(see 6.4.2.17). Failures during Group F testing shall be in accordance with 4.5.8.2.

b. Test sequence. The test sequence shall be as specified in 4.4.1 through 4.4.5.1 for Groups A through E, prior to the start of the Group F tests of 4.4.6. If the associated detail specification does not require Group B testing, the test sequence shall proceed from Group A to Groups C and D to Group E. The Group D testing may be performed concurrently with or sequentially after the Group C testing. Equipment operating time accumulated during the testing of Groups A through D may be considered toward the Group F reliability test time, at the manufacturer's discretion, in accordance with the restrictions specified in 4.4.6.

c. Test conditions and control settings. The test conditions and control settings shall be in accordance with 4.5.2.

4.4.1 Production inspection, Group A. Each unit shall be subjected to the Group A inspection of 4.5.3 to ensure qualitatively the proper functioning of the equipment, including all operating controls, and conformance with safety requirements.

4.4.2 Production control tests, Group B. The Group B tests of 4.5.4 shall be performed on units that have passed Group A inspection. If the associated detail

specification does not specify Group B testing, the test sequence shall proceed from Group A to Groups C and D as applicable, in accordance with 4.4b.

4.4.2.1 Production control sampling. From each lot (see 6.4.2.20) which has passed production inspection (see 4.4.1), a random sample shall be selected and subjected to the Group B tests. As a minimum, the contractor shall inspect a sample quantity of units in accordance with the sampling defined herein. Sample size depends on classification of the characteristic as shown in table XI. The sample size for each characteristic is shown in table XI. If a defect is found in any sample, the entire lot shall be rejected and screened by the contractor for the defect found. When the Group D testing is to be performed concurrently with the Group C testing, or when required for additional Group E tests, the Group B sample size shall be increased to provide the required samples for Groups C, D, and E testing.

Table XI. Lot size vs sample size

Lot size	Group B	Group C	Group D
2 to 8	All	3	2
9 to 15	8	3	2
16 to 25	8	3	3
26 to 50	8	5	5
51 to 90	8	6	5
91 to 150	12	7	6
151 to 280	19	10	7
281 to 500	21	11	9
501 to 1200	27	15	11
1201 to 3200	35	18	13
3201 to 10000	38	22	15
10001 to 35000	46	29	15
35001 to 150000	56	29	15

4.4.3 Environmental and electrical power tests, Group C. The Group C tests of 4.5.5 shall be performed on units that have passed the required tests in accordance with 4.4.2.

4.4.3.1 Environmental and electrical power sampling. From each lot, a random sample of units that have passed the required tests in accordance with 4.4.2 shall be selected and subjected to the Group C tests. Sample size shall be in accordance with table XI. If one or more defects is found, the entire lot shall be rejected and screened 100 percent by the contractor for the defect found.

4.4.4 Environmental tests, Group D. The Group D tests of 4.5.6 shall be performed on units which have passed the required test in accordance with 4.4.2.

4.4.4.1 Environmental sampling. From each lot, a random sample of units which have passed the required tests in accordance with 4.4.2 shall be selected and subjected to the Group D tests. Sample size shall be in accordance with table XI. If one or more defects is found, the entire lot shall be rejected and screened 100 percent by the contractor for the defect found.

4.4.5 Other tests, Group E. The Group E tests of 4.5.7 shall be performed on units which have passed the required tests in accordance with 4.4.2.

4.4.5.1 Other tests sampling. From the first production lot which has passed the required tests in accordance with 4.4.2, a random sample shall be selected and subjected to the Group E tests specified in a through g:

a. Maintainability. One unit shall be randomly selected and tested.

b. Acoustic noise. For units which contain a motor (such as a fan or blower) or other audible noise source, one unit shall be randomly selected and tested.

c. Dimensions and weight. Four units shall be randomly selected and tested.

d. Mechanical stability. For units of 2000 cc (122 in^3) or larger, with a weight of 2.5 kg (5.5 lbs) or more, one unit shall be randomly selected and tested.

e. Equipment emanations. One unit shall be randomly selected and tested, except X-radiation tests need not be performed unless the equipment is designed to have operating potentials of 10 kV, or greater, or could have potentials of 10 kV or greater, due to circuit malfunction resulting from the failure of any component, including related sequential failures.

f. Additional tests. Sampling shall be as specified in the associated detail specification.

g. Packaging inspection. Sampling shall be in accordance with the requirements of MIL-STD-2073-1.

4.4.6 Reliability tests, Group F. The Group F tests of 4.5.8 shall be performed on units which have passed the required tests in accordance with 4.4.2. The tests shall be conducted under the conditions specified in 4.5.8.

4.4.6.1 Reliability sampling. From each lot which has passed the required tests in accordance with 4.4.2, a random sample shall be selected and subjected to the Group F tests. The sampling shall be in accordance with 4.5.8.1.1.2 and 4.5.8.1.3.2.

4.5 Examination and test methods. The test methods, procedures, conditions, and failure criteria specified in 4.5.1 through 4.5.8.3.2 shall be applied. Equipment operation shall be verified in accordance with a and b:

a. Satisfactory operation check. Wherever this specification requires a satisfactory operation check (see 6.4.2.27) to be performed, the parameters and the limits of acceptability shall be as specified in the associated detail specification.

b. Satisfactory operation test. Wherever this specification requires a satisfactory operation test (see 6.4.2.28) to be performed, the parameters shall be as specified in the associated detail specification.

4.5.1 Test equipment. Test equipment used for inspections and tests shall be as specified in the associated detail specification or approved equipment test procedure (see 6.4.2.2). The test equipment shall be properly maintained and calibrated in accordance with MIL-STD-45662.

4.5.1.1 Test equipment approval. Use of test equipment in addition to or in place of those specified in 4.5.1 requires approval of the procuring activity.

4.5.2 Conditions and control settings. Conditions and control settings shall be as specified in 4.5.2.1 through 4.5.2.3.5.

4.5.2.1 Test conditions. Unless otherwise specified in the detailed test herein, the inspection of 4.5 shall be performed under the conditions of a through e. Ambient conditions within the specified ranges need not be controlled. For equipment having a specified warmup or stabilization period after turn-on, formal measurements and observations shall be made only after the specified interval (see 3.7.1.1).

a. Temperature: 25° ±10°C.
b. Humidity: 20 to 70 percent RH.
c. Altitude: 0 to 3050 m (10,000 ft).
d. Power: Nominal or alternate power source specified for the equipment.
e. Attitude: Normal operating position.

4.5.2.1.1 Measurements of test conditions. All measurements of the test conditions shall be made with instruments of the accuracy specified in 4.5.2.1.3.

4.5.2.1.2 Tolerance of test conditions. The tolerance of test conditions shall be as specified in a through h:

a. Temperature. The test item shall be totally surrounded by an envelope of air (except at necessary support joints). The temperature of the test section measurement system and the temperature gradient throughout this envelope, which is measured close to the test item, shall be within ±2°C of the test temperature and shall not exceed 1°C per m or a maximum of 2.2°C total (equipment nonoperating).

b. Pressure. Pressure shall be measured with an accuracy of ±5 percent of the measured value.

c. Humidity. Relative humidity at the chamber control sensor shall be ±5 percent RH of the measured value.

d. Vibration amplitude. Sinusoidal, ±10 percent; random, as specified for Method 514 in MIL-STD-810.

e. Vibration frequency. Vibration frequency shall be measured with an accuracy of ±2 percent, or ±1/2 Hz below 25 Hz.

f. Acceleration. Acceleration shall be measured to within ±10 percent.

g. Time. Elapsed time shall be measured with an accuracy of ±1 percent.

4.5.2.1.3 Accuracy of test instrument calibration. The accuracy of instruments and test equipment used to control or monitor the test parameters shall be verified prior to and following each test and then calibrated at predetermined intervals and shall meet the requirements of MIL-STD-45662.

4.5.2.2 Control settings. The control settings shall be as determined by the approved equipment test procedure (see 6.4.2.2) or the associated detail specification.

4.5.2.3 Performance of test. Tests shall be performed in accordance with 4.5.2.3.1 through 4.5.2.3.5.

4.5.2.3.1 Pretest qualification data. Prior to proceeding with the environmental tests, the test item shall be operated under standard ambient conditions (see 4.5.2.1) to obtain qualification data for determining satisfactory operation of the item as specified in the associated detail specification, before, during, and after the environmental test, as applicable. The pretest qualification data shall also include the functional parameters to be monitored during and after the test, if not specified in the associated detail specification. The qualification data shall include acceptable functional limits (with permissible degradation) when operation of the test item is required, as applicable.

4.5.2.3.2 Installation of test item in test facility. The test item shall be installed in the test facility in a manner that will simulate service usage, making connections and attaching instrumentation as necessary. Plugs, covers, and inspection plates not used in operation, but used in servicing, shall remain in place. When mechanical or electrical connections are not used, the connections normally protected in service shall be covered. For tests where temperature values are controlled, the test chamber shall be at standard ambient conditions when the test item is installed. The test item shall be operated to determine that no malfunction or damage was caused due to faulty installation or handling. The requirement for

operation following installation of the test item in the test facility is applicable only when operation is required during exposure to the specified test.

4.5.2.3.3 Performance check during test. When operation of the test item is required during the test exposure, suitable tests shall be performed to determine whether the test exposure is producing changes in performance when compared with pretest qualification data.

4.5.2.3.4 Post-test inspection. At the completion of each environmental test, the test item shall be inspected in accordance with the associated detail specification and the results shall be compared with the pretest qualification data obtained in accordance with 4.5.2.3.1.

4.5.2.3.5 Failure criteria. Failure criteria shall be as specified in a and b:

a. The item shall have failed the test when any of the conditions specified in 1 through 7 occur:

1. Monitored functional parameters deviate beyond acceptable limits established in 4.5.2.3.1.

2. Catastrophic or structural failure.

3. Mechanical binding or loose parts, including screws, clamps, bolts, and nuts, that results in component failure or a hazard to personnel safety.

4. Malfunction.

5. Degradation of performance beyond limits established in the associated detail specification.

Certain types of equipment (for example, propellants and electrically driven devices) are often expected to demonstrate lesser performance at an environmental extreme, particularly low temperature. A failure would occur only if degradation is more than expected.

6. Any additional deviations from acceptable criteria established before the test.

7. Deterioration, corrosion, or change in tolerance limits of any internal or external parts which could in any manner prevent the test item from conforming to operational service or maintenance requirements.

b. Additional or different failure criteria shall be as specified in the associated detail specification.

4.5.3 Group A inspection. Group A inspection shall consist of the preoperational inspection of 4.5.3.1 and the Level A performance tests of 4.5.3.2.

4.5.3.1 Preoperational inspection. Prior to the beginning of the Level A test (see 4.5.3.2), the preoperational inspection specified in a and b shall be performed on all equipment. When specified in the associated detail specification, the examinations specified in c and d shall be performed.

a. Mechanical and visual examination. The equipment shall be given a thorough mechanical and visual examination and test to determine that all materials, workmanship, and safety characteristics comply with the specified requirements. Particular attention shall be given to the requirements specified in 1 through 14:

1. Completeness.
2. Nameplates, identification marking, labels, and indexes.
3. Alignment and tightness.
4. Finish.
5. Fit and placement of components.
6. Operation of jacks, switches, sliding parts, and controls.
7. Mountings and brackets.
8. Fastening and securing of devices or parts.
9. Accessibility of components and parts.
10. Welded and soldered joints.
11. Forms, harnesses, and other wiring.
12. Grounding connections.
13. Safety examinations.
14. Workmanship.

b. Electrical circuit configuration. The equipment shall be examined or tested to confirm that the wiring is correct. Where applicable, the tests shall include the requirements specified in 1 and 2:

1. All intramodule wiring shall be tested to assure correctness, good electrical contact, and that shorts and undesired grounds are eliminated.

2. The module grounding system shall be examined or tested to ensure: proper separation of shield, signal, and framework grounds, and metal-to-metal contact for panels and components that serve as electromagnetic shields.

c. Environmental stress screening (random vibration). Prior to conducting the temperature cycling, random vibration shall be performed on each unit. Random vibration may be performed at the module, drawer, end item level, or line replaceable unit (LRU). All the hardware, including cables and connectors, shall be exposed to vibration. The vibration shall be random, or subject to procuring activity approval, pseudo-random or complex waveform vibration, for an accumulated time of 10 minutes in the axis most susceptible to vibration excitation. All items being screened shall be hard-mounted (without shock isolators) and subjected to the vibration conditions of figure 2. The control accelerometer shall be located next to one of the mounting points of the item being screened. Equipment having a bandwidth of not greater than 10 Hz for vibration frequencies up to 500 Hz, and 100 Hz for vibration frequencies above 500 Hz shall be used for the control and analysis

of the acceleration spectral density (ASD). The item being screened shall be energized during vibration, and appropriate input signals shall be applied to observe any abnormal conditions of the output functional characteristics. All failures occurring during the process shall be corrected and the screening resumed.

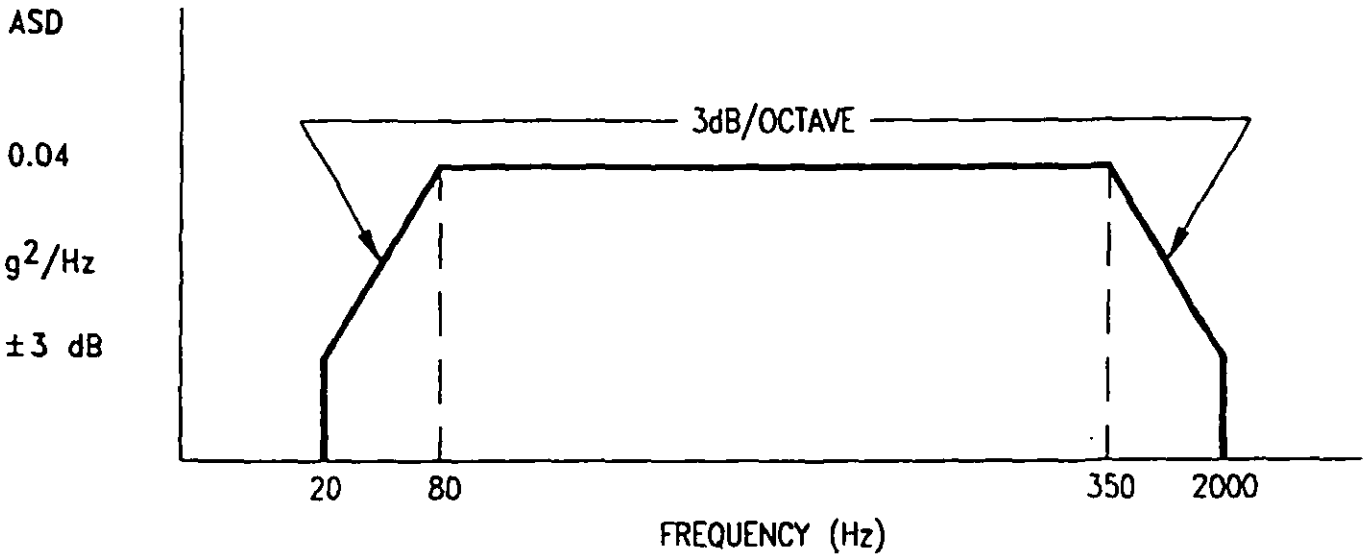


FIGURE 2. Random vibration curve.

d. Environmental stress screening (temperature cycling). Each equipment shall be subjected to the temperature cycling shown in figure 3. The number of cycles required shall be determined by the electrical and electronic parts count in table XII. The temperature rate of change shall be not less than 5°C per minute. Equipment power shall be turned on and off at the indicated times. When practical, the equipment drawers, panels, and enclosures shall be opened or removed for maximum exposure to the changing temperature. The last temperature cycle shall be failure free. The dwell time shall be 80 percent of the time required for the largest electrical or electronic part to become temperature stabilized. Temperature stabilization will have been attained when the temperature of the part of the item being screened considered to have the longest thermal lag reaches a temperature within 2.0°C of the specified temperature, except that any critical component will be within 1°C. Exceptions may occur in large items. When changing temperatures, the temperature of the chamber air may be adjusted up to 5°C beyond the desired end point for a period of up to 1 hour to reduce stabilization time, provided that the

stabilization requirements of this paragraph are ultimately attained relative to the specified end point temperature, and provided the extended chamber temperatures will not cause damage to the item being screened. Failures occurring prior to the last original temperature cycle shall be repaired and the cycling continued. If failures occur during the last original temperature cycle, table XIII shall be used to determine the number of additional cycles required.

