MIL-F-14252 (AR)
14 February 1956

MILITARY SPECIFICATION

FIRE CONTROL MATERIEL : GENERAL SPECIFICATION GOVERNING THE DESIGN AND INSPECTION OF

1. SCOPE

1.1 This specification covers general requirements for the design and inspection of fire-control materiel.

2. APPLICABLE DOCUMENTS

2.1 The following specifications, standards, drawings and publications of the Issue in effect on date of invitation bids, form a part of this specification:

SPECIFICATIONS

Federal

C-F-202	Felt Hair
C-F-206	Felt, Mechanical, Roll
L-L-31 .	Laminated thermosetting sheets, rods and tubes
L-V-345	Vinyl Chloride Polymer and Copolymer Rigid Molded Plastics
DD-G-451	Glass, Flat and Corrugated, For Glazing, Mirrors, and other Uses
KK-L-154	Leather; Cattlehide (Bag and Case)
KK-L-171	Leather Harness, Vegetable-Tanned
KK-L-271	Leather; Strap, Cattle-Hide, Vegetable Tanned
QQ-A-601	Aluminum-Base-Alloys: Sand-Castles
QQ-S-571	Solder, Soft (Tin, Tin-Lead, and Lead -SIlver)
QQ-S-763	Steel, Corrosion-Resisting: Bars and Forgings (Except for Reforging)
QQ-S-766	Steel, Corrosion-Reslsting?: plates, Sheets, Strips, and Structural Shapes

QQ-W-470		Wire, Steel (Carbon); Sping, MuSic
TT-C-595		Colors, (for) Ready-Mixed Paints
CCC-D-771		Duck; Cotton, Plied-Yams (Army, Numbered, and Tent-Duck)
DDD -S -751		Stitches; Seams; and Stitching

Military

MIL-E-1	-	Electron Tubes
MIL-c-5	-	Capacitors, Fixed, Mica-Dielectric
MIL-M-6	-	Meters, Electrical-Indicating, Panel Type
JAN-I-10	-	Insulatiilg materials, Ceramic Radio, Class L
MIL-R-11	-	Resistors, Fixed, COmpOsitiOn (Insulated)
MIL-P-14	-	Plastic-Materials, Molding, and Plastic Parts, Molded, Thermosetting
JAN-C-17	-	Cables, Coaxial and Twin-Conductor, for Radio Frequency
JAN-R-19	-	Resistors, Variable, Wirewound '(low operating temperate)
JAN-C -20	-	Capacitors, Fixed, Ceramic-dielec-tric (temperate comPensation)
MIL -R -22	-	Resistors, Variable (wirewound, power type)
JAN-S-23	-	switches, toggle (for electronic and communications use)
MIL -C -25	-	Capacitors, Fixed, paper-dielectric, direct current (hermetically sealed in metallic cases)
MIL-R-26	-	Resistors, Fixed, wirewound (power tYPe)
MIL-T-27	-	Transformers and Inductors (Audio, Power and Pulse)
JAN-S-28	-	Sockets, Electron-Tube; and Accessor-ies
JAN -R -29	-	Resistors, external meter (high voltage, ferrule terminal type)
JAN-s-57	-	Switches, vacuum
JAN-C-62	-	Capacitors, dry-electrolytic, polar-ized
JAN-s-63	-	Switches, sensitive
MIL-W-76	-	Wire and Cable, Hook-Up, Electrical, Insulated
MIL-P-78	-	Plastic-Material, Laminated (for designation plates)
MIL-P-79	-	Piastic-Materials, Laminated, ther-

MIL-P-80	-	Plastic-Materials, **Anti-Electro-static, Clear, Transparent (for indicating instrument** windows)
JAN-C-81	-	**Capacitors,** ceramic-dielectric , variable
MIL-T-85	-	Tubing, waveguide, Seamless rectang-ular
MIL-C -91	-	Capacitors, Fixed, paper-dielectric (nonmetallic cases)
JAN-C-92	-	Capacitors, air-dielectric, variable (trimmer capacitor)
MIL-R-93	-	Resistors, fixed, wirewound (accu-rate)
JAN-R-94	-	Resistors, variable, composition
MIL-P-116	-	Preservation, Methods of
MIL-V-173	-	Varnish, Moisture-and-fungus -Resist - ant, for the Treatment of communi-cations, electronic, and Associated Electrical equipment
JAN-G-174	-	Glass, Optical
JAN-R-184	-	Resistors, fixed, wirewound (low power)
JAN-w-287	-	Waveguide Assemblies, flexible
MIL-D-504	-	Dyeing and After treating processes for Cotton Duck and Twill
JAN-W-530	-	Webbing, Cotton, Natural or in colors
MIL-I-631	-	Insulation, Electrical, synthetic-resin composition, Nonrigid
MIL-L-644	-	Lubricating 011, Preservative, special
JAN-F-675	-	Films, Reflection-Reducing, for Glass Optical elements
MIL-S-901	-	Shockproof Equipment, Class HI (High-Impact), Shipboard application, test for
MIL -P **-997**	-	Plastic-Material, Laminated, thermo-setting, electrical-insulating sheets, glass cloth, silicone resin
MIL-M -2312	-	Mildew resistance and moisture re-sistance for felt, wool, (Army)
MIL-R-003065	-	Rubber and Synthetic Compounds; General Purpose (Except Tires, Inner tubes, Sponge Rubber, and Hard rubber)
MIL-T -3080	-	Tubes, Current-Regulat ing
MIL-P-3086	-	Plastic-Material, Thermoplastic, Non-rigid, Polyamide resin
MIL-P-3115	-	Plastic-Material, Laminated, thermo-setting, sheets, Paper-Base, Phenolic-resin

MIL-C-3133	Cellular Rubber Products, General Purpose (Except Ebonite)
MIL-V-3144	Vials, Level (All temperature type)
MIL-G-3278	Grease; Aircraft and Instruments (for low and high temperatures)
MIL-P 3408	Plastic-Material, Molding; Rigid thermoplastic, Aniline Formaldehyde; for use in electronic, communications, and Allied electrical equipment
MIL-P -3409	Plastic-Material, Molding; rigid thermoplastics Polydichlorostyrene, for use in Electronic, communications, and allied electrical equipment
M1L-P-3410	Plastic-Material, Molding rigid thermoplastic, polyvinyl chloride and copolymers thereof: for use in Electronic, communications, and allied electrical equipment
MIL-F 3411	Plastic-Material, Molding; rigid, thermoplastic, vinylidene chloride; for use in Electronic, communications, and allied electrical equipment
MIL-P-3412	Plastic-Material, Molding; rigid thermoplastic, ethyl cellulose: for use in electronic, communications and allied electrical equipment
MIL-P.-3414	Plastic-Material, Molding; rigid thermoplastic, cellulose acetate butyrate; for use in electronic,communications, and allied electrical equipment
MIL-P-3415	Plastic-Material, Molding; rigid thermoplastic, cellulose acetate; for use in electronic, communications, and allied electrical equipment
MIL-L-3754	Leather, cattlehide, chrome-tanned; strap, pad, and reinforcement
MIL -S -3786	switch, rotary (circuit selector, low current capacity)
MIL-A-3920	Adhesive, Optical, thermosetting
MIL-K-3926	Knobs, control (For use with electronic, communications and allied equipment)
MIL-S-4456	Test Procedure; Shock medium Impact; Variable duration, Method and apparatus for

MIL-A-5092	Cement, Rubber (Synthetic and Reclaimed rubber Base)
MIL-D-5548	Decalcomanias, Aircraft
MIL-R-5757	Relays, Armature (for Electronic and Communication Equipment)
MIL-O-6083	Oil; Preservative, Hydraulic Equipme nt
MIL-L-6085	Lubricating Oil; Aircraft Instrument, low volatility
MIL-O-6086	Oil; low temperature lubricating gear
MIL-W:6U0	Wood, Determination of Moisture Content of
MIL-I-7798	Insulation Tape, Electrical, Pressure - Sensitive adhesive, Plastic
MIL -T -7807	Thread, Nylon
MIL-T 8606	Tubing, Steel, Corrosion-resistant (18-8 Stabilized)
MIL-M -10304	Meters, Ruggedized Electrical
MIL-L-10331	Leather, Moisture and Mold-resistant treatment
MIL-S -10379	Suppression, Radio Interference General Requirements for Vehicles " (and Vehicular Sub-Assemblies)
MIL-P-10407	Plastic,Cellulose Acetate Butyrate, Molding Material and molded parts
MIL-P-10408	Plastic, Cellulose Acetate Molding material and molded parts
MIL-R -10509	Resistors, Fixed, Film (High Stability)
MIL-R-10683	Resistors, Fixed (Composition Film, Very high Frequency)
MIL-D-10861	Duck : Cotton, Piled-Yarns (Army, Numbered and Special Use)
MIL-C -10950	Capacitors, Fixed, Mica-Dielectric
MIL-C-11015	Capacitors, Fixed, Ceramic Dielectric (general purpose)
MIL-S-11030	Sealing Compound; Non-Curing (Poly - sulfide Base)
MIL-S-11031	Sealing Compound, Adhesive; Curing (Polysulfide Base)
MIL-R -11050	Rectifiers, Selenium (Open construction)
MIL-A-11052	Absorbers, Radio Frequency Radiation (Metallized Plates)
MIL-c-11272	Capacitors, Fixed, Glass, Dielectric
MIL-T-11293	Treatments, Mildew-resistant, copper processes (for fabrics, thread, and cordage)