TABLE XII. Test cycles.

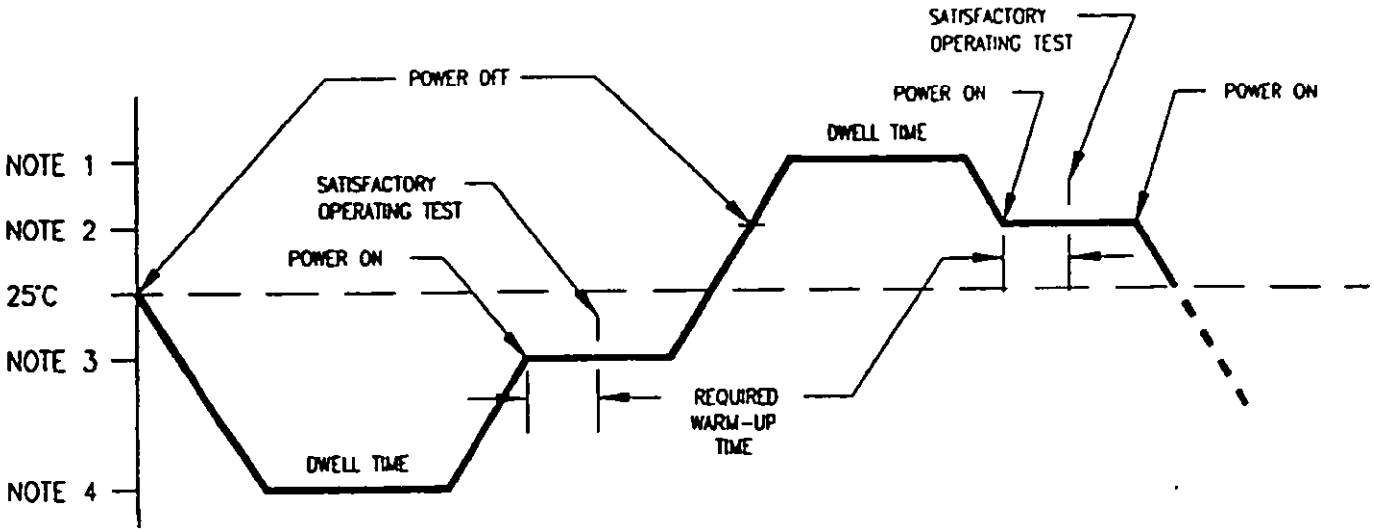
Electrical and electronic parts count	Number of temperature cycles
500 or less	3
501 to 1000	4
1001 to 2000	6
2001 to 3000	8
3001 or more	10

TABLE XIII. Additional test cycles.

Percentage of total parts reworked or replaced 1/	Equipment parts count		
	500 or less	501 to 2000	2001 or more
0 to 0.1 percent	None	Repeat 1 cycle	Repeat 1 cycle
0.1 to 1 percent	Repeat 1 cycle	Repeat 1 cycle	Repeat 2 cycles
1 to 5 percent	Repeat 1 cycle	Repeat 2 cycles	Repeat 4 cycles
Over 5 percent	Repeat 2 cycles	Repeat 4 cycles	Repeat 6 cycles
	Last cycle shall be failure-free		

1/ Each reworked solder joint or resoldered lead shall count as one part replaced.

4.5.3.2 Level A performance tests. The Level A performance tests for evaluating equipment performance shall be as required both herein and in the approved equipment test procedure, except that when an approved equipment test procedure is not provided or authorized for use, conformance to the performance requirements of the associated detail specification shall be verified (see 6.4.2.2). These tests shall be performed on each item of equipment and shall be conducted under the test conditions of 4.5.2.1 (see 6.4.2.2 and 6.4.2.23.1).



NOTES:

1. Upper nonoperating temperature limit for equipment class.
2. Upper operating temperature limit for equipment class.
3. Lower operating temperature limit for equipment class.
4. Lower nonoperating temperature limit for equipment class.

FIGURE 3. One cycle of temperature curve (not to scale).

4.5.3.2.1 Open circuit voltage test. The open circuit voltage test shall be in accordance with 4.5.3.2.1.1 and 4.5.3.2.1.2.

WARNING

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. DO NOT TOUCH EXPOSED METAL SURFACES WITHOUT ELECTRIC SHOCK PROTECTION.
THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR DURING OR AS A RESULT OF THIS TEST.

4.5.3.2.1.1 Equipment connections. Each equipment directly connected to an external power source and units deriving power from the equipment shall be placed on an insulated surface. All safety ground conductors between the equipment and units deriving power from the equipment and the power source shall be opened during the test. The equipment shall be connected as shown in figure 4, if it is connected to

a single-phase power source, as shown in figure 5, if it is connected to a dc power source, and as shown in figure 6, if it is connected to a three-phase power source.

4.5.3.2.1.2 Measurement. The open circuit voltage test shall be measured on equipment in the normal operating configuration. Equipment controls in each operation mode shall be such that maximum power will be utilized during the open circuit voltage test. A true rms voltmeter shall be used for ac potentials, and a dc voltmeter with a 10 megohm or greater input impedance shall be used for dc potentials. The probe in figures 4 through 6 shall be used to measure voltage on any conducting or adjustment controls and control shafts with the knobs removed. The voltage shall be measured from each part to ground and from each part to all other simultaneously accessible parts for every combination of switch positions specified in figures 4 through 6. The open safety ground conductor shall be reconnected immediately after the test has been completed.

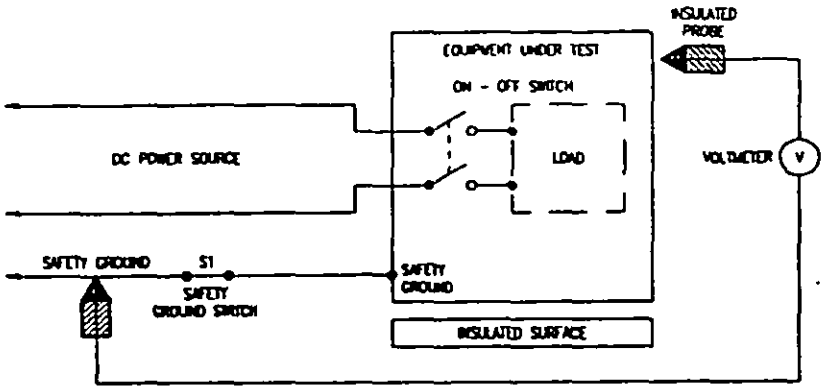
4.5.3.2.2 Leakage current test. The leakage current test shall be in accordance with 4.5.3.2.2.1 and 4.5.3.2.2.2.

WARNING

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. DO NOT TOUCH EXPOSED METAL SURFACES WITHOUT ELECTRIC SHOCK PROTECTION.
THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR DURING OR AS A RESULT OF THIS TEST.

4.5.3.2.2.1 Equipment connections. Each equipment directly connected to an external power source and units deriving power from the equipment shall be placed on an insulated surface. All safety ground conductors between the equipment and units deriving power from the equipment shall be intact. The safety ground conductor between the equipment and the power source shall be opened during the test. The equipment shall be connected as shown in figure 7, if it is connected to a single-phase power source, as shown in figure 8, if it is connected to a dc power source, and as shown in figure 9, if it is connected to a three-phase power source.

4.5.3.2.2.2 Measurement. The leakage current test shall be performed on equipment in the normal operating configuration. Equipment controls in each operation mode shall be such that maximum power will be utilized during leakage current measurements. The leakage current shall be determined by the voltage-drop method, using a true rms voltmeter for ac potentials and a high impedance dc voltmeter for dc potentials. The voltage measured across the 1500 ohm resistor (see figures 7 through 9) shall not exceed 5 V at the highest nominal power line voltage and the highest and lowest nominal power line frequencies which are specified by the



WARNING

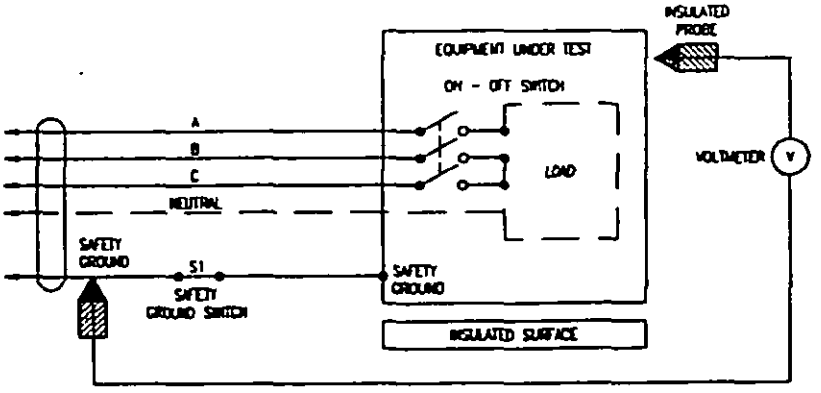
DO NOT TOUCH EXPOSED METAL SURFACES

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR FROM THE USE OF THIS DIAGRAM FOR OPEN CIRCUIT VOLTAGE MEASUREMENT.

GENERAL ORDER OF TEST:

1. POWER SOURCE OFF. CONNECT EQUIPMENT AS PER DIAGRAM.
2. ON-OFF SWITCH OFF. S1 CLOSED. S2 NORMAL. CONNECT POWER SOURCE.
3. OBSERVE WARNING! S1 OPEN. ON-OFF SWITCH ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE, CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SWITCH OFF. REPEAT STEP 4.
6. S1 CLOSED. ON-OFF SWITCH ON. REPEAT STEPS 4 AND 5.
7. REMOVE POWER SOURCE. DISCONNECT EQUIPMENT.

FIGURE 5. DC test diagram for open circuit voltage measurement.



WARNING

DO NOT TOUCH EXPOSED METAL SURFACES

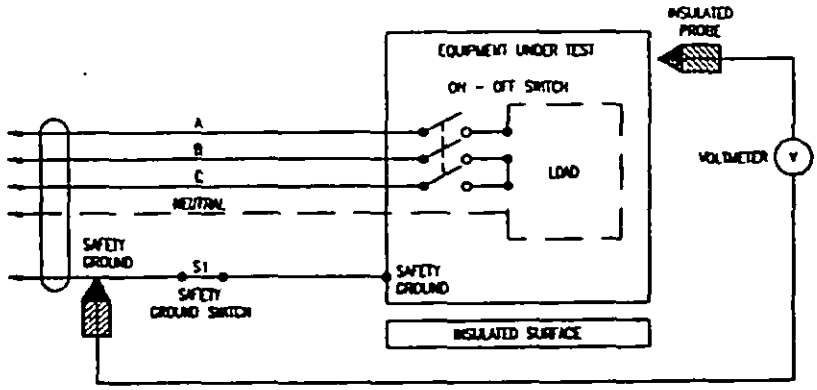
THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR FROM THE USE OF THIS DIAGRAM FOR OPEN CIRCUIT VOLTAGE MEASUREMENT.

NOTES:
1. ALL THREE PHASES SHALL BE CONNECTED DURING MEASUREMENT.
2. THE SAFETY GROUND CONDUCTOR SHALL NOT CARRY LOAD CURRENT.

GENERAL ORDER OF TEST:

1. POWER SOURCE OFF. CONNECT EQUIPMENT AS PER DIAGRAM.
2. ON-OFF SWITCH OFF. S1 CLOSED. S2 NORMAL. CONNECT POWER SOURCE.
3. OBSERVE WARNING! S1 OPEN. ON-OFF SWITCH ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE, CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SWITCH OFF. REPEAT STEP 4.
6. S1 CLOSED.
7. REPEAT STEPS 3 THROUGH 6 FOR EACH MODE OF OPERATION.
8. REMOVE POWER SOURCE. DISCONNECT EQUIPMENT.

FIGURE 6. Three-phase test diagram for open circuit voltage measurement.



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NOTES:
1. ALL THREE PHASES SHALL BE CONNECTED DURING MEASUREMENT.
2. THE SAFETY GROUND CONDUCTOR SHALL NOT CARRY LOAD CURRENT.

GENERAL ORDER OF TEST:

1. POWER SOURCE OFF. CONNECT EQUIPMENT AS PER DIAGRAM.
2. ON-OFF SWITCH OFF. S1 CLOSED. S2 NORMAL. CONNECT POWER SOURCE.
3. OBSERVE WARNING! S1 OPEN. ON-OFF SWITCH ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE, CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SWITCH OFF. REPEAT STEP 4.
6. S1 CLOSED.
7. REPEAT STEPS 3 THROUGH 6 FOR EACH MODE OF OPERATION.
8. REMOVE POWER SOURCE. DISCONNECT EQUIPMENT.

FIGURE 6. Three-phase test diagram for open circuit voltage measurement.

associated detail specification. The overall measurement error shall not exceed 5 percent. The leakage current test shall be performed when open circuit voltage in excess of the limits specified in 3.9.1.1 (for Type I) and 3.9.3.1 (for Type III) has been measured on any conducting parts such as the case, connector housings, recessed calibration or adjustment controls, and control shafts with the knobs removed. The voltage shall be measured from each part to ground and from each part to all other simultaneously accessible parts for every combination of switch positions specified in figures 7 through 9. The open safety ground conductor shall be reconnected immediately after the test has been completed.

4.5.4 Group B tests. The Group B tests consist of the Level B performance tests and shall be performed as specified herein and in the associated detail specification or approved equipment test procedure. These tests shall be performed and conducted under the test conditions of 4.5.2.1 (see 6.4.2.2 and 6.4.2.23.1).

4.5.5 Group C tests. The Group C tests shall be performed as specified in 4.5.5.1 through 4.5.5.7 and in the associated detail specification or approved equipment test procedure (see 6.4.2.2). These tests shall be performed under the test conditions of 4.5.2.1.

4.5.5.1 Temperature and humidity tests. The temperature and humidity tests shall be in accordance with 4.5.5.1.1 through 4.5.5.1.2.

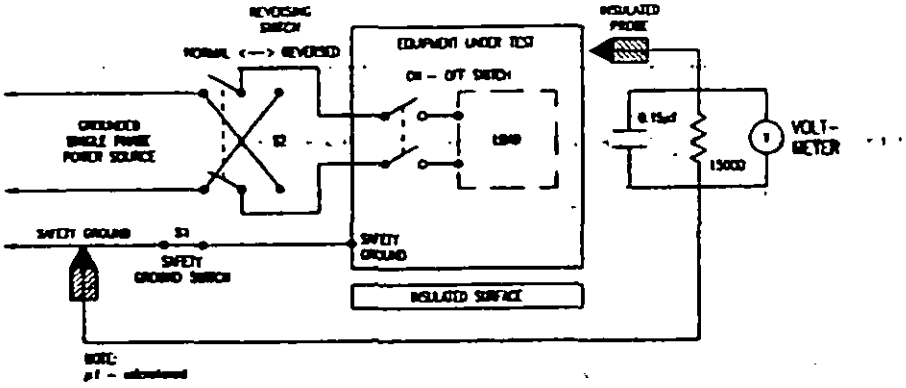
4.5.5.1.1 T/H test. The T/H test shall be performed. Figures 10 through 13 show the T/H test for Classes 2, 3, 5, and 6 equipment. Class 7 shall be as specified in the associated detail specification.

4.5.5.1.1.1 T/H chamber. No rust or corrosive contaminants shall be imposed on the test item by the test facility (T/H chamber).

4.5.5.1.1.2 Procedure. Install the test item in the test facility in accordance with 4.5.2.3.2. During the tests specified in Steps 1 through 27, the RH need not be controlled at temperatures below 10°C. RH of 95 percent (with the applicable tolerance) does not include conditions of precipitation. The rate of temperature change shall be 1°C to 5°C per minute. The temperature limits and RH are specified by class in table XIV. Precipitation is not authorized during the T/H test.

Step 1. Place the test item in the test chamber in accordance with 4.5.2.3.2. With the test item operating, reduce the chamber temperature until the applicable lower operating temperature limit specified in table XIV is reached. Maintain the temperature within 2°C for 4 hours.

Step 2. Operate the test item for the warmup period recommended by the manufacturer. Perform the satisfactory operation test and compare the results with the qualification data obtained in accordance with 4.5.2.3.1. No alignment or adjustment of other than the operating controls shall be permitted throughout the T/H cycle specified.



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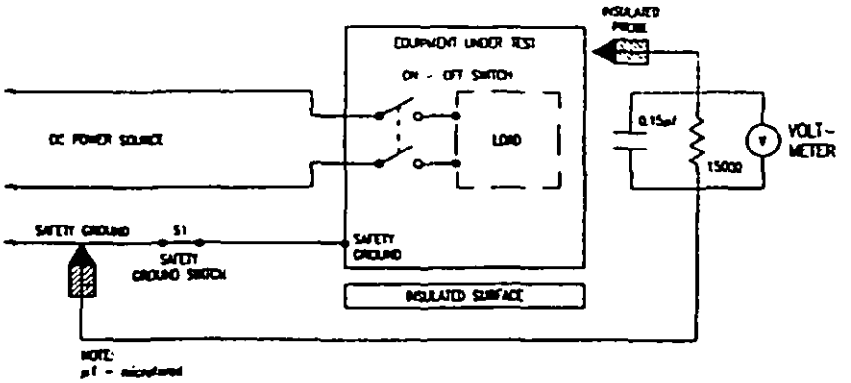
GENERAL ORDER OF TEST:

1. POWER SOURCE OFF. CONNECT EQUIPMENT AS PER DIAGRAM.
2. ON-OFF SWITCH OFF. S1 CLOSED. S2 NORMAL. CONNECT POWER SOURCE.
3. OBSERVE WARNING! S1 OPEN. ON-OFF SWITCH ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE, CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SWITCH OFF. REPEAT STEP 4.
6. S2 REVERSED. ON-OFF SWITCH ON. REPEAT STEP 4.
7. ON-OFF SWITCH OFF. REPEAT STEP 4.
8. S1 CLOSED. S2 NORMAL.
9. REPEAT STEPS 3 THROUGH 8 FOR EACH MODE OF OPERATION.
10. REMOVE POWER SOURCE. DISCONNECT EQUIPMENT.

FIGURE 7. Single-phase test diagram for leakage current measurement.



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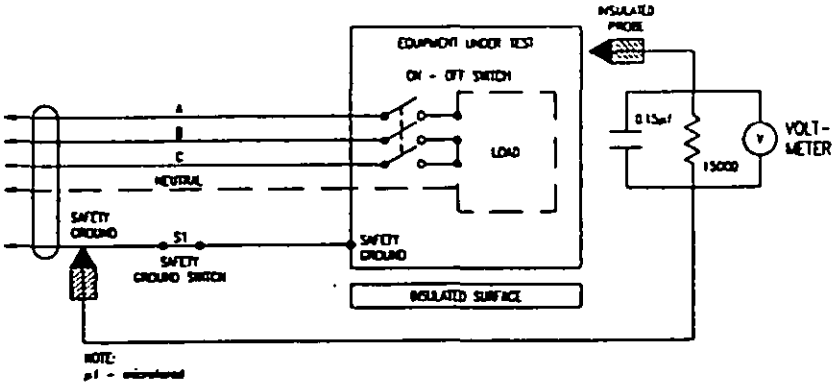
GENERAL ORDER OF TEST:

1. POWER SOURCE OFF. CONNECT EQUIPMENT AS PER DIAGRAM.
2. ON-OFF SWITCH OFF. S1 CLOSED. S2 NORMAL. CONNECT POWER SOURCE.
3. OBSERVE WARNING! S1 OPEN. ON-OFF SWITCH ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE, CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SWITCH OFF. REPEAT STEP 4.
6. S1 CLOSED. ON-OFF SWITCH ON. REPEAT STEPS 4 AND 5.
7. REMOVE POWER SOURCE. DISCONNECT EQUIPMENT.

FIGURE 8. DC test diagram for leakage current measurement.



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NOTES:
1. ALL THREE PHASES SHALL BE CONNECTED DURING MEASUREMENT.
2. THE SAFETY GROUND CONDUCTOR SHALL NOT CARRY LOAD CURRENT.

GENERAL ORDER OF TEST:

1. POWER SOURCE OFF. CONNECT EQUIPMENT AS PER DIAGRAM.
2. ON-OFF SWITCH OFF. S1 CLOSED. S2 NORMAL. CONNECT POWER SOURCE.
3. OBSERVE WARNING! S1 OPEN. ON-OFF SWITCH ON.
4. FOR EACH PROBE POINT, RECORD VOLTMETER READING (CASE, CONNECTORS, CONTROLS, SHAFTS).
5. ON-OFF SWITCH OFF. REPEAT STEP 4.
6. S1 CLOSED.
7. REPEAT STEPS 3 THROUGH 6 FOR EACH MODE OF OPERATION.
8. REMOVE POWER SOURCE. DISCONNECT EQUIPMENT.

FIGURE 9. Three-phase test diagram for leakage current measurement.

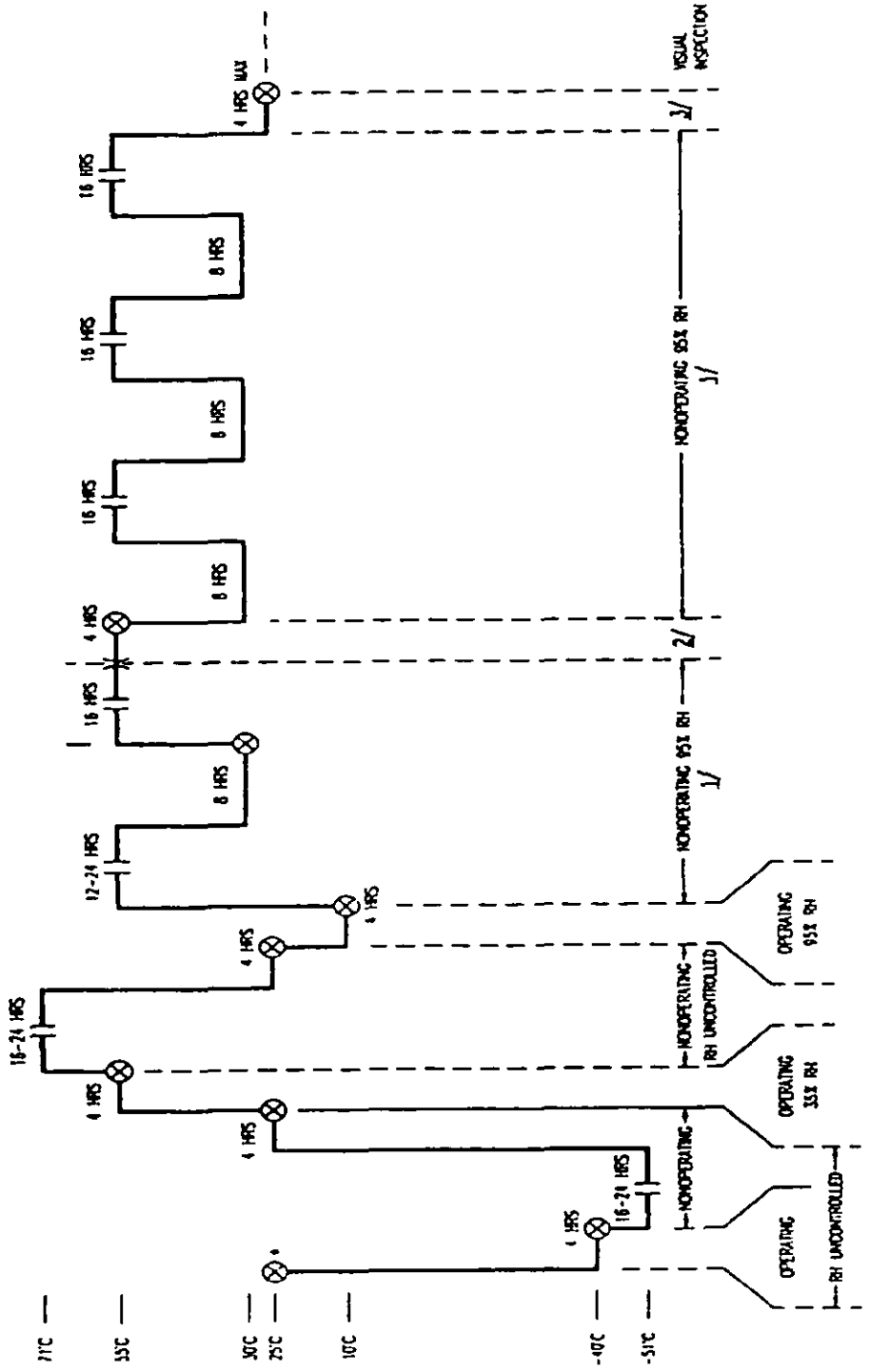

FIGURE 10. Class 2 1/A1 test sequence.