MIL-c-11561	Capacitors, suppression, high voltage
MIL-C -11693	Capacitors, Feed-through, suppression AC and DC
MIL-s-11748	Suppression Requirements for Electrical and Electronic Equipment (Except internal combustion engine - driven equipment)
MIL-O-11773	Oil, Lubricating, Synthetic (for Impregnating Powder Metal Sleeve Bearings)
MIL-R-11804	Resistors, Fixed, Non-wirewound, Power type
MIL-P-12011	Painting and Finishing of Fire-Control Instruments: General Specification for
MIL-W-12349	Wire, Hook-Up Monochlorotrifluoroethylene Insulated
MIL-T-12664	Treatment, Mildew-resistant; for Cork products
MIL-W-12683	Welding; Joint Design, Data, for (Structure other than Armor)
MIL-G-12803	Gasket Materials, Nonmetallic
MIL-C-12889	capacitors, Fixed, Paper Dielectric (By-Pass, Suppression)
MIL -M -13508	Mirrors, Front Surfaced, aluminum for Optical elements
MIL-W-13743	Welding, metal-arc; of readily weldable steel for highly stressed Joints
MIL-W-13773	Welding, repair of readily weldable steel castings (other than armor)
MIL-C -13777	Gable, Special Purpose, Electrical
MIL-0-13830	Optical Components for Fire-Control Instruments; General Specification Governing the Manufacture, Assembly, and Inspection of
MIL-I-135857	Impregnation of metal castings
MIL-T-13867	Treatment, Moisture and Fungus Resistant for Fire Control electrical and Electronic Instruments and Equipment
MIL-P -15035	Plastic-Material-Laminated, Thermosetting: Sheets, cotton-fabric-Base, Phenolic-Resin
MIL-P -15037	Plastic-Material, Laminated, thermosetting sheets, glass-cloth, melamine-resin
MIL-P-150L7′	Plastic-Material, Laminated, thermosetting, sheets, nylon fabric base, Phenolic-Resin

MIL-E-15090	-	Enamel, Equip ment, Light-Gray (Formula No. 111)
MIL-C -15305	-	Coils, Radio Frequency; and Transformers, Intermediate and Radio Frequency
MIL-G- 20098	-	Gypsum Cement

STANDARDS

Military

MIL -STD -8	-	Dimensioning and Tolerancing
MIL -STD -10	-	Surface Roughness, Waviness and Lay
MIL-STD-12	-	Abbreviations for use on Drawings and In Technical Publications
MIL-STD -16	-	Electrical and Electronic reference Designations
MIL-STD-19	-	Welding symbols ‘
MIL -STD -105	-	Sampling Procedure and Tables for Inspection by Attributes
MIL-STD-122	-	Color Code for Chassis wiring for Electronic equipment
MIL-STD-129	-	Marking of shipments
MIL-STD-200	-	Electron Tubes
MIL-STD-202	-	Test Methods for Electronic and Electric Component parts
MIL-STD-205	-	Frequencies for Electrical power

Ordnance Engineering

URAX6	-	Ordnance Finishes (Surface Roughness)

(Copies of specifications, standards, and drawings required by contractors In connection with specific procurement functions should be obtained from the procuring agency **or** as directed by the contracting officer.)

2.2 Other publications. - The following publications, of the Issue in effect on date of invitation for bids, form a part of this specification:

NATIONAL BUREAU OF STANDARDS PUBLICATIONS

Handbook H28 - Screw-Thread Standards for Federal Services

(Copies of Handbook H28 may be obtained upon application, accompanied by money-order, coupon, or cash, to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

ARMED SERVICES ELECTRO STANDARDS AGENCY PUBLICATION

ASESA Publication 49-2 - Armed Services Index of R.F. Transmission Lines and Fittings

(Information as to the availability of this public at ion may be obtained from the Armed Services Electro Standards Agency, Fort Monmouth, New Jersey)

FRANKFORD ARSENAL PUBLICATIONS

Fire Control Standard Practices

Volume I - Drafting
Volume III - Design
Volume IV - Manufacturing Processes

(Information as to the availability of these publications may be obtained from the Commanding General, Frankford Arsenal, Philadelphla 37, Pennsylvania.)

3. REQUIREMENTS

3.1 Order of precedence. - Should any conflict exist between the requirements of the contract, contractor **drawings, detail specificat ions, and this specification, the order of precedence shall be In the order listed:**

a. **Contract, Including modifications thereto.**
b. **Detail specification for a major combination, major item, assembly, or component (order of precedence as listed) .**
c. **This specification.**
d. **Detail specifications for materials or operations.**
e. **General specifications pertaining to classes of materials.**
f. Contractor's drawings.

3.2 Service conditions.- The following conditions of natural environment to which fire-control materiel may be exposed shall be used to establish uniform limits not to be exceeded in normal design requirements.

3.2.1 Life expectancy. - Fire control equipment shall have 3 life lengthas specified in the detail specification.

3.2.2 Continuous operation. - Fire-control equipment shall be capable of operating the specified number of hours per day without breakdown or Impairment of performance.

3.2.3 Altitude. - Unless otherwise specified, fire-control equipment shall operate satisfactorily from sea level to 6000 feet above sea level and shall not be damaged If transported by air at an altitude of 50,000 feet above sea level. The above specified altitudes shall be assumed to be under the most adverse barometric pressures which may be encountered at the particular altitudes (see 4. 3.5) .

3.2.4 Temperature range. - Fire-control. equipment shall operate satisfactorily over an ambient temperature range of minus 40°C (-4O°F) (minimum exposure of 3 days without benefit of solar radiation) to plus 52QC (\1250F) (minimum exposure of 4 hours with full impact of solar radiation, 360 Btu,/sq-ft/hr) and shall not be damaged by storage at temperatures between minus 620C (-8o°F) (minimum exposure of 3 days without benefit of solar radiat ion) and plus 77°C (/160°F) (minimum exPosure of 4 ‘ems with full impact of solar radiation, 36o Btu[sq-ft@) (see 4.3.1, 4.3.2, and 4.3.3).

3.2.5 Relative humidity Unless otherwise specified, fire-control equipment shall operate satisfactorily in relative humidities up to 100 percent.

3.2.6 Wind. - Unless otherwise specified, fire-control equipment shall function properly In winds as high as 60 miles per hour.

3.2.7 Dust, sand, rain and snow.- The equipment shall be adequately protected against damage by blowing dust, sand, rain or drifting snow as would normally be encountered during service life (see 4. 3.8 and 4.3.9).

3.2.8 Salt laden air.- The equipment shall not be damaged or Its performance impaired by salt-laden air as encountered in coastal service.

3.2.9 Storage life. - The equipment shall not be damaged or Its performanc e impaired by storage over a period as specified In the detail specification.

3.2.10 Shock. - Unless otherwise specified, a manner of construction shall employed which will prevent damage or subsequent failure to provide the performance specified in the detail specification, when the equipment components are subject to impact

shocks of specified duration and acceleration (see 4.3.10) in the following directions:

a. Horizontally, parallel to the major horizontal axis (both directions).
b. Horizontally, perpendicular to the major horizontal axis (both directions).
c. Vertically (both directions) .

3.2.11 Vibration. - Except for Internal resonances of specified parts and sub-assernblies, no components of equipment shall have mechanical resonant frequencies less than the specified frequency when shock mounts (if any) are blocked or removed (see 4.3.9).

3.2.11.1 Shock accounts*- Where necessary, each unit of equipment shall be provided with shock mounts which will limit Its resonant vibration within the specified frequency range along the vertical and horizontal axes. Provision shall be made for attenuation of impact shock along the critical axis so that no collision of any shock-mounted part, sub-assembly, or component during the vibration test can result.

3.2.11.1 Types of shock mounts. - The shock mounts may be of the resilient material, metallic type or may employ viscuous damping. The design of shock mounts shall be such-that failure of the resilient material will not set the supported part free.

3.2.11.1.2 Installation of shock mounts.- Unless otherwise specified, all shock mounts shall be readily replaceable without Major disassembly of the equipment. All electrical connections Between a resiliently supported shock mount and its foundation shall be as flexible as practicable. Sufficient clearance shall be provided between parts to preclude the possibility of a cushioned part striking any other part.

3.2.11.1.3 Electronic by-pass of shock mounts.- All shock mounts shall be electrically bY-PaSS by a flexible bonding strap of solid copper at. least one inch wide by 1/16 inch thick, except In such cases **bet'e a strap of this size would impair the action of the shock mount. Deviations from this requirement shall, In all cases, be under the control of the contracting officer.

3.2.12 Stability and leveling.- Fire-control equipment shall have sufficient stability for operation on sandy, muddy, and frozen terrain and shall be capable of being leveled as specified in the detail specification.

3.2.13 Safety of personnel.

3.2.13.1 Mechanical.- Suitable protection shall be provided to prevent accidental contact by personnel with moving mechanical parts such as gears, fans, and belts when the equipment Is complete and In the operating position. Sharp projections on cabinets, doors, and similar parts shall be avoided.

3.2.13.2 Electrical.- Satisfactory provision shall be made to prevent personnel from accidentally coming in contact with voltages in excess of 50 volts (RXS) to ground, chassis, or frame. This requirement shall be interpreted to require also protection to personnel against capacitor discharge. When doors, plates, and covers are opened or removed for maintenance and rePairs protection from voltage in excess of 500 volts shall be provided by **interlock switches.** Where interlock switches are used, manually operated by-pass switches shall be Installed which will automatically open when the door plate or cover is closed. Where voltages of 500 or more volts nominal Value are exposed when an access door or cover is removed, a label (see 3.12.3.2) shall be conspicuously displayed which reads 'DANGER-HIGH VOLTAGE' in white or aluminum letters at least 3/8 Inch high, on a red background.

3.2.13 .2.1 Ground potential. -The construction of the equipment shall be such that all external parts, exclusive of antenna and transmission lines, shall be at ground potential at all times (see **3.11.14.12).** **No** line of the primary power source shall be electrically connected to the case of any fire-ccntrol instrument.

3.2.14 Ease of operation. - Operating controls shall be conveniently located and where required by tactical consideration shall be capable of being operated by personnel wearing standard arctic clothing.

3.2.15 Ease of adjustment and maintenance of electrical equipment.- Test points or Jacks shall be conveniently Located where necessary to **provide proper operating** adjustment and maintenance. Indicating devices **such as** lamps and meters shall be installed where required. The equipmcnt shall be so constructed that parts, terminals, and wiring. will be accessible for circuit checking, adjustment, maintenance, repair, and replacement. with minimum disturbance to other parts and wiring and with use of the minimum number and variety of special tools, particularly these needed for tuning and adjustment. Tools required for operational adjustments shall be provided with the equipment and stored by convenient means near the component where they are to be used.

3.2. 15.1 Unit replacement. - The equipment shall be designed *for* ease of maintenance by providing for unit replacement of small electronic assemblies such as amplifiers, voltage regulators, IF strips, and similar assemblies, Wherever practicable, each Internal assembly having electrical circuits which are designed for removal from Its associated enclosure shall be provided with plug and sack connections or connectors. Means shall be provided for their proper alignment; alignment devices shall be self centering to permit ready engagement of parts; the exposed plug contacts shall be deenergized when the connectors are Separated.

3.3 Method of design.- The means and methods of executing the design and development of fire-control instruments may be determined by the contractor, but the obligation rests with the contractor to satisfy the contracting officer as to full compliance with the requirements of the contract and specifications. In all phases of the study, design and development of fire-control materiel to be directly operated by military personnel, the contractor will be expected to utilize the full or part-time consultation service of human engineering specialists In determining the existence of and solutions to problems In:

(a) space for operator's stations and the arrangement and design of controls.
(b) design of' visual displays and other means of supplying information.
c safety features.
d environmental conditions such as illumination noise level, vibration, temperature and ventilation.
(e) utilization of skills already existent in available crews.

The contracting officer shall provide a list of apprOved sources for such services. Upon request additional sources shall be approved by the contracting officer. The design and development of pilot models shall be carried on In such a reamer as to facilitate the transfer to subsequent manufacture on a production basis.

3.4 General responsibilties of the contractor,

3.4.; Gages and test equipment.. - The contractor shall furnish all gages (subject to certifiication by the Gage Branch of the Ordnance District Which: has inspection cognizance), templates, dies, jigs,

fIxtures, and environmental testing equiPment necessarY to verify the requirements of his drawings detail specification specification except such as the Government my prefer to furnish.

3.4.2 Electrical and electronic test equipment. - The contractor shall furnish all electrical and electronic test equipment necessary to verify the required characteristics and shall periodically check this equipment against certified standards for calibration accuracy.

3.5 Drawings. - The contractor shall prepare and submit to the Government a complete set of drawings of the materiel to be furnished. Unless otherwise specified, drawings shall conform, to "Fire Control Standard Practices, Volumes I and III. These drawings shall then be reviewed by the Government for approval as official drawings and will be issued for use *in* inspection and for other purposes, and shall become the property of the Government . Wherever possible, materials and finishes shall be specified by reference to Government specifications which have been approved for Ordnance Corps use. The contractor shall SUPPIY his applicable specification or catalog to the contracting officer when an equivalent Government specification does not exist for the material or item. The contracting officer shall reserve the right to require the contractor to use any specified material or item In lieu of the contractors material or item.

3.5.1 Abbreviations.- All abbreviations on drawings shall conform to Standar MIL-STD-12.

3.5.2 Welding symbols . Welding symbols on drawings shall conform to Standard MIL-STD-19 (see **3.13.5)** . .

3.5.3 Dimensions and tolerances.- Dimensions and tolerances shall be in accordance with "Fire Control Standard Practices", Volume 1.

3.5.3.1 Dimensions. - The contractor shall adhere to the dimensions given on the drawings, and in no case shall the drawings he scaled. Should additional dimensions be required, application therefor Shall be made through the contracting officer.

3.5. 301.1 Protective finished surfaces. - The dimensions for finished surfaces given on detailed drawings shall include the protective finish on plating. The contractor shall be responsible for controling finish thickness and initial machine dimensions so that the dimensions of the final finished product are all fall within dimension tolerances as specified on drawings. Where a precision fit is specified, the protective finish shall be omitted or removed from that surface if necessary. A precision fit is defined as any fit with 0.0007 inch or less clearance,

or any fit involving sliding or rotating contact surfaces in which the protective finish may normally become abraded in the early service life of the part. Tapped holes shall also be considered as precision fits, and the finish may be omitted or removed.

3.5.3.1.2 Bonding surfaces. - Bare metallic surfaces are required for bonding purposes especially where such bonding is for electrical interference reduction.

3.5.3.2 Tolerances. - Tolerances on Ordnance Corps (fire-control) drawings are indicated either by specifying the limits immediately after the basic size or by means of a general tolerance note on the drawing form.

3.5.3.2.1 Tolerance range of machining processes. Unless otherwise specified, the tolerance range of machining processes (e.g., drilling, milling, reaming, broaching and grinding) shall conform to Standard MIL-STD-8 wherever applicable.

3.5.3.2.2 Screw threads. - Unless otherwise specified, threads of all screws shall conform to the dimensions and tolerances of the Unified and American National Standard Classes 1, 2, and 3, A and B tolerances as specified in Handbook H28.

3.5.3.2.3 Undercuts. - Depth and width of undercuts on threaded parts (except standard fasteners), where not specified on drawings, shall be no more than 1-1/2 threads wide and shall extend 0.005 inch below the root diameter of the thread, with a diameter tolerance of 0.015 inch in the direction of removal of material.

3.5.3.2.4 Spares. - Spare parts requiring handfittings should employ maximum drawing tolerances requiring the minimum removal of material.

3.5.4 Lathe centers. - Lathe centers shall not be shown on detail drawings. In cases where lathe centers are objectionable, the note "LATHE CENTERS NOT PERMITTED" shall be entered on the drawing.

3.6 Parts and material. - Materials and parts (including hardware items of the equipment not covered by subsidiary specifications) shall be resistant to corrosion or shall be suitably processed to resist corrosion (see 3.9). Gold, nickel, chromium, rhodium, corrosion-resistant steel (12 percent or more chromium), tin, lead-tin alloys, or sufficiently thick platings of these metals are satisfactory without additional protection or treatment other than buffing or cleaning. There shall be no destructive corrosion after subjection to the salt spray test of MIL-STD-202.

corrosion after subJection to the salt spray test of MIL-STD-202. Destructive corrosion shall be construed as that type of corrosion which in any way interferes with mechanical or electrical performance.

3.6.1 Commercial quality. - Parts and material specified as "commercial quality" or prescribed by merely a name In general commercial use sun as "steel", "forged steel", "bronze", "cast Iron", "brass", "drill rod" "leather", or "wood shall be such as would be used in first-class commercial constructions, free from any defect that would render them unsuited or inefficient for the purpose for which they are intended. Such parts and material shall not ordinarily be subject to tests or analyses; however, if there is reason to doubt the quality, the right is reserved to make such tests as the Inspector deems necessary. Nothing in this paragraph shall be interpreted to mean that applicable material specifications should be ignored.

3.6.2 Dissimilar metals. - Dissimilar metals shall not be used in intimate contact unless suitably protected. against electrclytic corrosion.

3.6.2.1 Identification of dissimilar metals. - Dissimilar metals are arbitrarily defined as metals in contact with each other and indicating an electrically, potential difference of greater than 0.4 volts when immersed In a 3 percent sodium chloride solution. To serve as a guide in identifying dissimilar metal combinations, the most commonly employed metals are listed in four groups in Table I.

TaBle I - Groups of similar metals

Group I	Group II	Group 111	Group XV
(Most anodic) Magnesium alloys	Aluminum Aluminum alloys z Vlc Cadmium	Z Inc Cadmium Steel Lead Tin	Ccpper and its alloys Nickel and its alloys Chromium Stainless steel Gold Silver (Mzsc cathodic)

3.6.2.1.1 Design criteria. - The following rules shall apply in using Table I:

(a) Contact between a member of any one group and another member of the same group shall be considered similar.

1/ (b) Ccntact between a member of' one group and a member of another group shall be considered as dissimilar.

(c) **The above grouping shall not be construed to waive requirements in this specification or in the individ-- ual equipment specification as to corrosion resistance of components and assemblies.**

(d) **Where reference Is made to a metal In a particular groups the reference applies to the metal surface of the part; that is, zinc means ZINC Casting, zinc electroplate, zINc hot dip, or zinc metal spray.**

(e) **A plating metal and base need not be considered** dissimilar when the plating is continuous and covers all the surfaces of the base metal and the plating 13 in accordance with the applicable plating specifications.

(f) **Austenitic corrosion resistant steel inserts in aluminum castings need not be** considered dissimilar when the inserts are integrally cast in the aluminum castings.

G Combinations of dissimilar metals which are potted, pressurized, or under a lubricant film, so that moisture interaction is eliminated need not be considered as dissimilar provided a statement describing the proposed system is submitted to the contract. ing officer for approval.

3.6.2.1.2 Protection against electrolytic corrosion.- Where it is necessary that any combination o r dissimilar metals be assembled, the following methods or combination of methods shall be employed for the prevention of electrolytic corrosion, unless electrical considerations preclude the employment of **such** methods:

a Interposition of a material compatible to each to decrease the electrolytic potential difference such as cadmium or zinc plate on steel In contact with aluminum.

(b) Interposition of an inert. material between the dissimilar metals to act as a mechanical and Insulating barrier such as phenolic gaskets between nickel-plated brass **and** aluminum.

(c) Application of organic coatings to the contact faces of each of the dissimilar metals such **as** paint coats on steel and aluminum surfaces In contact.

1/ Excluding contact combinations of' zinc and cadmium with Groups II and III and with each other.

(d) Application of corrosion inhibitors to the faces of each of the dissimilar metals such as zinc chromate paste on nickel-plated brass screws in contact with aluminum.

(e) Design of dissimilar metal or similar metal contacts so that the area of the cathode metal is relatively smaller than the area of the anodic material such as screws of stainless steel or nickel plated brass in contact with aluminum.

(f) Limitation of amount of aeration reaching the dissimilar metal surfaces such as steel bolts in aluminum with all surfaces of contact sealed with zinc chromate primer, vinyl films, or equivalent.

(g) Any other systems of protection which are designed to prevent electrolytic corrosion shall be subject to the approval of the contracting officer.

3.6.3 Ratings . Ratings and derated values of parts and materials shall be exceeded when the equipment is subjected to specified service conditions (see 3.2) . Derating methods described by applicable specifications or standards shall be used.

3.6.4 Optical components. - Optical components for fire-control instruments shall be in accordance with Specification MIL-O-**13830.**

3.6.4.1 Optical glass Optical glass shall be in accordance with Specifications JAN-G-174 and DD-G-451.

3.6.4.2 optical adhesive.- Adhesive for cementing optical elements shall be in accordance with Specification MIL-A-3920.