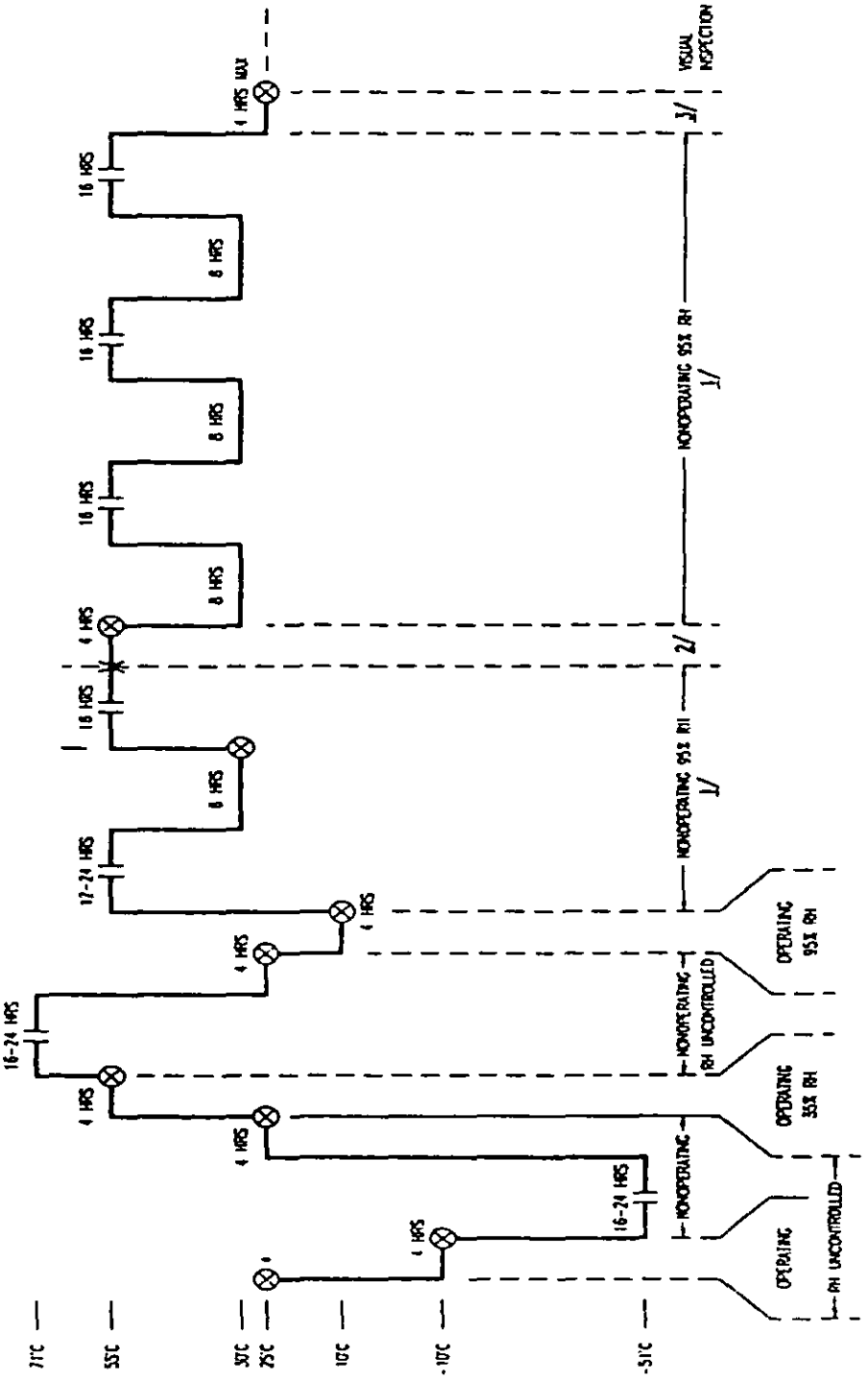

FIGURE 11. Class 1 I/H test sequence

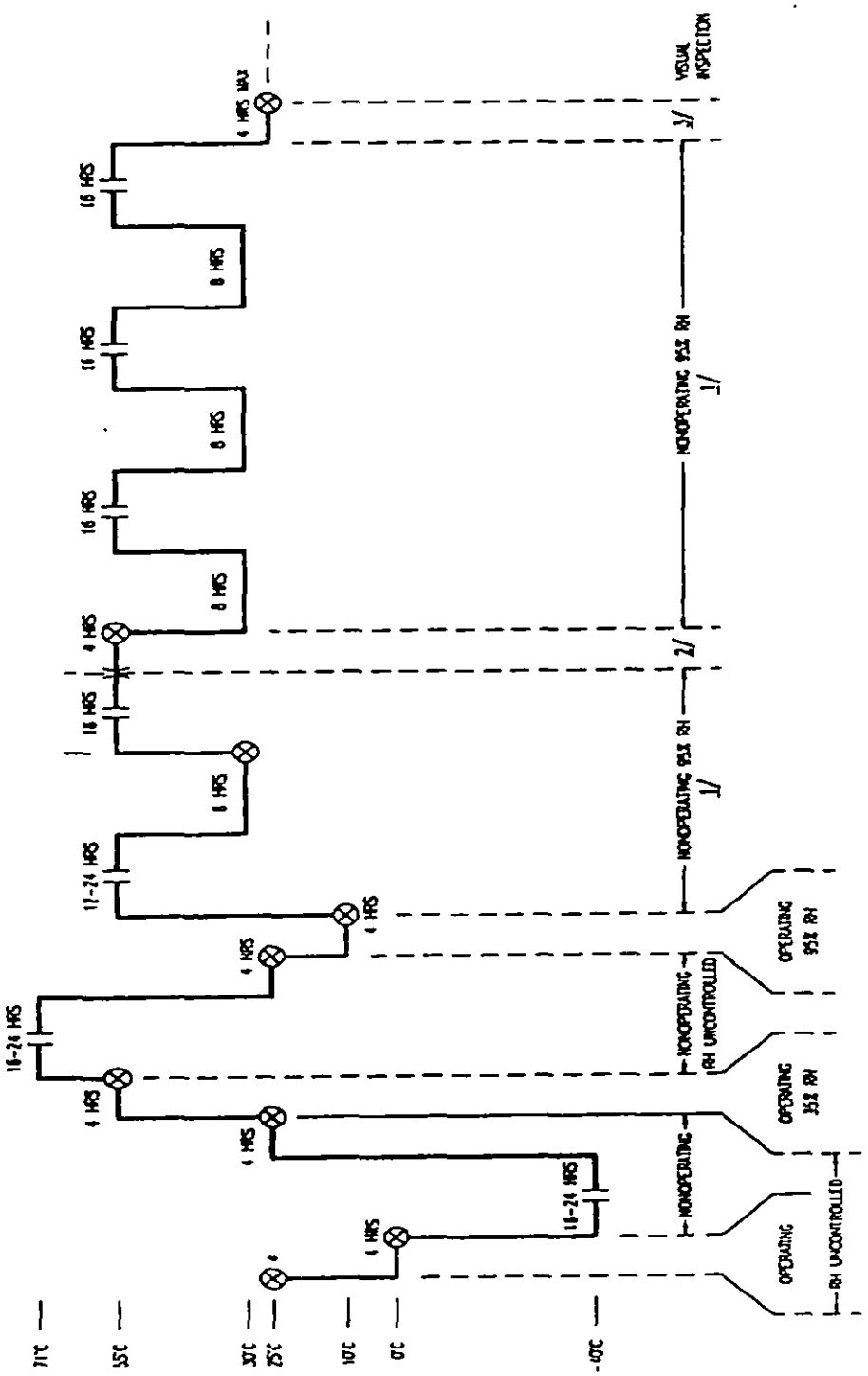

FIGURE 12. Class 3 I/H test sequence

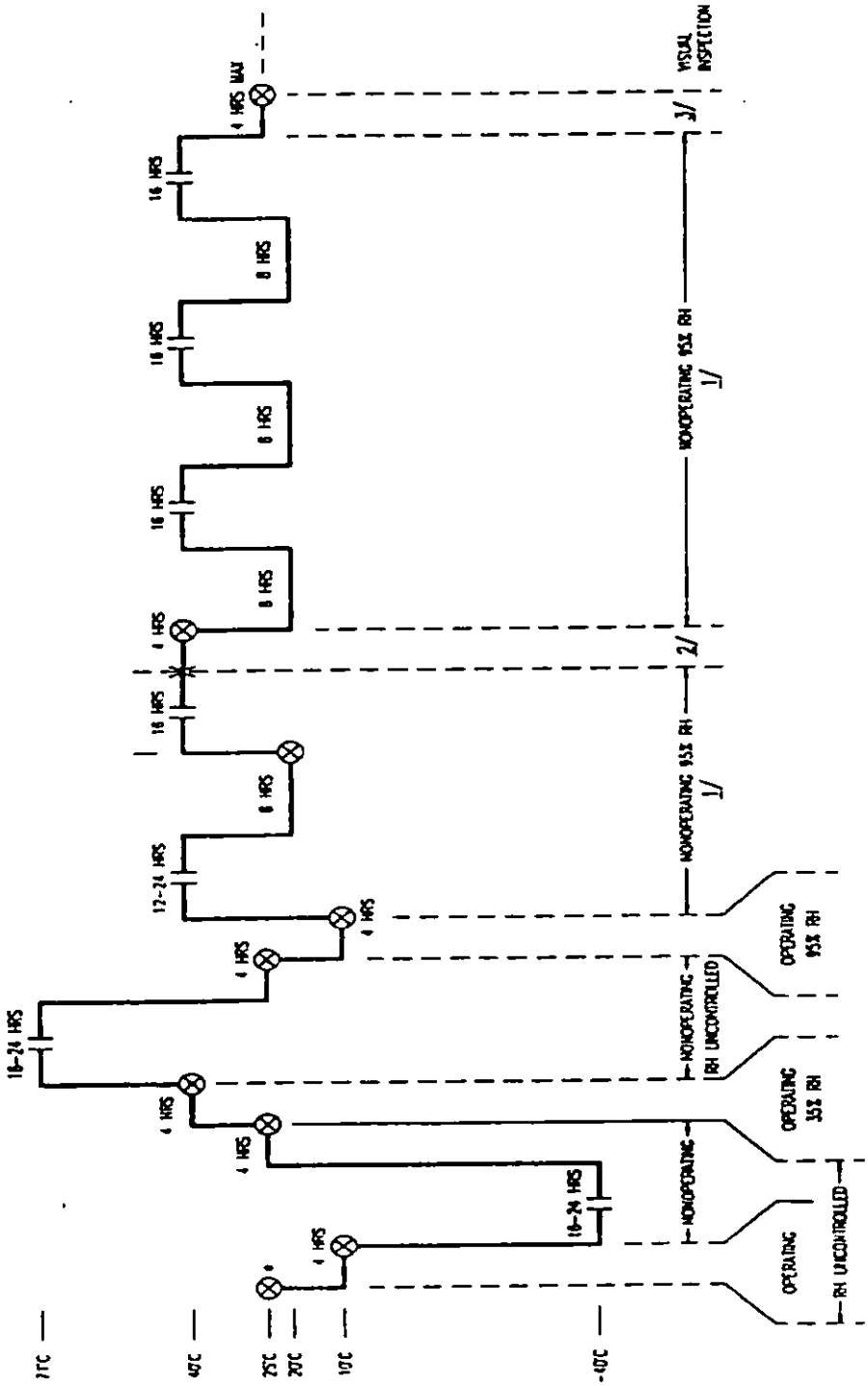

FIGURE 13. Class 5 I/A test sequence

TABLE XIV. Temperature limits and T/H test steps.

Class	Temperature limits		Applicable T/H test steps
	Nonoperating equipment (°C)	Operating equipment (°C at percent RH)	
2	-51 to 71	-40 to 55 at 35 30 to 55 at 95	3 and 8 1/ 1 and 6 13 thru 24
3	-51 to 71	-10 to 55 at 35 30 to 55 at 95	3 and 8 1 and 6 13 thru 24
5	-40 to 71	0 to 50 at 45 30 to 50 at 95	3 and 8 1 and 6 13 thru 24
6	-40 to 71	10 to 40 at 75 20 to 40 at 95	3 and 8 1 and 6 13 thru 24
7	As specified in the associated detail specification		

1/ For Class 2 equipment, 20 minute intermittent operation at 71°C after the required warm-up period; 15 minutes nonoperating.

Step 3. With the test item nonoperating, reduce the chamber temperature until the applicable lower nonoperating temperature limit specified in table XIV is reached. Maintain the temperature within 2°C for 16 to 24 hours.

Step 4. With the test item nonoperating, increase the chamber temperature to 25°C ±2°C. Maintain this temperature and 40 ±5 percent RH for 4 hours.

Step 5. Repeat Step 2.

Step 6. With the test item operating as in the satisfactory operation check, increase the chamber temperature until the applicable upper operating T/H limit specified in table XIV and the corresponding test sequence figure is reached. Maintain this condition within 2°C and 5 percent RH for 4 hours.

Step 7. Repeat Step 2.

Step 8. With the test item nonoperating, increase the chamber temperature until the applicable upper nonoperating temperature limit is reached. Maintain this temperature within 2°C for 16 to 24 hours.

Step 9. With the test item nonoperating, decrease the chamber temperature to 25°C ±2°C. Maintain this temperature and 40 ±5 percent RH for 4 hours.

Step 10. Repeat Step 2.

Step 11. With the test item operating as in the satisfactory operation check, decrease the chamber temperature to 10°C ±2°C and increase the humidity to a RH value of 95 ±5 percent. Maintain these conditions for 4 hours.

Step 12. Repeat Step 2.

Step 13. With the test item nonoperating, increase the chamber temperature to the applicable upper operating temperature for a RH of 95 percent. Maintain these conditions within 2°C and 5 percent RH for 12 to 24 hours.

Step 14. Decrease the chamber temperature to the applicable humidity cycle lower temperature. Maintain the temperature within 2°C for 8 hours.

Step 15. Repeat Step 2.

Step 16. Increase the chamber temperature to the applicable upper operating temperature limit and 95 percent RH. Maintain these conditions within 2°C and 5 percent RH for 16 hours.

Step 17. With the test item nonoperating, decrease the chamber humidity to 45 percent ±5 percent RH (classes 2 and 3), or the temperature to 50°C ±2°C and RH to 45 percent ±5 percent (Class 5) or 40°C ±2°C and 75 percent ±5 percent RH (Class 6), as applicable. Maintain this condition for 4 hours.

Step 18. Repeat Step 2.

Step 19. With the test item nonoperating, decrease the chamber temperature to the applicable humidity cycle lower temperature ±2°C while increasing the RH to 95 ±5 percent. Maintain this condition for 8 hours.

Step 20. Increase the chamber temperature to the applicable upper operating temperature limit and 95 percent RH. Maintain these conditions within 2°C and 5 percent RH for 16 hours.

Step 21. Decrease the chamber temperature to the applicable humidity cycle lower temperature. Maintain this temperature within 2°C and 95 ±5 percent RH for 8 hours.

Step 22. Repeat Step 20.

Step 23. Repeat Step 21.

Step 24. Repeat Step 20.

Step 25. Adjust the chamber temperature to 25°C ±2°C. Maintain this temperature and 40 ±5 percent RH for a maximum of 4 hours before performing step 26.

Step 26. Repeat Step 2.

Step 27. Inspect the equipment to detect evidence of physical degradation. Visible corrosion is permissible if the corrosion can be removed by cleaning and the equipment is returned to a condition which conforms to the requirements of 4.5.3.1.

4.5.5.1.2 Temperature shock test. When temperature shock is specified in the associated detail specification, the temperature shock test shall be performed as specified in Steps 1 through 9.

Step 1. The satisfactory operation tests specified in the associated detail specification shall be performed under the closely controlled conditions as modified by 4.5.2.1. The high temperature limit shall be the operating temperature limit specified for the equipment class under test (see table III). The equipment shall be nonoperating. Maintain the temperature for a period of 1 hour or until the test item is stabilized, whichever is longer.

Step 2. At the conclusion of this time period, the test item shall be transferred, within 5 minutes, to a cold chamber at the low operating temperature limit for the equipment class under test (see table III).

Step 3. The test item shall be exposed to the temperature for a period of 1 hour or until the test item stabilizes.

Step 4. At the conclusion of this time period, the test item shall, within 5 minutes, be returned to the high temperature chamber maintained as specified in Step 1.

Step 5. The test item shall be exposed to the temperature for a period of 1 hour or until the test item stabilizes.

Step 6. Repeat Steps 2 through 5.

Step 7. Repeat Steps 2 and 3.

Step 8. Return the test item to standard ambient conditions and stabilize.

Step 9. Perform the satisfactory operation tests specified in the associated detail specification. For Step 2 and Step 4, when authorized by the procuring activity, large or heavy test items shall be transferred from one chamber to the other in the minimum practical times.

4.5.5.2 Altitude test. The altitude test shall be performed as specified in Steps 1 through 5 at the simulated altitudes specified in table XV. Class 7 shall be tested as specified in the associated detail specification.

Step 1. Prepare the test item in accordance with 4.5.2.3 and maintain standard ambient temperature during the entire test.

Step 2. Decrease the chamber pressure to the m (ft) for the class of equipment in table XV at a rate not to exceed 2000 fpm. Maintain this pressure for not less than 1 hour and then operate the test item where applicable and observe test results in accordance with 4.5.3.2. The equipment shall also be tested to withstand an altitude of 4570 m (15,000 ft), nonoperating for 1 hour.

Step 3. Length of time required for operation and measurements: Warm-up or stabilization time as specified in 3.7.1.1, plus a minimum of 2 hours operation as in the satisfactory operation check.

Step 4. With the test item not operating, return the chamber to standard ambient conditions at a rate not to exceed 2000 fpm.

Step 5. Perform the satisfactory operation test after return to the test conditions of 4.5.2.1. Degradation of equipment performance beyond the specified requirements shall constitute a failure.

TABLE XV. Altitude.

	Altitude in m (ft) ±10 percent	
Class	Nonoperating	Operating
2, 3	4570 (15,000)	4570 (15,000)
5, 6	4570 (15,000)	3050 (10,000)
7	see 4.5.5.2	

4.5.5.3 Vibration tests. The vibration tests shall be as specified in 4.5.5.3.1 through 4.5.5.3.3. In the event an equipment failure occurs, the unit under test may be repaired at the discretion of the procuring activity. If repair is allowed, testing will continue from the point at which the failure occurred until the remaining test period is completed. The portion of the test period prior to the failure will be repeated to evaluate the integrity of the repair. Failure modes that are not related to the original failure will be disregarded during the retest. At the discretion of the procuring activity, a second unit may be subjected to the test in lieu of retesting the unit that failed.

4.5.5.3.1 Sinusoidal vibration test. Equipment of Classes 2, 3, 5, and 6 shall be subjected to the vibration test as specified in Steps 1 through 5. Class 7 shall be tested as specified in the associated detail specification.

Step 1. Method of attachment. The test specimen shall be attached or strapped directly to the vibration table or to an intermediate structure which is designed to be capable of transmitting the specified magnitudes of vibration to the points of specimen attachment throughout the required test frequency range.

Step 2. During vibration, the equipment shall be operating as in the satisfactory operation check mode.

Step 3. The frequency displacement, and time shall be as specified in table XVI. Resonance search, cycling, and dwell test times shall be continuous for the time periods specified. Testing need not be performed below 10 Hz for Type III equipment of Classes 5 and 6.

TABLE XVI. Vibration test limits.