3.6.4.3 Reflection reducing films.- Films or coatings applied to light transmitting glass surfaces for reducing reflection shall be in accordance with Specification JAN-F-675.

3.6.4.4 Mirrors, front surfaced.- Mirrors which are used for wavelengths of light within the visible spectrum shall be in accordance with Specification MIL-M-13508.

3.6.5 Friction *drives* and stops.- The necessary friction drives and stops shall be incorporated In mechanisms and so adjusted that no amount of incorrect operation, short of wilful breakages can **damage** the **mechanism..** **All** friction handwheels shall be arranged so that it is impossible to grasp the friction elements and render them inoperative Detents shall be provided where required on adjusting and spotting controls to prevent feedback and loss of adjustment or setting.

3. 6. 6 Springs. - Unless otherwise specified, springs shall be made of beryllium-copper, phosphor-bronze, nickel-silver, or corrosion resistant steel. Beryllium-copper springs shall be heat-treated to the proper temper. Other springs, unless heat treated, shall have the direction of grain within 45 degrees of the longitudinal centerline of the spring material. Springs requiring music wire shall be made of material conforming to Specification QQ-W-470. Plated steel springs over 0. 015 inches material thickness shall have a hydrogen embrittlement relief treatment (see 3. 9. 1. 3). Wire under 0. 015 inches material thickness shall not be plated but shall receive finish 22. 04, grade 1, of Specification MIL-P-12011.

3. 6. 7 Level vials. Vials shall conform to the requirements of Specification MIL-V- 3141. Vials shall be centrally positioned in their holders with gypsum cement conforming to Specification MIL-G-0020098.

3. 6. 7. 1 Assembly requirements. - The accuracy with which the cylindrical vial is made parallel with the outside diameter of the tube shall be checked on a leveled plate by rolling the vial through 90 degrees, 45 degrees each side of vertical, with the creep of the bubble not exceeding one full graduation from level. The bubble of the circular vial shall be centered on the circular graduation when checked on a leveled plate.

3. 6. 8 Wood. - Solid wood shall be free from any defect that would adversely effect the utility of the parts made thereof. Tight knots are permissible within the foregoing limitation. The wood shall have been dried to a maximum moisture content in accordance with Specification MIL-W-6110.

3. 6. 9 Thread. - Thread shall conform to Specification MIL-T-7807. The use of cotton or linen thread is prohibited.

3. 6. 9. 1 Stitching. - All stitching shall be in accordance with Specification DDD-S-751.

3. 6. 10 Felt. - Felt shall conform to Specifications C-F-202 and C-F-206, whichever is applicable. Approval of alternate specifications for felt shall be obtained from the contracting officer (see 3. 6. 14)

3. 6. 10. 1 Cement. - Where cementing of felt strips and gaskets are required, cement shall conform to Specification MIL- 5092, Type II.

3. 6. 11 Adhesives. - All adhesives shall be water-resistant types and shall be durable under all service conditions.

3.6. 11.1 Rubber to metal - Where rubber Is bonded to metal, the adhesive shall be such that the rubber shall resist cracking or separation from the metal caused by bending, shock, vibration, shear, or variations in temperature which will occur In the normal operation of the Instrument in which the part Is used. There shall be no corrosive action due to the bonding process which will affect the serviceability of the part.

3.6.12 Plastic materials. - Plastic materials shall have the original smooth or polished surfaces unless objectionable glare makes a dull surface more desirable. All surfaces that have been sawed, cut, or otherwise machined shall be reasonably smooth. Mold marks and "flashing" on Injection molded plastic Items are permissible only where the functional operation of the item Is not impaired nor detrimental to the operation of a mating part.

3.6.12.1 thermosetting. - Thermosetting plastic material shall conform to table II wherever applicable.

Table.II - Thermosetting Plastic Material

Material	Spec	Type	Use "
Molded-alkyd resin	MIL-P-14	MAG	General purpose
Molded-melamine resin	MIL-P-14	MME	Arc and flame resistant-electrical
Molded-melamine resin	MIL-P-14	CMI-5	Impact resistance . (0.6-#/in. notch)
molded-phenolic resin	MIL-P-14	MFE	Best electrical properties
Molded-phenalic resin	MIL-P-14	MFI-20	Impact resistant -(2(-#/in. notch)
Molded-phenolic resin	MIL-P-14	MFH	Heat resists.r.t
Laminated-melamine resin	MIL-P-15037	GMG	Electrical insulating - general purpose
Laminated-rods & tubes	MIL-P-79	GMG	Mechanical application
Methyl methacrylate		AEW	Anti-electrostatic windows
Laminated-phenolic resin	L-L-31	II	Electrical application
Laminated-phenolic resin	MIL-P-15035	FBE	Electrical application
Laminated-phenollc resin	MIL-P-15035	FBM	Mechanical application
Laminated-phenolic resin	MIL-P-3115	PBE	Electrical application
Laminated-phenololic resin	MIL-P-3115	FEG	General purpose
Laminated-phenolic resin	MIL-P-15047	NPG	Marker strips
Laminated-silicone resin	MIL-P-997	GSG	Fire and Arc resistant - heat resistant-electrical Insulation

3.6.12.2 Thermoplastic rigid.- Thermoplasttc rigid molding material shall conform to Table III wherever applicable.

Table III - Rigid Thermoplastic Material

Material	Spec.	Type	Use
Aniline formaldehyde	MIL-P - 3408	EM?I-1	Wired equipment - medium to high frequency - best heat resistance
Cellulose acetate	MIL-P-10408	I	General purpose
Cellulose acetate	MIL-P-10408	II	Heat resistant
Cellulose acetate	MIL-P-10408	III	Impact resistant
Cellulose acetate	MIL-P-10408	IV	Moisture resistant
Cellulose acetate	MIL-P-3415	G -1	Wired equipment - impact resistant (0.7' - #/in. notch)
Cellulose acetate	MIL -P - 3415	G -2	Wired equipment - Impact resistant (1.4 - #/in. notch)
Cellulose acetate	MIL-P-3415	G -3	Wired equipment - impact resistant (2.1 - #/In. notch)
Cellulose acetate butyate	MIL-P-10407	I	General purpose
Cellulose acetate butyrate	MIL-P-10407	11	Heat reststant
Cellulose acetate butyrate	MIL-P-10407	.111	Impact resistant
Cellulose acetate butyrate	MIL-P-3414	G -1	Wired equipment - impact resistant (0.75' - #\In. notch)
Cellulose acetate butyrate	MIL-P-3414	G -2	wired equipment - impact resistant (1.5 - #/In. notch)
cellulose acetate butyrate	MIL-P-3414	G-3	Wired equipment - impact resistant (3.0' - #/in. notch)
Cellulose acetate butyrate	MIL-P-3414	GH -1	Wired equipment-impact & heat resistant (G.6' - #/In. notch)
Ethyl cellulose	MIL-P-S412	E -1	Wired equipment - medium frequencies - heat resistant
Ethyl cellulose	MIL-P-3412	EM -1	Wired equipment - high dielectric and Impact strength
Polydichlorostyrene	MIL-P-3409	EH-1	Wired equipment - high frequencies-good heat resistance
Polydlchlorostyrene	MIL-P-3409	EH-2	Wired equipment - high frequencies-high heat resistance
Polyvinyl chloride and copolymers	MIL-P-3410	EM-4	Wired equipment - general purpose
Vinylldene chloride	MIL-P-3411	EN -2	Wired equipment - general purpose - low frequencies
Vinyl chloride	L-V-345	--	011 and water resistant - good dielectric

3. 6.12.3 Thermoplastic, non-rigid. - Nan-rig id thermoplastic material shall conform to Table IV wherever applicable.

TAble IV - NGn-rigid thermoplastic material

Material	Spec	Use
Polyamice resin synthetic resin	MIL-P-3086 MIL-I-631	Wrist straps and similar parts Electrical insulation

3.6.13 Rubber. - Unless otherwise specified, rubber (natural or synthetic shall conform to Specification MIL-C-3133 for Cellular type and MIL-R-003065 for other types. When "class", "grade" and 'Suffix' are net specified, the contractor shall submit complete data on the application and proposed material to the contracting officer for approval.

5.6.14 Gasket material. - Gasket material shall conform to the applicable requirements of Specification MIL-G-12803. (see 3.6.10).

3.6.15 Duck. - Unless otherwise specified, cotton duck shall conform =S-pacifications MIL-D-10861, Types I, II, and 111, or COD-D-771, Type II, whichever is applicable and shall be dyed and treated In accordance with the applicable requirements of Specification MIL-D-504.

3.6.16 Webbing.- Unless otherwise specified, cotton webbing shall conform to Specification JAN-W-530.

3.6.17 Leather.- Unless otherwise specified, leather shall conform to the applicable specifications of Table V. Where leather applications are considered for design, nylon shall be substituted wherever practicable.

Table V - Leather

Use	Spec	Type
Harnesses Straps Cases Straps, pads, and corner reinforcements	KK-L-171 KK-L-271 KK-L-154 MIL-L-3754	Wade A, Class 1 Grade A, Class 1 II

3.6.18 Aluminum alloy sand castings.- Aluminum alloy sand castings shall conform to Specification QQ-A-601.

3.6.19 Hardware and fastenings. - All screw type fasteners shall be tight enough to cover the purpose Intended by the design. *Al 1* screw-thread assemblies shall be made vibration-proof. Lock washers shall be provided under all nuts, except those of' the self-locking and castellated types. Bolts or machine screws, when not intended for use with nuts and when not suitably locked by other means, shall be of the self-locking type, shall have drilled heads for locking wires, or shall be secured with lock washers. (see 3.13.2).

3.6.19.1 Material and treatment. - Fastening devices (screws, bolts, nuts, washers, etc.) shall be of alloy steel or corrosion-resistant steel, unless electrical considerations require use of other materials (see **3.11.14.11),** and shall be heat treated as required to produce the necessary physical properties.

3.6.19.2 Thread form and dimensions. - Threaded parts shall conform to the requirements or 3 6.3 2.4. Unless otherwise specified, threads shall not be swaged, peened, staked, or otherwise permanently fixed.