Class	Frequency increments Hz (G)	Displacement (in) peak-to-peak	Resonance search time per increment (minutes 1/)	Cycling time per axis (minutes)	Resonance dwell time per axis (minutes)
2, 3	5 to 15 (.037 to .675)	1.5 mm (0.06)	5	15	10
	16 to 25 (0.52 to 1.27)	1.0 mm (0.04)	5		
	26 to 55 (0.69 to 3)	0.5 mm (0.02)	5		
5, 6	5 to 55 (.016 to 2)	0.33 mm (0.013)	15	15	10
7	see 4.5.5.3.1				

1/ Search times specified shall be for a low frequency (LF) to HF to LF variation for the applicable increment.

Step 4. A resonance search, cycling, and resonance dwell shall be conducted in each axis as specified in a through c:

a. Resonance search. A resonant search shall be performed at vibration levels less than those specified in table XVI but with sufficient amplitude to excite the test item. A difference of 6 dB or more between the excitation source and the test item, or a part thereof, shall indicate the presence of a resonance. If there is an audible or visual indication of resonance or any vibration related malfunction of the equipment, an individual resonance test may be performed using the full vibratory test level and cycling time specified for the cycling test provided the resonance search time is included in the required cycling time. The test item or a subpart thereof is considered at the resonance if vibration amplitude is more than twice the amplitude of the vibration table.

b. Cycling. The test item shall be vibrated in accordance with the applicable test levels, frequency range, and times specified in table XVI. The frequency of applied vibration shall be swept over the specified range. The specified cycling time is that of an ascending plus a descending sweep and is twice the ascending sweep time.

c. Resonance dwell. The test item shall be vibrated at the most severe resonant frequency determined in the resonance search for that axis. Test levels, frequency ranges, and test times shall be in accordance with table XVI. If a change in the resonant frequency occurs during the test the frequency shall be adjusted to maintain the peak resonance condition. If no significant resonant response is found, the equipment shall be vibrated for 10 minutes (resonance dwell) at 33 Hz.

Step 5. Perform the satisfactory operation tests specified in the associated detail specification.

4.5.5.3.2 Random vibration test. When specified in the associated detail specification, random vibration shall be in accordance with MIL-STD-810, Method 514. Class 7 shall be tested for random vibration as specified in the associated detail specification.

4.5.5.3.3 Loose cargo bounce test. When specified in the associated detail specification, the equipment prepared for field transportation shall be subjected to the loose cargo bounce test as specified in Steps 1 through 3.

Step 1. The test apparatus shall be a package tester capable of 1 inch (double amplitude) displacement.

Step 2. The test bed of the package tester shall be covered with a panel of 0.50 inch plywood, with the grain parallel to the drive chain. The plywood shall be secured with six-penny nails, with top of heads flush with or slightly below the surface. Nails shall be spaced at 6 inch intervals around all four edges. If the distance between either pair of fences is greater than 24 inches, the plywood shall also be nailed at 3 inch intervals in a 6 inch square at the center of the test area. Using wooden fences, constrain the test item to a horizontal motion of not more than 2 inches in a direction parallel to the axes of the shafts, a distance

more than sufficient to ensure the test item will not rebound from fence to fence. For large items, care shall be taken to avoid potential air-cushioning effects which may exist between the surface of the package tester and the test item.

Step 3. The test item, as secured in its transit case, or combination case, or as otherwise prepared for field transportation, shall be placed on the package tester within the constraints specified in Step 2 above. The test item will not be operated during vibration. The package tester shall be operated in the synchronous mode with the shafts in phase. (In this mode any point on the bed of the package tester will move in a circular path in a vertical plane perpendicular to the axes of the shafts.) The package tester shall be operated at 1 inch double amplitude and 284 rpm ±2 rpm for a total of 3 hours. At the end of each 0.50-hour period, turn the test item to rest on a different face, so that at the end of the 3-hour period the test item will have rested on each of its six faces (top, bottom, sides, and ends). At the end of the 3-hour period, the test item shall be operated and inspected and results obtained in accordance with 4.5.3.2. Minor surface abrasion shall not be cause for failure. The package tester shall be operated in the vertical linear mode (straight up and down in the vertical plane) instead of in the synchronous mode when one of the conditions specified in a and b occurs:

a. Bouncing of the test item is very severe and presents a hazard to personnel.

b. Forward and rear oscillations cannot be reduced. When operated in the vertical linear mode, wooden fences shall be placed on all four sides of the test item to constrain the test items motion to not more than 5.08 cm (2 in) in either direction.

4.5.5.4 Mechanical shock tests. The shock test specified in 4.5.5.4.1, when required, shall be performed prior to required water resistance tests.

4.5.5.4.1 Functional shock test. Equipment of Classes 2 through 6 shall be subjected to functional shock testing. A half-sine shock pulse with the configuration and tolerance limits shown in figure 14 shall be used. The duration (D) of the pulse shall be 11 ms, and the peak shock value (A) shall be 30g. The equipment shall be operating during the test. The equipment shall be given three shocks in each direction and on each axis for a total of 18 shocks. Perform the satisfactory operation test after shock exposure. Class 7 equipment shall be tested as required in the associated detail specification.

4.5.5.4.2 Transit drop test, Styles A, B, C, P, S, and T. Subject Styles A, B, C, P, S, and T enclosures, with the contained test equipment, to the transit drop test of MIL-STD-810D Method 516 Procedure IV. The drop height and number of impacts for each type and style shall be as specified in table XVII. For equipment 454 kg (1000 lbs) or less, the floor or barrier receiving the impact shall be of 5.08 cm (2 in) plywood backed by concrete. For equipment over 454 kg (1000 lbs), the floor or barrier shall be concrete.

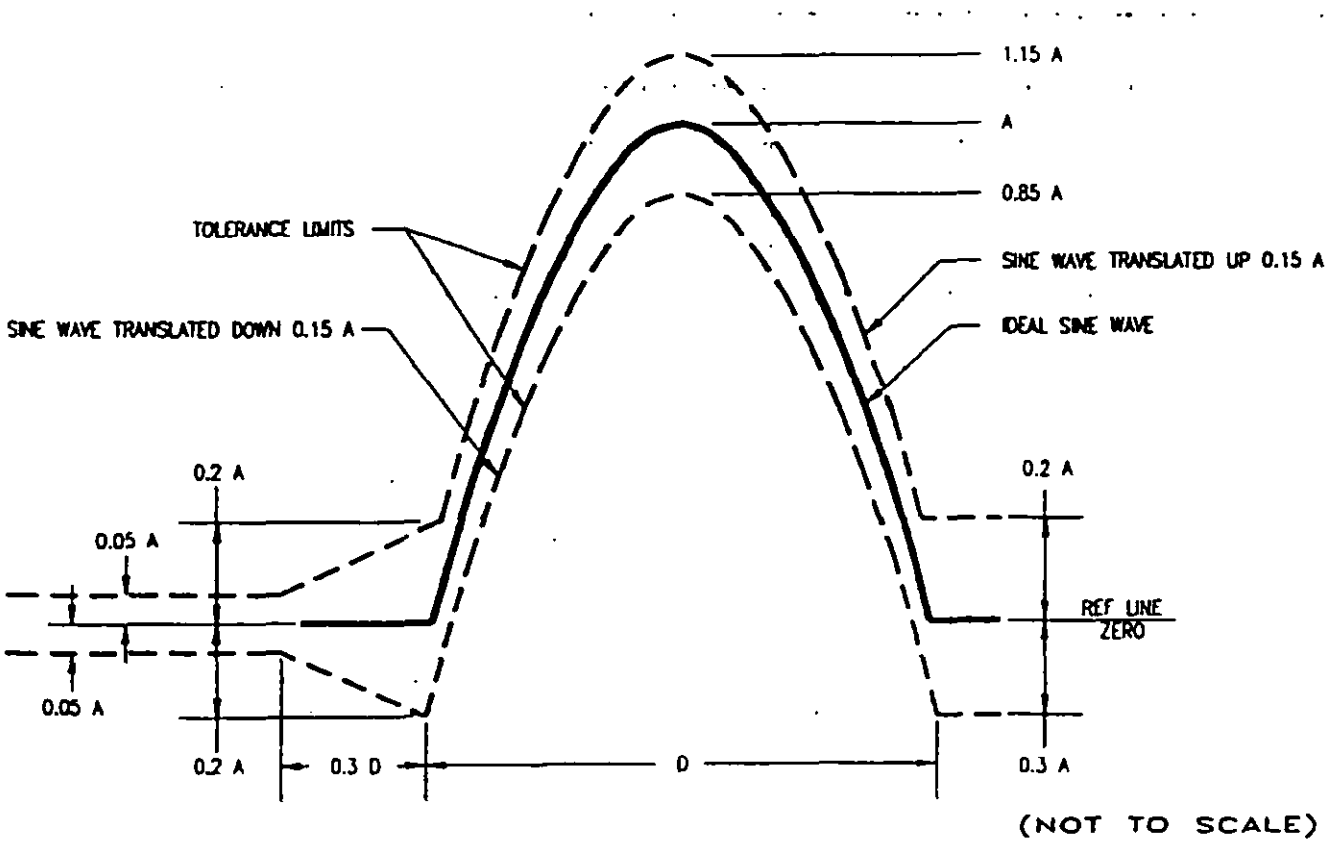

FIGURE 14. Half-sine shock pulse configuration and limits.

NOTE: The oscillogram shall include a time about 3D long with a pulse approximately in the center. The acceleration amplitude of the ideal half-sine pulse is A and its duration is D. The measured acceleration pulse shall be contained between the broken line boundaries and the measured velocity change (which may be obtained by integration of the acceleration pulse) shall be within the limits $V_i \pm 0.1\ V_i$ where V_i is the velocity-change associated with the ideal pulse which equals 2 AD/π. The integration to determine velocity change shall extend from 0.4D before the pulse to 0.1D after the pulse.

TABLE XVII. Transit drop test.

Equipment style	Drop height	Number of impacts 1/	
		Type I	Types II and III
A, P, T	46 cm (18 in)	14	10
B	305 mm (12 in)	14	10
C	203 mm (8 in)	14	10
S 2/	61 cm (24 in)	N/A	2 per strap

1/ The equipment shall be dropped on each corner (Type I), or the 4 bottom corners (Types II and III), and 6 faces for the total number of impacts divided between the test items.
2/ Only those cases with shoulder straps shall be subjected to this test. The shoulder strap shall be supported at a point sufficient to allow a fall of 24 inches while preventing the enclosure from contacting the impact surface. The equipment shall remain inside the transit case throughout this test.

4.5.5.4.3 Bench handling test. With the instrument in its case or cabinet and operating as in the satisfactory operating check, place the instrument in a suitable position for its servicing on a horizontal, solid wooden bench top at least 4.1 cm (1.62 in) thick. The test shall be performed, as specified in Steps 1 through 5 in a manner simulating shocks liable to occur during its servicing.

Step 1. Using one edge as a pivot, lift the opposite edge of the chassis until one of the conditions specified in a through c occurs (whichever occurs first):

a. The chassis forms an angle of 45 degrees with the horizontal bench top.

b. The lifted edge of the chassis has been raised 4 inches above the horizontal bench top.

c. The lifted edge of the chassis is just below the point of perfect balance.

Let the chassis drop back freely to the horizontal bench top. Repeat, using other practical edges of the same horizontal face as pivot points, for a total of four drops.

Step 2. Repeat Step 1, with the test item resting on other faces until the test item has been dropped for a total of four times on each face on which the test item could reasonably be placed during its servicing.

Step 3. Repeat Steps 1 and 2 with instrument nonoperating and cabinet or case removed, except for equipment where the case serves as the only chassis or support structure.

Step 4. Examine the instrument for mechanical damage. Damage to any control, indicator, fuseholder, connector, or other protruding component part shall constitute a failure.

Step 5. Perform the satisfactory operation test.

4.5.5.4.4 High impact shock test. When specified in the associated detail specification, the equipment shall be subjected to MIL-S-901, Type A shock testing for Grade B equipment. The equipment shall be nonoperating during the test and is not required to operate after completion of the test. The equipment shall be stowed in an upright position on a shelf which is representative of a standard shipboard stowage shelf in accordance with NAVSEA ST000-AB-GYD-010/PEETE. The equipment shall be placed on one inch of shock absorbant material that complies with MIL-P-15280 and secured with Hughes Aircraft P/N K1012766-7, or equivalent, quick release nylon straps. One strap shall be used per 40 pounds of equipment weight.

4.5.5.5 Water resistance tests. When specified in the associated detail specification the water resistance tests specified in 4.5.5.5.1 through 4.5.5.5.3 shall be performed after the required mechanical shock tests.

4.5.5.5.1 Watertight test, Styles A and T. With the case cover latched in place and all drains and ports closed, equipment with Style A enclosures, and Style T enclosures with the equipment installed, shall be subjected to the submergence test for watertight equipment, in accordance with MIL-STD-108, submerging the assembly to provide a minimum of 0.9 m (3 ft) of water above the top of the enclosure, or equivalent pressure as provided in the MIL-STD-108 Submergence Tests Table. The equipment shall be nonoperating while the cover is latched in place. Perform the satisfactory operation test specified in the associated detail specification after submergence.

4.5.5.5.2 Splashproof test, Style A. With the cover off and the instrument operating, perform the splashproof test as specified in MIL-STD-108 Definitions, Design Requirements and Tests Table and the Water Repellent Tests Table for a minimum of 5 minutes. Perform the satisfactory operation test specified in the associated detail specification.

4.5.5.5.3 Dripproof test, Styles B and C. Perform the following dripproof test on Styles B and C enclosures. Style C shall have the cover latched in place.

Step 1. The test item shall be placed in the chamber in its normal operating position on a platform or tilt table in a manner such that it can be oriented horizontally and in any of four directions forward, backward, and to each side to the extent of 15 degrees from the horizontal plane.

Step 2. Attach a spray nozzle with a uniformly distributed full cone spray pattern to a flexible hose and using a container calibrated in liters or an equivalent method, determine the rate of flow out of the nozzle. The requirements for water flow shall be 16.3 ±1 liters (4.3 gallons) per hour for each square foot of area covered by the spray 0.9 m (3 ft) below the nozzle.

Step 3. Position the nozzle 0.9 m (3 ft) above the test item so that the spray is directed downward onto the test item. The test item shall be subjected to a uniform spray over the entire surface being tested. During the test, Style C equipment shall not be operated. Style B equipment shall be operated as in the satisfactory operation check during the test.

Step 4. Direct the spray onto the top of the test item (with platform or tilt table horizontal) for at least 8 minutes. Turn off spray for 4 minutes.

Step 5. Direct the spray downward onto the test item for at least 8 minutes with the platform or table tilted such that the test item is oriented 15 degrees from the horizontal in the forward position. Turn off spray 4 minutes.

Step 6. Direct the spray downward onto the test item for at least 8 minutes with the platform or table tilted such that the test item is oriented 15 degrees from the horizontal in the backward position. Turn off spray for 4 minutes.

Step 7. Direct the spray downward onto each remaining side of the test item for at least 8 minutes with the platform or table tilted such that the side being sprayed is oriented 15 degrees from the vertical. Turn off spray for 4 minutes.

Step 8. Return the test item to the horizontal (platform or tilt table horizontal) and perform the satisfactory operation test.

4.5.5.6 Electrical power tests. During the electrical power tests, the equipment performance shall be monitored as specified in 4.5.5.6.1 through 4.5.5.6.5.

4.5.5.6.1 Input power test. The input power test shall be tested by measuring the power consumption of the equipment with a wattmeter. Power consumption which exceeds the value specified in the associated detail specification shall constitute a failure of this test.

4.5.5.6.2 Voltage and frequency variation test. The response of the equipment to input voltage and frequency variations shall be tested as specified in Steps 1 through 4:

Step 1. Connect the power cable of the equipment to a variable voltage and frequency source.

Step 2. Set the output of the variable source at 115 V, 60 Hz.

Step 3. Performance of the equipment outside the limits required in the satisfactory operation check or other tests specified in the associated detail specification shall constitute a failure of this test.

Step 4. Repeat Steps 2 and 3 for voltages and frequencies required by the associated detail specification from the variable source as specified in table XVIII, using the maximum voltage and minimum voltage limit values. The voltage and frequency shall be maintained for at least 15 minutes at each level specified. This test may be performed at other points within the specified ranges at the discretion of the Government quality assurance representative.

TABLE XVIII. Variable frequency power supply outputs.

Frequency (Hz)	Minimum voltage	Maximum voltage	
		Type I	Type III
47	103.5	126.5	126.5
53	103.5	126.5	126.5
57	103.5	126.5	126.5
63	103.5	126.5	126.5
380	103.5	126.5	126.5
420	103.5	126.5	126.5

4.5.5.6.3 Voltage-transient test. The equipment performance during voltage transients shall be tested as specified in Steps 1 through 9.

Step 1. Connect the power cable of the equipment to a 60 Hz variable voltage source.

Step 2. Set the output of the source to the maximum voltage for the equipment type as specified in table XVIII.

Step 3. For requirements of Type I and Type III, quickly increase the source voltage to a transient value of 149.5 V, hold for approximately 0.5 second, and quickly return to the starting voltage of Step 2. Monitor equipment performance during and after the transient for compliance with the satisfactory operation check or other tests specified in the associated detail specification. Type I performance which is outside the specified limits during the transient, and Type III performance

which is outside the specified limits for longer than 30 seconds, shall constitute a failure of this test.

Step 4. For requirements of Type I only, quickly change the source voltage to a transient value of 161 V, hold for approximately 0.5 second, and quickly return to the starting voltage of 126.5 V. Monitor equipment performance during and after the transient for compliance with the satisfactory operation check or other tests specified in the associated detail specification. Performance which is outside the specified limits after the transient has passed shall constitute a failure of this test, except that any externally accessible fuses that have failed may be replaced if the specified performance is restored by replacement of the fuses.

Step 5. Repeat Steps 3 and 4 four more times (as applicable to the type), at 2-minute intervals.

Step 6. Set the output of the source to a starting voltage of 103.5 V.

Step 7. For requirements of Type I and Type III, repeat Step 3 with a transient value of 80.5 V and the starting voltage specified in Step 6.

Step 8. For requirements of Type I only, repeat Step 4 with a transient value of 69 V and the starting voltage specified in Step 6.

Step 9. Repeat Steps 7 and 8 four more times (as applicable to the type), at 2-minute intervals.

4.5.5.6.4 Frequency-transient test. The equipment performance during frequency transients shall be tested as specified in Steps 1 through 21.

Step 1. Connect the power cable of the equipment to a 115 V variable frequency source. The output voltage shall be the operating voltage specified for the equipment.

Step 2. Set the output of the source to a starting frequency of 47.5 Hz.

Step 3. For requirements of Type I and Type III, quickly change the source frequency to a transient value of 45 Hz, hold for approximately 0.5 second, and quickly return to the starting frequency of 47.5 Hz. Monitor equipment performance during and after the transient for compliance to the satisfactory operation check or other tests specified in the associated detail specification. Type I performance which is outside the specified limits during the transient, and Type III performance which is outside the specified limits for longer than 30 seconds, shall constitute a failure of this test.

Step 4. For requirements of Type I only, quickly change the source frequency to a transient value of 42.5 Hz, hold for approximately 0.5 second, and quickly return to the starting frequency of 47.5 Hz. Monitor equipment performance

during and after the transient for compliance to the satisfactory operation check or other tests specified in the associated detail specification.

Step 5. Repeat Steps 3 and 4 four more times (as applicable for the type) at 1-minute intervals.

Step 6. Set the output frequency of the source to a starting frequency of 57 Hz.

Step 7. For requirements of Type I and Type III, repeat Step 3 with a transient frequency of 54 Hz and a starting frequency of 57 Hz.

Step 8. For requirements of Type I only, repeat Step 4 with a transient frequency of 51 Hz and a starting frequency of 57 Hz.

Step 9. Repeat Steps 7 and 8 four more times (as applicable for the type) at 1-minute intervals.

Step 10. Set the output frequency of the source to a starting frequency of 63 Hz.

Step 11. For requirements of Type I and Type III, repeat Step 3 with a transient frequency of 66 Hz and a starting frequency of 63 Hz.

Step 12. For requirements of Type I only, repeat Step 4 with a transient frequency of 69 Hz and a starting frequency of 63 Hz.

Step 13. Repeat Steps 11 and 12 four more times (as applicable for the type) at 1-minute intervals.

Step 14. Set the output frequency of the source to a starting frequency of 380 Hz.

Step 15. For requirements of Type I and Type III, repeat Step 3 with a transient frequency of 360 Hz and a starting frequency of 380 Hz.

Step 16. For requirements of Type I only, repeat Step 4 with a transient frequency of 340 Hz, and a starting frequency of 380 Hz.

Step 17. Repeat Steps 15 and 16 four more times (as applicable for the type) at 1-minute intervals.

Step 18. Set the output frequency of the source to a starting frequency of 420 Hz.

Step 19. For requirements of Type I and Type III, repeat Step 3 with a transient frequency of 440 Hz and a starting frequency of 420 Hz.

Step 20. For requirements of Type I only, repeat Step 4 with a transient frequency of 460 Hz and a starting frequency of 420 Hz.

Step 21. Repeat Steps 19 and 20 four more times (as applicable for the type) at 1-minute intervals.

4.5.5.6.5 Power source interruption test. The power source interruption test shall conform to the requirements of 3.4.1.2.3 (Type I) or 3.4.5.2.3 (Type III).

4.5.5.7 Group C verification test. The Group C verification test shall be performed after the required tests of 4.5.5.1 through 4.5.5.6 have been completed. The Group C verification test shall consist of the Group A and Group B tests specified by the associated detail specification. Group A and Group B test failure criteria shall apply.

4.5.6 Group D tests. The Group D tests shall be performed as specified herein and in the associated detail specification or approved equipment test procedure (see 6.4.2.2). These tests shall be performed under the test conditions specified in 4.5.2.1.

4.5.6.1 Fungus resistance test. When specified in the associated detail specification, perform the fungus test in accordance with MIL-STD-810, Method 508. Pre and post-operation tests are required. The test duration shall be 28 days.

4.5.6.2 Salt fog tests. Salt fog tests shall be conducted in accordance with MIL-STD-810, Method 509, Procedure I, and as specified in 4.5.6.2.1 and 4.5.6.2.2. The test duration shall be 48 hours with the samples being constantly wetted with a 5 percent ±1 percent salt solution. A 48 hour drying period in a standard ambient atmosphere shall follow.

4.5.6.2.1 Salt fog test, structural parts. Unless otherwise specified for Styles A and B and, when specified in the associated detail specification, for Styles C through G, the equipment shall have one or more samples of each material used for the fabrication of panels and structural parts (chassis, rails, braces, and so forth) with finishes as in the completed equipment, subjected to the salt fog test. After exposure, the material shall be inspected to detect any evidence of physical degradation. Visible corrosion is permissible if it is removed by suitable cleaning and the material is, as a result of the cleaning, returned to a condition which conforms to the requirements of 4.5.3.1. Degradation of material beyond the requirements of the intended use shall constitute a failure of this test.

4.5.6.2.2 Salt fog test, enclosure. When specified in the associated detail specification, enclosures of any style shall be submitted to the salt fog test. Style A and C enclosures shall have the cover removed from the enclosure and placed in the salt fog chamber with the accessories (except the technical manual and those accessories used in the satisfactory operation test) packed in the normal manner in the cover. The equipment shall be nonoperating but with cables and connectors attached as for the satisfactory operation test. Unused connectors may have caps or

covers installed. For Style A equipment, perform the satisfactory operation test required in the detailed specification before any cleaning is performed. Inspect the equipment to detect evidence of physical degradation. Visible corrosion is permissible if it is removed by suitable cleaning and the equipment is returned to a condition which conforms to the requirements of 4.5.3.1. Perform the satisfactory operation test required in the detailed specification. Degradation of equipment performance beyond the requirements of the detailed specification shall constitute a failure of this test.

4.5.6.3 Explosive atmosphere test. Class 2 equipment shall be subjected to the explosive atmosphere tests of MIL-STD-810, Method 511, Procedure I.

4.5.6.4 Dust resistance test, Class 2 and Styles A, P, and T. Class 2 equipment and Style A, P, and T enclosures shall be subjected to the dust test of MIL-STD-810, Method 510, Procedure I. Class 2 equipment and Style A enclosures shall be tested with the equipment nonoperating and with the cover on. Style P and Style T enclosures shall have the cover installed and latched. The test shall be conducted with small particle silicone flour at an air velocity of 8.9 m/s (1750 fpm) and a concentration of 0.3 ±0.2 grams per cubic foot (g/ft^3). The test duration shall be 6 hours at 23°C followed by 6 hours at the specified high storage temperature. The RH shall not exceed 30 percent. Perform the satisfactory operation test specified in the associated detail specification before and after the dust test. Degradation of equipment performance beyond the requirements of the detailed specification shall constitute a failure of this test.

4.5.6.5 EMI test. The equipment shall be subjected to the EMI compatibility tests specified in 3.8 and as specified in the detailed specification. The measuring equipment, set up, procedures, and operation of the test sample (equipment) shall be in accordance with MIL-STD-462. Test conditions shall be in accordance with 4.5.2.1.

4.5.6.6 Magnetic environment test. When specified in the associated detail specification, the magnetic environment test specified in steps 1 through 7 shall be performed. The equipment performance and accuracy shall be as specified in the associated detail specification. The magnetic environment test shall be conducted with a Helmholtz coil set that is 1 m (40 in) in diameter, each coil not over 0.13 m (5 in) in breadth, spaced 0.5 m (20 in) apart, and capable of carrying sufficient current to produce a field intensity of 20 Oersteds. Larger coil diameters and separation may be used when the dimensional ratios are as specified herein.

Step 1. Prior to placing equipment in the area of the field, energize the coil set with a dc current to produce a 20 ±1 Oersted field in air. Observe the magnitude of current required and de-energize the coil set.

Step 2. Place the equipment in the center of the coil set.

Step 3. Operate the equipment. The performance of the equipment shall be as specified in the associated detail specification.

Step 4. Energize the coil set so that the equipment is subjected to a magnetic field that is increased from 0 Oersteds to 20 ±1 Oersteds at a rate of change between 20 Oersteds and 200 Oersteds per second (using the current observed in Step 1). Maintain the field at 20 ±1 Oersteds for 5 minutes or longer, if necessary, to verify correct operation in the satisfactory operation check. Observe any effect on the equipment other than correct operation. If an effect is observed, reduce the magnitude of the field at a rate of change between 20 Oersteds and 200 Oersteds per second until the effect is no longer apparent and observe the magnitude of the field at that point. Reduction of the field to less than 5 Oersteds, to permit specified operation of the equipment, shall constitute a failure of this test. De-energize the coil set.

Step 5. Reverse the connections of the coil to the power source and repeat Steps 4 and 5.

Step 6. Perform Steps 3 through 5 for the three major axes of the equipment.

Step 7. Perform the satisfactory operation test.

4.5.6.7 Group D verification test. The Group D verification test shall be performed after the required tests of 4.5.6.1 through 4.5.6.6 have been completed. This test shall consist of the Group A and Group B tests specified by the associated detail specification. Groups A and B test failure criteria shall apply.

4.5.6.8 Solar radiation test. When specified in the associated detail specification, Class 2 and Class 3 equipment shall be subjected to the solar radiation test of MIL-STD-810, Method 505.

4.5.7 Group E tests. The Group E tests shall be performed as specified herein and in the associated detail specification or approved equipment test procedure (see 6.4.2.2).

4.5.7.1 Maintainability tests. Maintainability tests shall be as specified in 4.5.7.1.1 and 4.5.7.1.2.

4.5.7.1.1 Maintainability demonstration. When specified in the contract, compliance with the maintainability requirements shall be demonstrated by a maintenance demonstration procedure, maintenance task selection, and maintenance task performance in accordance with MIL-STD-471, Appendixes A and B, Test Method 1-A. The producer's risk shall be not greater than 0.20, and the consumer's risk shall be not greater than 0.10.

4.5.7.1.2 Washability test. When specified in the associated detail specification, the equipment shall be subjected to the washability test specified in Steps 1 through 7. When maintainability compliance is to be demonstrated in accordance with 4.5.7.1.1 and the washability test is invoked, the washability test shall be performed prior to the maintainability demonstration.

Step 1. Remove the equipment case or covers to expose internal parts and circuits as for servicing.

Step 2. Using a hand-atomizer or paint-sprayer, spray a thin coat of light machine oil containing a coloring agent such as food coloring over the exposed interior and exterior parts. The coating shall be sufficient to cause easily recognizable discoloration.

Step 3. Subject the equipment to 50°C for 24 hours with suitable precautions against accumulation of flammable vapor.

Step 4. Subject the equipment to water-wash according to the equipment manufacturer's washing procedure and with detergents or cleaners specified for the equipment by the manufacturer, until the added contaminants of Step 2 have been removed. Rinse and dry the equipment according to the contractor's furnished procedure.

Step 5. Perform relubrication as specified in the manufacturer's procedure.

Step 6. Inspect the equipment. Loss of finishes or markings, deformation of parts, or other evidences of deterioration shall constitute a failure of this test.

Step 7. Operate the equipment, with particular attention to the ease of operation of controls and switches, and functional stability. Operate as in the satisfactory operation test. Degradation of equipment performance beyond the specified requirement shall constitute a failure of this test.

4.5.7.2 Acoustic noise test. When the equipment contains a motor (such as a fan or blower) or other audible noise source the acoustic noise generated shall be measured in accordance with a through c.

a. The apparatus for the acoustic noise test shall consist of an anechoic type test chamber. All noise measurements shall be made with a sound level meter and an octave band filter set in accordance with ANSI S1.4-1983 and ANSI-S1.11-1986, respectively. Ambient background noise levels shall be at least 10 dB below the octave band noise levels produced by the test equipment at all measurement positions.

b. The noise levels at the operator's position shall be measured by slowly moving the measuring microphone in a 0.6 m (2 ft) diameter circle centered on the most probable position for an operator. The average noise levels in each octave band shall be determined by an arithmetic average of the minimum and maximum sound pressure levels found on the circle. Average noise levels which exceed the noise level criteria for the operator's position specified in table XIX shall constitute a failure of this test.

c. The noise levels on the 7.6 m (25 ft) radius circle, centered on the geometric center of the test equipment, shall be measured at head level of 1.7 m (67 in) at 12 positions equally spaced every 30 degrees. If any dimensions of the test equipment exceed 7.6 m (25 ft), increase the radius of the measurement circle to 15.2 m (50 ft), and reduce the noise level criteria for the circle by 6 dB in each octave band. The criteria for the operator's position shall remain unchanged. Maximum sound pressure levels which exceed the noise level criteria for the 7.6 m (25 ft) radius circle specified in table XIX for any octave band at any of these measurement positions, shall constitute a failure of this test.