3.6.19.3 Thread extension.- Bolts and screws shall extend not less than one full thread beyond the nut and shall extend not more than two full threads where excessive projectiion of thread may be hazardous to personnel or may be a jeopardy to the operation of the equipment.

3.6.19.4 Thread engagement. - Thread engagement of screws and bolts In tapped parts other than nuts shall be a minimum effective thread length equal to 1-1/2 times the diameter of the bolt or screw.

3.6. 19.5 Screw restrictions.- The use of thread sizes No. 3 and 12 screw fasteners in.mechanical application is prohibited. Screw and bolt sizes 5/16, 7/16 and 9/16 Inch diameters are non-preferred sizes but may be used where necessary. All sizes of commercial standard *screw* threads are acceptable on commercial items (switches, receptacles, etc.). Standard length screws and bolts, In accordance with *Ordnance* Corps standards (see **3.7),** shall be used wherever practicable.

3.6.19.6 Set screws.- Set screws shall be used only where uniquely required by design of the equipment. Cone-point set screws may be used where the engaging surfaces are suitably countersunk to receive the point; otherwise cup-point set screws shall be used. Flat surfaces shall be provided for engagement of cup-point screws when the per: is not adjustable In angular relationship to the shaft on which It is secured. Where two set screws are used, the angle between their major axes shall not be less than 90 degrees nor more than 120 degrees.

3.6.19.7 Self tapping screws. - Thread-cutting screws may be used where construction is improved thereby and where they will not require loosening or removal during operation or maintenance of the equipment. Chips formed by self-tapping screws in through-holes shall be removed. Self-tapping sheet metal screws shall not be used.

3.6.19.8 Anchor nuts and nut plates. - Where practicable, anchor nuts or nut plates shall be used for threaded engagement in light sheet metal.

3.6.19.9 Tooth type lockwashers. - Tooth-type lockwashers shall be used for making electrical bonds for suppression and external grounding purposes (see 3.11.1.12.1)

3.6.19.10 Wood parts. - When wood parts are bolted to metal parts with the nut against the metal surface, the bolt shall be secured by self-locking nuts. A flat washer shall be used under the head of a nut placed against wood surfaces. When the nut is adjacent to a wood surface, the end of the bolt shall be staked or lightly peened.

3.6.19.11 Spade bolts. - The shank of each spade bolt used to mount parts shall be secured by two or more rivets.

3.6.20 Rivets and riveting. - Riveting shall not be used for mounting parts such as capacitors, resistors, transformers, and inductors, when they may require removal for maintenance of the equipment. Thickness of countersunk material which accepts the heads of flush rivets shall not be less than the height of the rivet heads. The distance from the centers of rivet holes to the edges of the material in which the holes are formed shall be at least 1-1/2 times the rivet diameter. Rivets shall be used where practicable in preference to other meals of securing aluminum or magnesium structural parts which do not require removal when the equipment is serviced or for joints which will be subjected to dynamic tension loads under operating conditions.

3.6.20.1 Button-head rivets. - Button-head rivets shall be used to the maximum practicable extent. The heads shall be full size and concentric with the body. Dimensions of the rivets shall be such that when riveting is completed, the holes will be completely filled and the work otherwise will meet the requirements specified herein.

3.6.20.2 Method of riveting. Machine riveting shall be used wherever practicable and shall be installed by the pressure (squeeze) method. Loose, cracked, or badly formed rivets, including protruding countersunk rivet heads, shall be replaced before acceptance of the item. Excess metal shall be removed from counter-sunk-head rivets.

before acceptance of the Item. Excess metal shall be removed from counter-sunk-head rivets.

3.6.20 .2.1 Ferrous rivets - When riveti is to be accomplishd by the pressure method, ferrous rivets 3/ -inch diameter and small mnay be driven cold. Ferrous rivets larger than 3/8-inch diameter shall be driven "hot unless specia1 authorization IS granted by the contracting officer to do otherwlse.

3.6.20 .2.2 Non-ferrous rivets.- Non-ferrous rivets shall be driven cold. Age-hardened aluminum-alloy rivets shall be driven by heavy blows or high pressure to avoid hardening of the surface before the head is formed and the hole completely filled. Quenched or refrigerated aluminum-alloy rivets shall be driven In accordance with approved engineering practice.

397 Use of standard ltems.- To facilitate Interchangeability and mainter.ante of materiel, standard Items, such as hardware (ruts, bolts, rivets, washers and pins) electrical components (resistors, capacitors-, relays, fuses, switches, electron tubes, transformers, and meters) and other standard parts shall conform to Ordnance Corps approved standard drawings. The contractor shall use the ordnance **corps approved standard drawings and the associated part numbers. The contractor is not requtred to prepare** an individual drawing (see 3.5) when Standards for these items exist; however, standard drawing numbers shall appear on the tabulated List of Drawings" format and all assembly drawings.

.3.7.1 Precedence of standard drawings. - The order of precedence for filing materiel standards shall be as follows:

(a) Military Standards Preferred for Ordnance
(b) Ordnance Engineering Standards 1/ (commonly known as "BEFAX" drawings)
Military Standards
c Ordnance Divisional Standards, F12e -Control 1/
e Ordnance Corps drawings for parts peculiar. If standard item are not included in c and d above, drawings must then be screened through established channels for possible duplicatlon.

1/ **These standards shall continue to be used for design and engineering until the items** have been replaced by Military Standards.

3.7.2 Avail ability OF drawings for standard items. - Drawings for standard items may be obtained through the contracting officer upon application.

3.8 Finish, mechanical. - The method for specifying finishes shall be in accordance with Standard MIL-STD-10. Finishes on all drawings-prepared for the Ordnance Corps under this specification (see **3.5**) shall be indicated by numerical RMS roughness values. The degrees of finishes required for surfaces of fire-control materiel shall conform to Standard URAX6. The old system of letter symbols for roughness designation (g, cf, f, ff and fg) used on Ordnance or contractor drawings shall be converted to the numerical surface roughness symbols in accordance with the conversion sheets of Standard URAX6.

3.8.1 Corners and sharp edges .- Unless otherwise specified on the drawingss all corners and edges shown sharp shall be broken to a radius of 0.005 to 0.03 Inch or bevelled at a 45 degree angle. Where parts fit or work together, the corners shall be broken so that no interference occurs. All sharp edges, burrs, and rough surfaces of threads shall be removed, especially from conduit fittings, solid or flexible conduit, and any other part with which the insulation of electrical wiring may come In direct contact.

3.8.2 Worms.- The sharp corners of the flat at the top of the thread the worm shall have a slight radius before the worm is fitted to its worm gear or segment. Before final assembly, a check shall be made to Insure that the worm is not bottoming in the worm gear or segment.

3.8.3 Fillets. - The radii of all fillets must comply with the values specified on the applicable drawings and the surface finish of all fillets must comply with that finish specified for the adjacent surfaces.

3.9 Finish, painting and protective.- Painting, plating, and protective finishes shall be in accordance with Specification MIL-P-12011 whenever applicable. Where Ordnance Corps drawings are not in effect, instruments, parts and equipment, commercial tools and articles, except those made from materials which are inherently corrosion resistant, such as stainless steel, shall have suitable protective finishes conforming to Specification MIL-P-12911 to resist salt spray, abrasion, chemical corrosion, and galvanic corrosion due to contact of dissimilar metals.

3.9.1 Ferrous alloys. - Corrosion-reststaat ferrous alloys shall be given a passivation treatment but need not receive any other protective plating or finish, unless such finish or plating Is

necessary or desirable for electrical or mechanical reasons. Passivation treatment of straight chromium stainless steels shall not be required where corrosion-resistant properties are adequate. The iron or steel used In magnetic circuits need not be plated OF given a protective finish If they are otherwise protected against corrosion.

3.9.1.1 Corrosion-resisting steel.- All components made of corrosion-resisting steels conforming to classes 1, 2, 7, 8 and 9 of "Specification QQ-S-763, classes 1, 2, 4, 5 and 6 of Specification QQ-S-766, and Specification MIL-T-8606 shall be treated In accordance with finish 25.01 of Specification MIL-P-12011.

3.9.1.2 **Gears**- Steel gears shall be given a final finish In accordance with finishes 22.04, grade 1 or 22.02 class A Or B of Specification MIL-P-12011, whichever is applicable.

3.9.1.3 Hydrogen embrittlement relief treatment.- After being subject to electrolytec cleaning *or* after the application of electrodeposits of cadmium, copper, chromium~ nickel or zincs ferrous alley components of high carbon content or cold-worked low carbon steels requiring good ductility, fatigue resistance and impact strength shall be given the hydrogen embrittlement relief treatment as specified in process 26 of Specification MIL-P-12011. Non-ferrous metals do not require this treatment.

3.9.2 Non-ferrous alloys

3.9.2.1 Aluminum.- Aluminum shall be anodized in accordance with the series 23 finishes in Specification MIL-P-12011. Where weldments are Specified, the chromic acid finishes, series as.ol or 25.02 of Specification MIL-P-12011 shall be preferred.

3.9.2.2 Copper and tin plating. - Unless otherwise specified, copper and tin plating shall be 0.0004 to 0.0006 inches thick.

3.9.2.3 Magnesium. - Magnesium shall be treated in accordance with the appliable series 23 finishes of Specification MIL-P-12011. Finishes 23.05 through 23.11 are pre-treatments to painting and are not finish systems.

3.9.2.4 Electrical equipment finish.- Cadmium and zinc plating of electronic chassis and panels is permissible only when followed by a chromate treatment and painting. Zinc plating shall conform to finish 21.11, classes GSC, LSC or RSC of Specification MIL-F-12011. Cadmium plating shall conform to finish 21.01, classes NSC, OSC or TSC of Specification MIL-P-12011.

3.9.3 Impregnation of castings. - Unless otherwise specified,

all castings and housings designed to contain oil shall be vacuum Impregnated with an approved thermosetting resin *in* accordance with Specification MIL-I-13857.

3.9.4 Mounted hardware.- After hinges, catches, screws, and nuts have been mounted any break in the film Of Paints either on the hardware or mounting surface, shall be touched up to provide a continuous protective coating. A reasonably exact color match between the painted surfaces and the touch-up coating shall be provided. When stainless steel hardware is specified, their surfaces shall conform to the background finish.

3.9.5 Heat dissipation.- When heat dissipation is a design factor, consideration shall be given to the *use* of finishes providing the best rates of heat transfer.

3.9.6 painting.- Colors of paint shall conform to S **catbn** TT-C-595; olive drab shall conform to color number 2430; gray shall conform to color number 1640. Painting of electronic chassis and panels shall be in accordance with finish systems 19.11 or **20.06** of Specification MIL-P-12011.

3.9.6.1 General test equipment.- The top coat of paint finish on exteriors surfaces and on **any interior surfaces** that are visible when the equipment is In use, shall be semi-gloss~ light-gray enamel conforming to Specification MIL-E-15090, e cept in **such cases** as may functionally require other finishes.

3.10 Lubrication.- The contractor shall properly lubricate all instruments before delivery. Unless otherwise specified, fire-control equipment shall conform to the requirements of **Table VI.**

Table VI

Use	Specification
Worms, worm gears, cams, slides, traverse ing screws.. gears In quadrants and mounts.	MIL-G-3278
Fine-and sensitive movements, close fitting sleeves, spindles slides and synchros	MIL-L-6085
Moving- of optical instruments	MIL-G-3278 [very sparingly
Ball bearings	MIL-L-6085 (thin film) or MIL-G-3278 (as specified)
Powder metal sleeve bearings	MIL-O-11773
Speed reduction gear boxes(for extreme pressure application,	MIL-O-6086
Hydraulic equipment (for application at all temperatures)	MIL-O-6085
General purpose low temperature lubricating oil protection aginst corrosion	MIL-L-644

3.10.1 Lubrication fittings. - Lubrication fittings shall be properly designed into the equipment so that excessive application of lubricant to the fitting shall not impair serviceability. All lubrication fittings and oil holes shall be identified with a 3/4 inch red circle finish 19.11 of Specification MIL-P-12011 with color red No. 1105 conforming to Specification TT-C-59S) wherever practicable or with the specified color coding. Lubrication fittings shall be so painted as not to interfere with their proper functioning.

3.11 Wired equipment

3.11.1 Mechanical design.- Electronic and electrical equipment shall be designed and constructed in such a manner that all circuitts are readily serviceable.

3.11.2 Power. - The standard nominal voltages (a.c. and d.c.) for electic power sources and fire-control utilizing equipment shall be In accordance with the detail specification.

3 1L2.1 Frequency. - The standard frequencies for alternating current electric power to be supplied to fire-control utilizing equipment shall be in accordance with Standard MIL-STD-205 or the applicable detail specification.

3.11.3 Parts and materials, general. - The use of parts and materials conforming to Government specifications and standards is mandatory wherever applicable.

3. 11.3.1 Inflammable materials. - Inflammable materials which will readily ignite or explode from an electrical spark, flame or from heating, shall not be used. (Impregnating and potting compounds when enclosed in fire-resistant containers may be used) .

3.11.3.2 Toxic and corrosive compounds. - Unless otherwise specified, the use of uncontrolled compounds which will readily produce harmful toxic effects and liberate gases which combine with the atmosphere to from acid or corrosive alkali Under service conditions shall not be permitted.

3.11.3.3 Fungus-inept materials.- All non-metallic materials shall be inert to or adequately treated so that they will not support fungus growth. The use of mineral filled melamine formaldehyde and alkyds such as Types MKE and MA(3 conforming to specification MIL-P-14 generally provide good resistance to fungus growth arid do not require fungus proofing. Fungus inert materials are not necessary In cables protected by a cable sheath and where exposed are coated with fungus inert material.

3.1.3.3.1 fungus-proofing of materials -- The following materials shall be fungus-proofed in accordance with the applicable requirements of the specifications listed in Table VII.

Table VII

Material	Specification	Classification
Ceramic	No treatment ordinarily required	
Cork	MIL-T-12664	Class I
Duck and webbing	MIL-T-11293, MIL-D-504	
Felt	MIL-M-2312	Type III
Leather	MIL-L-10331	
Paper	No applicable spec.	
Thread 1/	MIL-T-11293, MIL-T-3530	
Wood	MIL-S-13518	

1/ Nylon thread which is inherently fungistatic does not require any special treatment.

3.11.3.3.2 fungus-proofing of parts and assemblies. - parts and assemblies shall be moisture-fungus-proofed in accordance with specification MIL-T-13867; the type of treatment shall conform to Table VIII. Detailed methods for fungus proofing are contained in fire Control Standard Practices, Volume IV.

Table VIII

Item	Type Treatment
Assembled electrical units containing non-moving parts	I
Electrical equipment and components whose operating temperatures do not exceed 200°F	II
Bonding of components and equipment which operate above 200°F	III
Vacuum impregnation of rotor and stator windings of rotating electrical machinery, synchros, coil windings of relays, solenoids, contactors, reactors, and transformers	IV

3.11.4 Capacitors.- Wherever applicable, capacitors shall conform to the specifications listed in Table IX. The values of

capacitors selected shall conform to approved Ordnance Corps Standards wherever possible. In addition to the above requirements, capacitors shall be subject to the following limitations:

Table IX - Capacitors

Use	Specification
Air-Dielectric, Variable (Trimmer Capacitors)	JAN-c-92
Ceramic-Dielectric, Variable	JAN-C-81
~ry-Electrolytic, Polarized	JAN-c-62
Fixed, Ceramic Dielectric (General Purpose)	MIL-C-1101~
Fixed, Ceramic-Dielectric (Temperature Compensating)	JAN-C-20
Ftxed, Electrolytic (A.C., Dry-Electrolytic, Nonpolarized)	MIL-c-3871
Fixed, Glass Dielectric	MIL-c-11272
Fixed, Mica-Dielectric	MIL-c-5
Fixed, Mica-Dielectric, Button Styles	MIL-C -10950
Fixed, Paper-Dielectric, Direct Current [Hermetically sealed In Metallic Cases)	MIL-C-25
Fixed, Paper-Dielectric (Nonmetallic Cases)	MIL-C-91
Feed-Through, Suppression, AC and DC	MIL-C-11693
Suppression, High Voltage	MIL-c -l1561

3.11 .4.1 Electrolytic Unless otherwise specified or if capacitance values of the order of hundreds of microfarads are required electrolytic capacitors shall not be used where the maximum DC potential applied to the capacltor may exceed 50 volts.

3.11 .4.2 Ceramic dielectric, variable. - Ceramic dielectric variable capacitors shall be used only which infrequent adjustments will be required Where frequent adjustments are required, air dielectric capacitors shall be used.

3.11 .4.3 Paper dielectic, non-metallic cases. - Paper dielectric CaPacitors in non

3.11.4.4 Paper dielectric, metallic cases.- Paper dielectric, bypass capacitors in metallic cases, intended for broad band radio

interference suppression applications (see 3.11.20) shall conform to Specification MIL-C-12889.

3.11.5 Resistors, general.- Where applicable, resistors and rheostats shall conform to the specifications listed in Table X. The values of resistors and rheostats selected shall conform to approved Ordnance Corps Standards wherever possible. Resistors and rheostats shall be such that the allowable hot-spot temperatures, as specified in the applicable detail specifications, will net be exceeded when the equipment is subjected to service conditions. Fixed composition resistors operated continuously at ambient temperatures in excess of 104°F shall be derated in accordance with applicable specifications. Each fixed resistor which is supported by means of wire leads shall be so mounted that the leads will be as short as practicable (not less than 1/4 inch) and in no case shall the total length of the lead from the supporting terminal to the resistor exceed one inch.

Table X - Resistors

Use	Specification
Non-wirewound, fixed power type, capable of withstanding high relative humidity and continuous operation at rated wattage and high hot-spot temperatures	MIL-R-11804
Composition film, fixed, very high frequency	MIL-R-10683
External meter, high voltage, ferrule terminal type	JAN-R-29
Fixed, composition, insulated, full load operation to 70°C	MIL-R-11
Fixed, composition, uninsulated, full load operation to 40°C, not suited where vibration and high humidity are factors	MIL-R-15401
Fixed, deposited film, 1-2-5% tolerance, high stability	MIL-R-10509
Fixed, wirewound, accurate; maximum tolerance, 1%; full load operation to 85°C; not for use in critical AC application	MIL-R-93
Fixed, wirewound, low power (2 watts max)	JAN-R-184
Fixed, wirewound, power type	MIL-R-26
Variable, composition	JAN-R-94
Variable, wirewound (low operating temperature)	JAN-R-19
Variable, wirewound, power type	MIL-R-22

3.11.5.1 Wirewound fixed resistors - Where high accuracy (0.1% tolerance and ruggedness is required, selected wirewound, non-inductive presision resistors shall be used. In computing applications resistance values In excess of 100,000 ohms should be avoided wherever possible. Power resistors should not be located close to sensitive circuitry. Precision resistor Input networks shall be balanced, shielded and mounted as close as possible to the computing amplifier.

3.11.5.2 Potentiometers and rheostats.- Potentiometers employed as volume control Shall be wirewound construction and shall provide a means for staking to obviate turning of the part when the shaft is rotated. Unless otherwise specified, composition potentiometers shall not be used. Power rheostats shall not be located close to sensitive circuitry. Large wirewound rheostats shall be of the type using a ceramic covered resistance element.

3.11.6 Transformers and inductors

3.11 .6.1 Audio power, and pulse. pulse Transformers shall coform to specification MIL-T-27 and, unless otherwise specified, shall be grade 1*. The class of the transformer or inductor shall be such that the maximum operating temperature, as specified, will not be exceeded when the equipment is subjected to the specified service conditions.

3.11.6.1.1 Core. - The core of cased units shall be electrically grounded to - c a s e .

3.11.6.1.2 Size and weight. - Transformers and Inductors shall be as small and light as practicable, consistent with required performance and life

.2.2.6.2 Intermediate and radio frequency.- Radio frequencY coils and intermediate and radio frequency transformers shall be in accordance with Specification MIL-C-15305. Intermediate and radio frequency transformers and COIlS unless hermetically **sealed or of the single layer type, shall be vacuum impregnated In accordance with specification MIL-T-l3867 or an equivilent procedure which will Insure compliance of all electrical characertstics after the specified humidity test and shall also be non supporting to fungus growth.**

3.11.6.3 Variable inductors.- When a roller or slider Is used in contact with the conductor of variable inductors, suitable provision shall be made to limit the travel of the roller or slider to prevent its leaving the conductor.