TABLE XIX. Noise level criteria.

Octave band center frequencies (Hz)	Octave band sound pressure levels (dB referenced to 0.0002 dyne/cm^2)	
	0.3 m (1 ft) radius from operator's position	7.6 m (25 ft) radius from equipment geometric center
63	76	66
125	70	60
250	64	54
500	60	50
1000	57	47
2000	55	45
4000	53	43
8000	52	42

4.5.7.3 Dimensions and weight tests. Compliance with the specified weight and dimensional requirements of the equipment (and any plug-ins or accessories for which the dimension and weight are separately specified in the associated detail specification) shall be determined by weighing and measuring the equipment.

4.5.7.4 Mechanical stability test. Unless excluded in 3.5.3, the equipment shall be subjected to the mechanical stability test specified in Steps 1 through 5:

Step 1. Position the test item on a raised platform or table with a surface area of sufficient size to accommodate the total bottom surface of the test item in its normal operating position and configuration.

Step 2. Reposition the test item so that one-fourth of the bottom surface extends beyond the edge of the platform or table. The extended side of the test item shall be parallel to the edge of the platform which is located under the test item.

Step 3. Determine that there is no evidence of instability. Evidence of instability shall be considered as a test failure.

Step 4. Repeat Steps 2 and 3 for all additional vertical sides of the test item.

Step 5. Repeat Steps 2 through 4 for each required alternate operating position and configuration of the test item. When the rear of the test item is equipped with feet or bumpers (such as for use on a floor or deck) which prohibit the repositioning of the test item in accordance with Step 2, an auxiliary support may be provided for this step. The auxiliary support (such as a piece of plywood) shall be not larger than the bottom surface in its alternate position, but shall be sufficiently large to accommodate the rear feet or bumpers. During the test, the support and the test item shall be repositioned as specified in Step 2.

4.5.7.5 Equipment emanations test. When specified in the associated detail specification, the emanations tests for X-radiation, microwave radiation, ozone liberation, and ultrasonic pressure shall be performed in accordance with ANSI/ISA-S82.01-1988 or ANSI/ISA-S82.02-1988 or both as applicable. The test for X-radiation and ozone liberation shall be modified as specified in a and b.

a. X-radiation testing shall be limited to equipment which has operating potentials of 10 kV or greater, or which could have potentials of 10 kV or greater due to the failure of any one component.

b. Ozone testing which shows a maximum concentration exceeding 0.3 ppm in any 15-minute period which is closer than 60 minutes from the adjacent period, and which occurs more than four times in 8 hours, shall constitute a failure of this test.

4.5.7.6 Front panel marking test. When specified in the associated detail specification, the front panel marking test shall be performed on a 100 mm (4 in) by 100 mm (4 in) sample of the front panel with marking in the abrasion area, which is representative of the equipment (see 6.4.2.18). The test shall be performed in accordance with the abrasion resistance Types I and II requirements and the abrasion test of GG-P-455, modified as specified in a through d.

a. A CS-10 abrading wheel shall be used.
b. The abrading wheel shall be weighted with 1000 g.
c. Testing shall consist of 1000 cycles.
d. The panel marking shall be legible at the completion of the test.

4.5.7.7 Additional tests. The test and accept/reject limits for any additional tests shall be as specified in the associated detail specification.

4.5.7.8 Packaging inspection. The inspection of the preservation, packaging, packing, and marking shall be in accordance with the requirements of MIL-STD-2073-1.

4.5.8 Group F tests. The reliability of the equipment shall be verified in accordance with MIL-STD-781. Failures shall be as defined in 6.4.2.17. Calibration interval verification in accordance with the requirements of 3.11 may be performed during reliability testing in lieu of the test specified in 4.5.9.

4.5.8.1 Reliability tests, all types. The reliability tests shall consist of a demonstration phase and a sampling phase as specified in 4.5.8.1.1, 4.5.8.1.2, or 4.5.8.1.3.

4.5.8.1.1 Reliability test, Type I. Seals shall be used to control access to internal adjustments and circuitry on all reliability models. Breaking of the seals to permit adjustment (or repair) shall constitute a failure, and the elapsed failure-free operational period with unbroken seals shall be observed to establish the calibration interval.

4.5.8.1.1.1 Demonstration phase, Type I. The demonstration phase of the reliability testing shall be conducted in accordance with MIL-STD-781, Task 301, with the required upper test MTBF θ_0, and the required lower test MTBF θ_1. The decision risk is 10 percent. A sample of at least 5 models shall be utilized for the reliability demonstration and the use of 10 models is encouraged; however, no more than 10 models are allowed. The conditions of a through i shall apply.

a. Temperature limits. The temperature test limits shall be the operating temperature specified for the equipment class under test.

b. Test schedule. The test shall consist of three 8-hour periods per day. One period shall be manned. The two remaining periods need not be manned.

c. Temperature cycling. The temperature in the test chamber, with the equipment installed, shall be reduced to the lower temperature limit and maintained for 2 hours. The temperature shall then be cycled between approximate equal length upper and lower temperature limits during each 8-hour period. The rate of temperature change shall be 1°C to 5°C per minute. The temperature limits shall be the required continuous operating temperature limits for the equipment class under test (see 3.7.2.1).

d. Humidity. The humidity need not be controlled during the reliability tests but the test chamber shall have an RH of approximately 35 percent at 25°C. Precipitation shall not be permitted.

e. Vibration. Vibration shall be in accordance with MIL-STD-781.

f. Equipment on-off cycling. The equipment shall be turned off for 30 minutes during the cooling period of each temperature cycle except that equipment powered by self-contained batteries need not be turned off during unmanned periods.

g. Duty cycle. The equipment shall be operated as in the satisfactory operation test during the latter part of one high temperature alternation each week.

During the remainder of the on-time (including the vibration periods), the equipment shall perform as in the satisfactory operation check.

h. Power input voltage cycling. Equipment powered by other than self-contained batteries shall have the input voltage sequentially cycled during each power-on period. The input voltage shall be maintained at the nominal voltage during the first power-on period, at the high voltage (nominal +10 percent) during the second power-on period, and at the low voltage (nominal -10 percent) during the third power-on period (see 3.4.1.2.1). This sequence shall be repeated throughout the reliability test.

i. Preventive maintenance. Preventive maintenance shall be in accordance with 3.13.1.3.

4.5.8.1.1.2 Sampling phase, Type I. The sampling phase of the reliability testing shall be conducted in accordance with MIL-STD-781, Task 302, with the required upper test MTBF θ_0 and the required lower test MTBF θ_1. Testing shall be conducted on 10 units, and the conditions specified in 4.5.8.1.1.1 shall apply.

4.5.8.1.2 Reliability test, Type II. Unless otherwise specified in the associated detail specification, The reliability test plan for Type II equipment shall be as specified for Type III equipment.

4.5.8.1.3 Reliability test, Type III. Seals shall be used to control access to internal adjustments and circuitry on all reliability models. Breaking of the seals to permit adjustment (or repair) shall be observed as a failure, and the elapsed failure-free operational period with unbroken seals shall be observed to establish the calibration interval.

4.5.8.1.3.1 Demonstration phase, Type III. When specified in the associated detail specification, the reliability test for Type III equipment shall be conducted in accordance with MIL-STD-781, Task 301, with the required upper test MTBF θ_0, and the required lower test MTBF θ_1, on at least five models. The decision risk is 10 percent. The use of 10 models for reliability demonstration is encouraged, but not more than 10 models shall be used. The test shall be conducted at a fixed temperature of 40°C ±5°C. Burn-in (or debugging) shall be as specified in 3.12.3.1. The conditions specified in a through f shall apply:

a. Test schedule. The test shall consist of three 8-hour periods per day. One period shall be manned. The two remaining periods need not be manned.

b. Humidity. The humidity need not be controlled during the reliability tests but the test chamber shall have an RH of approximately 35 percent at 25°C. Precipitation shall not be permitted.

c. Vibration. Vibration shall be in accordance with the vibration stress (continuous) requirement of MIL-STD-781 modified as follows: The frequency shall be swept from 10 Hz to 45 Hz to 10 Hz.

d. Duty cycle. The equipment shall be operated weekly as in the satisfactory operation test. The equipment shall perform continuously as in the satisfactory operation check during the power-on time except during normal battery recharging or replacement (end of specified operating time) in units powered by self-contained batteries where the battery compartment does not give access to internal adjustments (see 3.4.6.9).

e. Input power voltage cycling. Equipment powered by other than self-contained batteries shall have the input voltage sequentially cycled during each power-on period. The input voltage shall be maintained at the nominal voltage specified for the equipment during the first power-on period, at the high voltage upper tolerance limit during the second power-on period, and at the low voltage lower tolerance limit during the third power-on period (see 3.4.5.2.1). This sequence shall be repeated throughout the reliability test.

f. Preventive maintenance. Preventive maintenance shall be in accordance with 3.13.3.3.

4.5.8.1.3.2 Sampling phase, Type III. When specified in the associated detail specification, the sampling phase shall be conducted in accordance with MIL-STD-781, Task 302, with the required upper test MTBF θ_0, and the required lower test MTBF θ_0 for a decision risk of 20 percent. Testing shall be conducted on 10 units. All the conditions of 4.5.8.1.3.1 shall apply.

4.5.8.2 Failure action, Group F. In the event of failures during reliability testing (see 6.4.2.17), failure action shall be taken as specified in MIL-STD-781.

4.5.8.3 Corrective action. Failures occurring during reliability testing, for which modifications are installed in test samples to conform to the reliability requirements, shall be classified as specified in a and b:

a. Those that cause the equipment to be unusable for the purpose intended
b. Those that cause inconvenience in use for the purpose intended

4.5.8.3.1 Undelivered equipment. All equipment undelivered, at the time the modifications of 4.5.8.3 exist, shall have the modifications installed prior to delivery to the Government.

4.5.8.3.2 Delivered equipment. Equipment delivered prior to the completion of reliability testing shall be updated to remove all defects which cause the equipment to be unusable for the purpose intended and may at the option of the Government be updated to remove defects which cause inconvenience in use for the purpose intended. Delivered equipment shall, at the option of the Government, be updated by one or both of the methods specified in a and b:

a. Installation of modifications in the equipment by the contractor at his preferred place of service

b. Delivery to the Government by the contractor of modification kits for installation by the Government

4.5.9 Calibration interval verification. Calibration interval verification shall be as specified in the associated detail specification.

4.6 Inspection of preparation for delivery. Inspection shall be performed to ensure conformance with the requirements of Section 5.

5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct shipments to the Government. Preparation for delivery requirements of reference documents in Section 2 do not apply unless specifically stated in the contract. Preparation for delivery requirements procured by contractors shall be specified in the individual order.)

5.1 Preservation, packaging, packing, and marking. Unless otherwise specified herein, preparation for delivery shall be in accordance with the applicable levels of preservation, packaging, packing, and marking specified in MIL-STD-2073-1.

5.2 Battery protection. Prior to shipment of the equipment, batteries, except those used for memory back-up, shall be removed from the battery compartment and packed with the equipment in a manner that will protect them from electrical shorting.

5.3 Power selection switch setting. When the configuration of the equipment requires a power selection switch, the equipment shall be provided with the switch set to the 115 V or 120 V position and with the correct fuse installed.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Equipment covered by this specification is intended for use in testing equipment and systems in the worldwide natural and controlled environments in which Military equipment is operated (on a continuous or intermittent basis for extended periods of time), either stored or transported, or both, including utilization in all types of moving Military and commercial vehicles (land, sea, and air). The extent of an equipment's penetration (levels of use) into the Military environment is limited by its classification (type, class, style, and color, as specified in 1.2). Selection of the correct class is essential to ensure procurement of the desired equipment. Where needs supersede requirements, this specification can be referenced in part. Where environmental needs overlap specific classes or styles, the lowest appropriate class or style (lowest environmental resistance) will form the basic requirements, and the additional specific requirements will be selected from the higher classes. The inclusion of batteries may alter the

environmental resistance of equipment designed to operate from either internal or external power sources or both.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Title, number, and date of the applicable associated detail specification.

c. Appropriate type, class, style, color, and configuration (see 1.2).

d. Number of first article samples to be submitted if other than specified in 4.3.

e. Levels of preservation, packaging, packing, and marking (see 5.1)

f. Issue of DODISS to be cited in the solicitation, and, if required, the specific issue of documents referenced (see 2.1.1, 2.1.2, and 2.2)

6.3 First article. When first article inspection is required, the equipment should be first production units. The first article sample consists of five units. When front panel marking test requirements are invoked, the first sample will be supplemented with a sample of the front panel. The contracting officer should include specific instructions in procurement documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Definitions. Definitions of terms used in this specification are given in 6.4.1 through 6.4.2.31.

6.4.1 Input power. Input power is defined as specified in a through g.

a. Voltage waveform deviation factor. Deviation factor of a wave is the ratio of the maximum difference between corresponding ordinates of the wave and of the equivalent sine wave to the maximum ordinate of the equivalent sine wave when the waves are superimposed in such a way as to make this maximum difference as small as possible (see ANSI/IEEE-STD-100-1984). Deviation factor computed from the actual crest factor may exceed the specified deviation factor, at peak of the waveform.

b. Harmonics. Harmonics are defined as specified in 1 and 2:

1. Total harmonics. The total harmonic content is the total rms voltage remaining when the fundamental component is removed and is equal to the square root of the sum of the squares of the voltages of the individual harmonic frequencies.

2. Individual. An individual harmonic is the total rms voltage remaining when the fundamental and other harmonic components are removed. Any individual harmonic may be as large as 5 percent of the fundamental; however, total harmonic content will not be greater than 10 percent.

c. Crest factor. Crest factor is the ratio of the crest voltage to the effective voltage and has a value of 1.414 for a true sine wave. The crest factor specified is derived from a total harmonic content (10 percent) wherein the phase and amplitude relationship of the individual harmonic frequencies causes the crest factor to fall between the specified values.

d. Steady-state tolerances. The limits of voltage and frequency within which primary input power is delivered to the equipment, the difference between such limits and the nominal value being expressed as a plus and minus percent of nominal value.

e. Steady-state variation. The effect of periodic and random deviations of instantaneous voltage and frequency of the mean steady-state value, at any constant load, the limit of such effect being expressed as a plus and minus percent of nominal value.

f. Maximum transient amplitude. The maximum excursion of voltage or frequency transient from any initial point within the steady tolerance limits, expressed as a plus and minus percent of nominal voltage or frequency.

g. Transient recovery time. The total elapsed time of the transient disturbance measured from the instant the voltage or frequency (or both) departs from the defined steady-state variation limits to the instant the voltage or frequency (or both) recovers to steady-state condition and stabilizes within the defined steady state variation band.

6.4.2 Terms. Terms other than defined in 6.4.2.1 through 6.4.2.31, definitions of part, subassembly, assembly, unit, set, system, and model, will be in accordance with MIL-STD-280. Test, measurement, and diagnostic equipment (TMDE) terms are defined in MIL-STD-1309.

6.4.2.1 Accessory. An accessory is an assembly or a group of parts or a unit which is not always required for the operation of a test set or unit as originally designed but serves to extend the functions or capabilities of the test set; similarly as headphones for a radio set supplied with a loudspeaker, a vibrator power unit for use with a set having a built-in power supply, or a remote control unit for use with a set having integral controls.