3.11.7 Relays. - Relays shall conform to Specification MIL-R-5757. and shall be of the sealed type wherever practicable. Use of unsealed relays shall be subject to approval of the contracting officer.

3.11.8 Meters.- Unless otherwise specified, meters shall conform to Specification MIL-M-6. Where design requirements dictate the use of a rugged type meter, Specification MIL-M-10304 shall be used.

3.11.9 Protective devices.- Unless otherwise specified, power Input circuits shall be protected by fuses or by circuit breakers connected directly to all input terminals. Where practicable, other circuits shall be protected by suitable means to prevent damage from incorrect adjustment of the equipment, short or open circuits, and failure of tubes or other parts. Protective devices shall be conveniently located and arranged for safe and easy renewal or resetting. Panel-mounted fuse posts shall be such that the fuses can be renewed without use of tools.

3.11.10 Synchros. - Synchros shall conform to the types listed jn 6.4. Extra precaution should be exercised in mounting receiver type synchros in dust free spaces to prevent sluggish operation of the precision bearings.

3.11.11 Selenium rectifiers . Selenturn rectifiers of the open construction type shall conform to specification M1L-R-11050.

3.11.12 Electron tubes . Electron tubes shall conform to Specification MIL-E-l and shall be of the types listed In Standard MIL-STD-200, wherever possible. The number of tube types In a particular equipment shall be kept to a minimum consistent with obtaining the specified performance with the best design practices.

3.11.12.1 Non-standard and non-preferred tube types.- If there are compelling reasons for use of non-standard and non-preferred tubes, the contractor shall request approval thereof and shall ***include the*** following data:

(a) Detailed explanation of need for the proposed tubes, with data showing the advantages thereof.
(b) Information on the availability of the proposed tubes for maintenance of the equipment.
[c) Tube specification sheets (unless the tubes are covered by specification MIL-E-1 or other Government Specifications, having comparable requirements and tests, giving the required ratings, characteristics, *and* l!.nits and referencing by paragraph

number and heading those paragraphs In the basic section of specification MIL-E-I which are applicable for tube requirements and tests.

3.11 .12.2 Tube limits and ratings. - The equipment shall be such that specified tube limits and ratings will not be exceeded when the equipment is subjected to service conditions~ within the limits of good design, a tube may exceed normal rating in certain cases (e.g., a blocking oscillator). In order to operate electron tubes within permissible bulb temperature devices which conduct heat to the case of the instrument may he used. Tubes that operate at high temperatures shall not be located near sensitive circuitry. In extreme low temperature applications, mercury vapor tubes shall not be used.

3.11.12.3 Non-selection of tubes.- Unless otherwise approved by the contracting officer, specified performance of the equipment shall be obtained without selection of tubes. If the contractor finds it impossible to meet specified equipment performance without selection of tubes, he shall so inform the contracting officer and include:

(a) Evidence that use of selected tubes cannot be avoided by adjustment or minor redesign of the equipment .
(b) Complete detailed information on the narrower limits or special characteristics of selected tubes.
(c) Information on availability of selected tubes for maintenance of the equipment.

3.11.12.4 Current regulating tubes.- Current regulating tubes of the non-electron type shall conform to specification MIL-T-3080.

3.11.12.5 Tube sockets arid accessories. - Tube sockets and accessories shall conform to Specification JAN-s-28.

3.11.12.5.1 Assembly of tube sockets.- Tube sockets shall be of the single unit type. Gang type sockets shall not be acceptable. This requirement is not intended to preclude the assembly of several tubes sockets on a supporting frame so long as the contact clips for any tube are on insulating material which is discontinuous with that for any other tube.

3.11.12.6 Tube clamps.- Electron tubes shall be provided with suitable tube clamps so that the tubes; will be retained firmly in their sockets when the equipment is subjected to service conditisns . Tube clamps shall be capable of gripping firmly any tubing within specified dimensions and tolerances. Wherever

possible, the placing of tubes and tube clamps shall be such as to allow easy removal of the tubes.

3.11.13 Waveguide assemblies. - ASESA publication 49-2, "Armed Services Index of RF Transmission Lines and Fittings", should be used as a guide for selecting RF components to be used in fire control equipment. Aluminum waveguides or fittings shall not be employed where they will come in contact with silver or copper alloy waveguides or fittings. Copper alloy flanges shall be silver plated (after assembly) when assembled to silver waveguide tubing.

3.11.13.1 Rigid rectangular. - Rigid rectangular waveguide tubing shall conform to Specification MIL-T-85. Attenuation plates shall conform Specification MIL-A-11052. Flanges shall be Of the types appearing on the "Standard List of Waveguide Flanges" in ASESA publication T49.2.

3.11 .13.2 Flexible. - Where it is Impracticable to use rigid waveguides flexible waveguides conforming to Specification JAN-W-287 may be used.

3.11.14 Wiring and harnesses.- Wiring and harnesses shall be neat and sturdy. Insulated wires shall be formed into harnesses except where operation of the equipment would be adversely affected thereby or where it Is mechanically impracticable as In the case where the resulting harnesses would be excessively large and would interfere with operation or maintenance of the equipment. Where harnesses are employed between hinged parts, sufficient slack and protection shall be provided to prevent chafing or breaking of individual wires with repeated flexing.

3.11 .14.: Lacing tape.- Harnesses shall be laced with tape conforming to

Table XI

Use	Specification
General purpose, radio frequency, special purpose (operating range of -65°F to 190°F and oil and grease resistant)	MIL-w-76
Coil leads in contact with impregnating varnish during processing	MIL-W-12349

3.11.14.2.2 Special application.- Approval must be obtained from the contracting officer for the type of insulated hook-up wire to be used under the following conditions:

(a) Maximum potential to ground (rms value or equivalent d.c.) exceeds 2500 volts.
(b) Ambient temperature inside a component may exceed 176°F under specified service condition.
(c) The wire is used in a sealed component which also incorporates heat-dissipattna parts (power transformers, power resistors, and electron tubes). (The volatile matter given off by some types of wire insulation or jacketing may have a deleterious effect on the component).

3.11.14.3 Passing through conduits.- Wire harnesses that pass through conduits shall have two layers of tape conforming to Specification MIL-I-7798 over the body of the harness ‘and two layers over all breakouts. Each layer shall be wrapped in opposite directions.

3.11.14.4 Slack.- Wires and harnesses shall be as short as practicable~pt that sufficient slack shall be provided to prevent undue stress on harness forms, wires, and connections; to enable parts to be removed and replaced during servicing without disconnecting other parts to factiltate field repair of broken or cut wires.

3.11.14.5 Protection. - Wires and harnesses shall be so placed and protected as to avoid contact with rough or Irregular surfaces or sharp edges under service conditions. Wires shall not be bent sharply where they enter Insulation material. Where wires run through holes in metal (partitions, and sheilds .) suitable grommets or bushings shall be used for abrasion protection. The use of friction tape is prohibited.

3.11.14.6 support.- Wires and harnesses shall be properly supported

and secured to prevent undue stress on conductors and terminals and undue change in position of the wires and harnesses after the equipment has been subjected service conditions or has been serviced or repaired in a normal manner.

1.1 J.T Clearance - Clearance between wires or harnesses, and Parts such as electrical tubes, resistors, and dyamot ors, Shall be Sufficient to avoid deterioration of the wires because (if' the heat. dissipated by such parts under service conditions. C1earance between any two electrical circuits or between any elect rical circuit and ground shall be such as to meet the requirements for dielectric strength (see 3.11.23) and insulation resistance, see 3.11.22) ., For bare minimum assurance of opera t- ing stability in wired equipment, the minimum separating distances for potential points shall be as shown in Table XII These values are based on the point spark gap breakdown voltages under extreme probable operative conditions of high temperature and high altitude.

Table XII

Volts	Distance (inches)
0-100	1/16
100-300	1/16
300-600	1/8
600-1000	1/4
1000-2000	1/2
2000 +	1/2 + 1/16 for each 1000 over 2000 or fraction thereof

3.11.14.8 Inductive and ca[capacitive effects.- Wires and harnesses shall be so located that inductive and capacitive effects, unless used as a design feature of the equipment, shall be the minimum practicable

3.11.14.9 splicing.- Wires in a continuous run between two terminals shall Not spliced during assembly of the equipment, except where a stranded conductor is spliced to a solid conductor and the two are supported at the splice.

3.11.14.10 Insulating sleevling. - Insulating sleeving shall not be used when other means of insulation are practicable.

3.11.14.11 Connect lox.- Soldering leads, lugs, and terminals (solderless and solder type) shall be made of copper and terminal plates shall be made of copper or brass and shall be tinned (lead-tin alley), silver -Plated, or lead-alloY coated Metal components, such as screws and washers, in contact with current carrying parts, shall be made of copper, brass, or bronze and shall be similarly finished. The use of cadmium plating shall not be permitted on current carrying parts or on metal components In contact with them. The use of fork type terminals Shall'not be permitted unless specifically approved by the contracting officer. Terminals shall not turn or become loose when the equipment is subjected to service conditions. All electrical connections shall be mechanically secure and electrically continuous. Wires subject to breakage at the connections **shall be** provlded with terminals that grip the wire insulation. Textile Insulation ends of **wires** shall be secured against fraying by mechanical means, by application of varnish conforming to Specification MIL V-173, or any other approved method.

3.11 .14.11.1 Terminals attached to parts. - Terminals attached to parts shall be mechanically strong and shall not break when soldering and unsoldering **connection thereto** Terminals of potted parts shall be designed and fastened to a terminal lnsulating strip or plate in such a manner as not to cause any degradation in the moisture excluding property of the enclosure by normal soldering and resoldering of the external leads to the terminals. Terminals shall be so spaced as to assure a sufficiently high leakage resistance.