6.4.2.2 Approved equipment test procedure. The test procedure furnished by the Government or furnished by a contractor in accordance with the requirements of the contract or order and approved by the Government in accordance with the contract or order.

6.4.2.3 ATE. For the purpose of this specification, the terms ATE and automatic checkout equipment (ACE) are synonymous.

6.4.2.4 Bench-top equipment. Bench-top equipment is designed to be used on a fixed bench or table or on a mobile cart. Equipment which exceeds 5 kg (11 lbs) in weight and has no handles, or exceeds 20 kg (44 lbs) with or without a handle, is considered to be bench-top equipment. Bench-top equipment may be of Style B or E.

6.4.2.5 BIT. For the purpose of this specification, the term BIT identifies the test approach using either BITE or self-test capability or both.

6.4.2.6 BITE. Any device which is part of or permanently mounted in the prime test equipment and used for the express purpose of testing that equipment, either independently or in association with external test equipment.

6.4.2.7 Calibration interval. The maximum length of time between calibration services during which a specified percentage of equipment is expected to remain within acceptable performance levels under normal conditions of handling and use.

6.4.2.8 Certification time. Certification time includes all time required to check the equipment parameters on all range and function settings and all inputs and outputs. Certification time does not include the time to repair and readjust the equipment as a result of a malfunction.

6.4.2.9 COTS equipment. COTS electronic and electrical test equipment is a commercially available and developed product, the quality and suitability of which is evidenced by substantial market acceptability, and which is sold to the general public at an established catalog price.

6.4.2.10 Component batteries. Batteries used as components are nickel cadmium, or equivalent, batteries, designed for extended use and reliability equal to or exceeding that of other components (such as resistors or capacitors) which are incorporated into the equipment.

6.4.2.11 Configuration. Configuration is used to identify two or more units from a single associated detail specification which differ in type, class, style, color, or other electrical or mechanical characteristics.

6.4.2.12 Destructive corrosion. Destructive corrosion is any type of corrosion which, in any way, interferes with mechanical or electrical performance of the equipment or associated equipment parts.

6.4.2.13 Detail specification. Detail specification as used herein may include a Military specification, purchase description, purchase exhibit, or brand name or equal purchase description.

6.4.2.14 Dimensions. Dimensions are specified in units of width, height, and depth of the equipment in its normal operating position, and may be specified as maximum or partial, or both. Maximum dimensions include all handles, latches, knobs, and other protuberances, and are the three interior dimensions of a rectangular box into which the equipment (less detachable cords, cables, or accessories) may be fitted. Partial dimensions, when specified, include all protrusions except removable handles, connectors, bumper feet, latches, and cover. Partial depth, when specified, is defined in a and b:

a. Portable bench-top equipment. From the front surface of the front panel (less removable bezels, handles, or cover) to all rear protrusions except controls, bumper feet, connectors, latches, or handles

b. Rack-mounted equipment. From the rack-mounting surface (normally, the rear surface of the front panel) to the rearmost permanent protrusion, including any connectors or controls, but not including cable retractors, slide-out track parts not fixed to the equipment, or cable clearances

6.4.2.15 Enclosure. Enclosure and case are interchangeable terms which may apply to any of the styles specified in a through f. A multiple enclosure identifier may be used when specified by the associated detail specification. An example of this would be "ET" for a Style E equipment case which is supplied with a Style T enclosure.

a. Combination case, Styles A and C. A combination case combines features of the transit case (Style T) and an instrument case (Styles B, D, E, or F). The combination case is designed to protect the instrument and accessories from environmental conditions encountered during storage, shipment, and use in unprotected areas. Additional protection (packaging) may be required when shipped by common carrier.

b. Instrument or equipment case, Styles B, D, E, and F. An instrument case is a case designed to protect the instrument proper, and is part of the instrument. For example, a dust cover may be part of the case, and is not intended for shipment by common carrier without additional packaging.

c. Console cabinet, Style G. A console cabinet is an enclosure or rack designed to accommodate Style F rack-mounted enclosures or enclosures of Styles B, C, D, or E which have been converted for rack-mounting by a conversion kit (bolt-on mounting extenders and filler panels as required).

d. Transit case, Style P. The Style P transit case is designed to provide protection for the contained test equipment against shock, vibration, and other

environmental conditions which may be encountered during use in more than one location.

e. Transit case, Style S. A style S transit case is designed to provide protection for the contained equipment during transit between work locations. Compartments for accessories (or provisions for stowing accessories) are provided in a transit case. Style S transit cases are not intended to double as shipping containers.

f. Transit case, Style T. A Style T transit case is designed to house and protect an instrument or equipment case. Compartments for accessories (or provisions for stowing accessories) are provided in a transit case. The case is designed to protect the enclosed instrument against environmental conditions encountered during storage, shipment, and handling without additional packaging.

6.4.2.16 Equipment/Unit. Equipment is an instrument, with the parts, accessories, components, or any combination thereof, required for performing a specified operational function. Unless otherwise specified in the detail specifi-cation, the equipment consists of a single instrument or a mainframe and plug-in configuration. When a mainframe and plug-in configuration is supplied, the combined weight will not exceed the maximum weight allowed by the associated detail specification. Accessories, such as sensors, leads, bridges, loads, and adapters, will be provided with a storage case. Certain equipment may be complete within itself and may not require the addition of parts, accessories, or components to perform a specified operational function. The term 'units' is used to denote multiple items of equipment.

6.4.2.17 Failure. Equipment failure as used herein is any departure from the required performance or operation outside of the required accuracies (not correctable by normal use of the operating controls), or deviation from the criteria of 4.5 after the test is initiated.

6.4.2.18 Front panel sample. Front panel samples are 100 mm (4 in) by 100 mm (4 in) samples which are representative of the equipment's front panel with marking. The sample is flat, uniform in thickness, free from warp, and contains no holes or discontinuity other than the specified marking in an abrasion area located between two concentric circles, 60 mm (2.4 in) and 90 mm (3.5 in) in diameter, referenced to a center hole. A center hole is 6.4 mm (0.25 in) for material thicknesses of 6.4 mm (0.25 in) or less, and 9.5 mm (0.38 in) for material to 12.7 mm (0.5 in) thick.

6.4.2.19 Intermittent and short-time operation. Intermittent and short-time operation are the alternating periods of operation for the specified time followed by 15 minutes of non-operation

6.4.2.20 Lot. The size of a lot is that quantity of units from each individual production run that is specifically set aside for delivery to the Government (i.e., if a given production run consists of 1000 units of which 150 are set aside for delivery to the Government, the lot size would be 150). Portions of separate

production runs will not be combined into a single lot but will be treated as individual lots.

6.4.2.21 Microelectronics. Microelectronics is that area of electronic technology associated with or applied to the realization of electronic systems from extremely small electronic parts or elements.

6.4.2.22 Nonrepairable subassembly. A component, module, or subassembly is nonrepairable if the physical nature of the item is such that the item cannot be economically or feasibly repaired due to the excessive cost of material and labor required to effect such repair. This excessive cost is normally considered as 65 percent, or greater, of the acquisition cost of the item. Examples of nonrepairable subassemblies are: a) an integrated circuit, b) a printed circuit card wherein the components and card are sealed in a hard thermosetting plastic compound, and c) a module wherein all printed circuit cards or components are sealed in a hard thermosetting plastic compound or the module is hermetically sealed.

6.4.2.23 Performance requirements of the test equipment. Wherever referenced in this specification, the performance requirement of the test equipment means the satisfactory performance of all electrical and mechanical characteristics under the conditioning, destructive, and accelerated tests specified in the associated detail specification for simulating anticipated field service demands as closely as possible.

6.4.2.23.1 Level A and Level B performance tests. Level A and Level B performance tests are characterized by the degree of testing performed for a specific parameter. Level A testing is intended to be a reduced amount of testing per unit, which is performed on each unit of a lot. Level B testing is more extensive within each parameter, but is limited to certain samples of the lot.

6.4.2.24 Portable equipment. Portable equipment is designed to be easily carried between locations of use. Equipment of 5 kg (11 lbs), or less in weight which is readily hand held with no handles, or 20 kg (44 lbs), or less, and provided with a handle, is considered to be portable. Portable equipment may be of Styles A, C, or D, but may include some Style E equipment designed for portable as well as bench-top use.

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

6.4.2.26 Ruggedized. Physical and operational characteristics that allow equipment to withstand rough handling and extreme or hostile environments.

6.4.2.27 Satisfactory operation check. A satisfactory operation check employs a maximum number of active circuits of the equipment with a minimum requirement for external input or evaluation equipment to ensure that all functions of the equipment are operational.

6.4.2.28 Satisfactory operation test. A satisfactory operation test employs the necessary external input and evaluation equipment to determine if the equipment conforms to the requirements of the associated detail specification.

6.4.2.29 Self-test. A self-test is a test or series of tests, performed by a device upon itself, which shows whether or not the device is operating within designed limits. This includes test programs on computers and ATE which check out their performance status and readiness.

6.4.2.30 Special tools. Special tools are tools not listed in the National Supply Catalog (copies of this catalog may be consulted in the office of the Defense Contract Administration Service).

6.4.2.31 Standby. Equipment is considered to be in a standby condition when any part of its circuitry is energized regardless of the power switch setting.

6.5 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards that have been cleared and listed in DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under a separate contract line item in the contract.

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

6.7 Subject term (key word) listing.

Acoustic noise
Aircraft and shipboard requirements
Aluminum alloys
Automatic test equipment (ATE)
Batteries
Bench-top equipment
Bounce, loose cargo
Brittle materials
Built-in test (BIT)
Built-in test equipment (BITE)
Burn-in
Calibration interval
Commercial-off-the-shelf (COTS) equipment
Derating of electronic parts
Enclosures
Environmental requirements and tests
Explosive atmosphere requirements and tests
First article

Ferrous alloys
Flammable materials
Frequency-transient test
Gasoline
Helium
Human engineering
Intended use: worldwide natural and controlled environments, stored and transported, land, sea, and air
Interchangeability
Leakage current
Magnesium and magnesium alloys
Maintainability
Mercury, lithium, or radioactive material, Navy use of
Mercury and lithium batteries, Navy use of
Microwave radiation
Optional quality assurance testing
Ozone liberation
Paint
Plates, tags, and bands
Rack-mounting requirements
Reliability
Shock
Transient-state power
Vibration
Wood
Workmanship screen
Zinc

Preparing Activity
Navy - SH

(Project No. 6625-0770)

Custodians:
Army: CR
Navy: SH
Air Force: 11

Review activities:
Army: AV, MI, EA, AL, AR, TE
Navy: MC, AS, OS
Air Force: 13, 17, 19, 99

User activities:
Army: CE, SC, MD
Navy: MCRDAC, YD
Air Force: 10, 15, 18

APPENDIX A

10. SCOPE

10.1 Scope. This appendix is provided for the specification writer to use as a guideline or check list in the preparation of a detail specification invoking MIL-T-28800. It provides a list of the requirements which are automatically invoked, or, when needed, those which may be specifically invoked by the detail specification. This appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 General. General specification requirements which are automatically invoked by referencing MIL-T-28800 in the associated detail specification are as specified in 30.2 for Type I equipment. Requirements which may be invoked at the option of the specification writer are as specified in 30.3 and 30.4. When the requirements of 30.4 are invoked, supplemental information is required in the detail specification to complete each requirement.

30.2 Automatic requirements. The requirements listed below are automatically invoked when the detail specification requires conformance with the Type I requirements of MIL-T-28800. Any one of these requirements may be specifically disinvoked or overridden by the detail specification under the provisions of paragraph 2.3.

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30.4 Supplemental requirements. The requirements listed below may be invoked in the detail specification at the option of the specification writer. Supplemental information is required in the detail specification to complete each requirement.

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10. SCOPE

10.1 Scope. This appendix is provided for the specification writer to use as a guideline or check list in the preparation of a detail specification invoking MIL-T-28800. It provides a list of the requirements which are automatically invoked, or, when needed, those which may be specifically invoked by the detail specification. This appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 General. General specification requirements which are automatically invoked by referencing MIL-T-28800 in the associated detail specification are as specified in 30.2 for Type II and III equipment. Requirements which may be invoked at the option of the specification writer are as specified in 30.3 and 30.4. When the requirements of 30.4 are invoked, supplemental information is required in the detail specification to complete each requirement.

30.2 Automatic requirements. The requirements listed below are automatically invoked when the detail specification requires conformance with the Type II or Type III requirements of MIL-T-28800. Any one of these requirements may be specifically disinvoked or overridden by the detail specification under the provisions of paragraph 2.3.

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30.3 Optional requirements. The requirements listed below may be invoked in the detail specification at the option of the specification writer.

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Rack-mounting provisions, Styles B, C, D, E, F, and G. 3.6.2.1.1.2, 3.6.3.1.4, 3.6.4.1.4, 3.6.5.1.1, 3.6.6.1.1, and 3.6.7.1.1
Tilt bail handle, Styles B, C, D, and E. 3.6.2.2.4.1, 3.6.3.2.4.1, 3.6.4.2.3.1, 3.6.5.2.3.1
Convertible/rack-mountable equipment. 3.6.11.1

Environmental requirements. 3.7
Temperature shock. 3.7.2.2
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Bounce, loose cargo. 3.7.4.3
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Solar radiation. 3.7.13

Marking and identification. 3.10
Alternate marking processes. 3.10.1.1.4.2
Nomenclature assignment. 3.10.4

Reliability. 3.12
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Maintainability. 3.13
Maintainability demonstration, Type I. 3.13.1.2
Washability, Type I. 3.13.1.5

Environmental stress screening. 3.14

30.4 Supplemental requirements. The requirements listed below may be invoked in the detail specification at the option of the specification writer. Supplemental information is required in the detail specification to complete each requirement.

Electrical power sources and connections. 3.4
Power consumption, Type I. 3.4.1.1
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APPENDIX B

10. SCOPE

10.1 Scope. This appendix is provided for the specification writer to use as a guideline or check list in the preparation of a detail specification invoking MIL-T-28800. It provides a list of the requirements which are automatically invoked, or, when needed, those which may be specifically invoked by the detail specification. This appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. REQUIREMENTS

30.1 General. General specification requirements which are automatically invoked by referencing MIL-T-28800 in the associated detail specification are as specified in 30.2 for Type II and III equipment. Requirements which may be invoked at the option of the specification writer are as specified in 30.3 and 30.4. When the requirements of 30.4 are invoked, supplemental information is required in the detail specification to complete each requirement.

30.2 Automatic requirements. The requirements listed below are automatically invoked when the detail specification requires conformance with the Type II or Type III requirements of MIL-T-28800. Any one of these requirements may be specifically disinvoked or overridden by the detail specification under the provisions of paragraph 2.3.

Requirements. 3.

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30.3 Optional requirements. The requirements listed below may be invoked in the detail specification at the option of the specification writer.

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30.4 Supplemental requirements. The requirements listed below may be invoked in the detail specification at the option of the specification writer. Supplemental information is required in the detail specification to complete each requirement.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-T-28800E	2. DOCUMENT DATE (YYMMDD) 3 SEPTEMBER 1991

3. DOCUMENT TITLE
TEST EQUIPMENT FOR USE WITH ELECTRICAL AND ELECTRONIC EQUIPMENT, GENERAL SPECIFICATION FOR

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)
	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

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