3.11 .14.11.2 Replaceable assemblies. Connections to assemblies that are intended to be replaceablee, such as terminal connections to a terminal block assembly, shall not be soldered. Connections of this nature shall be made with screws or by means of plug and jack type connectors. Solder connections shall be used for small replaceable assemblies employing miniature tubes and components.

3.11.1$.12 Grounding. - Ground connections to complete electrical circuits shall be made to the chassis or frame and not to shields or other mechanical parts; however, IF transformers shall **be grounded** through their ,cases if other means of grounding are impracticable.

3.11.14 .12.1 Grounding to chassis. - Ground connections **to** the chassis or frame shall be made mechanically secure by soldering to a spot-welded terminal lug or to a portion of the chassis or frame that has been formed Into a soldering lug, or by use of a terminal on the ground wire and securing the terminal by a screw, flat washer, and lock washer; the screw shall either fit

in a tapped hole In the chassis or frame, or shall be held in a through-hole by a nut. When the chassis or frame is of steel, the metal around the screw hole shall be plated or tinned to provide a corrosion-resistant connection. When the chassis or frame Is of' aluminum or magnesium, the metal around the screw hole shall be masked when the chassis or frame is given a protective finish prior to assembly or the finish around the screw hole shall be removed after finish aPPlication~

3.11 .14.12.2 Shielding on wire and cable. - Shielding on wire or cable shall be grounded to the chassis or frame as specified in the above paragraph and shall end at a sufficient distance from exposed conductors to prevent shorting or arcing between the conductor and the shielding. (see 3.11.14.2.1)

3.11.14.13 Identification of wiring. - Wires shall be identified by color ceding and by use of wire markers. The same color coding and Identification markings shall be used throughout any circuit for all items in the contract. Color coding for chassis wiring of electronic equipment shall conform to Standard MIL-STD-122. Where wire markers are used, the insulation shall conform to type F, grade A, form U, color yellow, class 1, category 1 of Specification MIL-I-631. These markers shall be approximately 1/2 Inch in length and of an inside diameter to fit snugly over the wire. Where stamped markings on terminals are specified, wire markers shall be substituted. Reference designationons used on wire markers shall be In accordance with Standard MIL-STD-16.

3.11.15 Solder, flux, and soldering

3.11.15. Z Soft solder.- Unless otherwise specified, only rosin core solder conforming to composition SN60 of Specification QQ-S-571 shall be used.

3.11 .15.2 Flux and cleaning agents. - Flux for soldering shall be rosin or rosin and alcohol. NO acid or acid salts shall be used in preparation for or during soldering; however, exception is permitted .'or preliminary tinning or soldering of mechanical points not used to complete electrical circuits, but in no case shall acid or acid salts be used where they can come in contact with insulating material. Where acid or acid salts are used, aspermitabove, they shall be completely neutralized and reserved immediately after use.

3.11 .15.3 soldering. - Soldered connections shall be neat. There shall be no sharp points or rough surfaces resulting from insufficient heating. The solder shall feather out to a thin edge,

indicating proper flowing and wetting action, and shall not be crystallized, overheated, or underheated. The minimum necessary amount of flux and solder shall be used for electrical connections, resulting in visible wire contour for the finished joint. Wherever practicable, excess rosin shall be removed with a wire brush followed by a dry cloth; any resulting loose flakes of rosin shall be carefully removed from the Inside of the equipment. Insulatton material subjected to heating during the soldering operation shall be undamaged and parts fastened thereto shall not become loosened. The connection shall not depend on the solder for mechanical strength. At the point where wirea are terminated by soldering, the wires shall be hooked, wrapped around or otherwise mechanically secured to the terminals prior to soldering. Mechanical loads shall not be imposed on solder connections.

3.11.16 Cable and cable assemblies.- Where permitted by electrical consideration and space limitations, the lengths of the cable assemblies shall conform to approved Ordnance Corps Standards. The application of various types of cable shall be in accordance with the specifications listed in Table XIII wherever possible.

Table XIII

Use	Specification
Combination power, data, and audio frequency transmission, not to exceed b&o volts and 400 cps; good flexibility	MIL-C-13777
Radio-frequency	JAN-C-17

3.11.17 Connectors ; plug and receptacle.- Plugs and receptacles shall conform to Military Standards Preferred for Ordnance wherever practicable. Iieavy duty connectors shall be used in those applications required by the service conditions.

3.11.17.1 Radlo-frequency.- Radio-frequency cable connectors shall conform to ASMA publication 49-2 wherever applicable.

3.11.18 Switches. - Switches shall conform to the applicable specifications Listed in Table XXV wherever practicable.

Table XIV

switch Typ:	Specification
Rotary (circuit selector, Low capacity)	MIL-S -si'86
Sensitive	JAN-S-%3
Toggle	JAN-s-23
Vacuum	JAN-S-5'7

3.11.19 Controls. - Operating controls shall be conveniently located and redily accessible and shall be sufficiently rugged to withstand repeated operation by unskilled personnel (See 3.2. 14)

3.11.19.1 Operation.- Play and backlash shall be held to the minimum necessary to prevent poor contact or inaccurate setting. Controls shall operate freely and smoothly without binding, scraping, or cutting, and shall be lubricated when lubrication does rot interfere with operation. Controls shall maintain their setting when the equipment is subjected to service conditions.

3.11 .19.2 Knobs .- Knobs shall conform to Specification MIL-K-**3926** wherever applicable. Knobs shall have high impact strength and each shall be firmly secured to Its shaft. Plastic knobs shall have metal inserts for the screws. Due consideration shall be given to the shape coding or color coding of knobs where applicable.

3.11.19.3 Dials .- Plastic for dials shall be in accordance with specifcation MIL-P-80 Under normal conditions of eyesight and lighting, divisions and lettering of dials shall be legible at a distance of two feet, anywhere within an angle of 30 degrees from a line through the center of the dial and perpendicular to the panel on' which the dial is mounted. Dials shall be of sufficient thickess to avoid distortion.

3.11.19.4 Direction of' rOtation.- Unless otherwise specified, rotating controls shall be connected in the circuit that the controlled characteristics (sensitivity, volume and voltage) increases with clockwise rotation of the control as viewed from the operating position..

3.1.1.20 Radio suppression.- Electrical components of fire-control equivilent shall conform to the requirements of Specification MIL-S-117E8 and the interference limits set forth therein, and where necessary, shall be suppressed in accordance with the requirements of SpecIfication MIL-S-103T9$_0$

3.11.20.1 Radio interference rejection.- Fire-control equipment shall be provided with adequate radio interference rejectlon measures to prevent random operation or malfunctioning of the eqivilent.

3.11.21 21 High potenti al.- Unless otherwise specified, insulation break-down shall not. occur between isolated electrical circuits and between electrical circuits and ground when tested in accordance with 4.5.12.

3.11.22 Insulation resistance.- Unless otherwise specified, the

insulation resistance between ungrounded electrical circuits and the body or frame of' individual units, and between isolated circuits shall net be less than 10 megohms when tested in accordance with 4.3.13.

3.11.23 Dielectric. - Unless otherwise specified, motor and transformer windings shall not decrease in the insulation resistante requirement of 3.11.22 'when twice the rated voltage and twice the rated frequency is applied.

3.11.24 Temperature rise. - The hot temprature of any component shall not exeed the highest permissible temperature for the materiais involved. Thermocouples or the resistance method shall be used to measure temperature rise.

3.12 Identlftcatien of parts, assemblies, and complete items

3.12.1 Part numbering.- Each part, for which a detail drawing is prepared shall bear a permanent legible Ordnance part number if at all feasible. The following do not require part. numbers :

(a) Individual parts of inseparable assemblies (components of welded, brazed, molded, and sewed construction) which are not stocked as spares. The inseparable assembly as a whole Is part numbered.
(b) Individual parts which comprise metal chests, wooden boxes and leather cases.
(c) Unmodified commercial items.

The size, shape, material, and function of the part shall determine how or where the part number should be applied. The contracting officer shall reserve the right to make the final decision in case of conflict.

3.12.1.1 Part numbers.- Part numbers, excluding Ordnance Engineering Standards or Military part numbers, shall contain seven digits and shall not be prefixed by the drawing size letter.

Example:

Drawing No.	Part No.
A7618155	7618155

3.12.1.1.1 Optical pressing blanks.- Part numbers of optical pressing blanks may be entered on the blanks by either molding raised characters thereon or by the use of permanent marking ink which is waterproof, non-fading, abrasion-resistant, and

insoluble in solutions used for inspection immersion tests or cleaning.

?. 12.1.2 commercial Items- Commercial items, such as hardware amd electrical cOmponents, shall have a part number assigned for stocking purpcses. The part number need not be inscribed on the item even thcugh the applicable drawings for such items indicate a part number. According to the type of part, this part number shall be an Ordnance standard part number, a Federal standard stcck cataloging number, or a part number assigned by the Frankford Arsenal Fire-Control Instrument Group.

3.12.1.3 Method of application.- Wherever possible, the marking shall be applied to a surface of the part by a stamping, etching, engraving, casting, or molding. When these methods are not possible or practicable, the marking shall be applied by rubber stamp, stencil, decalcomania transfer (in accordance with Type II of Specification MIL-D-5548) , branding, vibro-pencil, emossing or by any other method suitable for the use intended.

3.12.2 Identification marking.- All units of equipment "which are composed or major asemblies, pieces which are housed by a common cabinet or assembled to a common panel end item shall be identified by a metal nameplate, decal, or suitable identification marking affixed to the main portion of the item in such a visible while in use. The design of identification marking shall be in accordance with the procedures outlind unteeor fire control practices./

3.12.2.1 Nomenclature and designators.- Nomenclature and designators for electrical and/or electronic components, sub-assemblies and complete functioning units shall be assigned by the Joint Communications-Electronics Committee Nomenclature Sub-Panel after submission by the contractor of a completed Form DD-61 to the cognizant agency.

3.12.3 Marking of electrical items.- Reference designations shall be in accordance with Standard MIL-STD-16 and shall be marked on an adjacent surface, space permitting; otherwise, the reference designation shall be marked on the part itself. Marking shall not adversely effect the leakage path between conductors or any other factor of performance.

MIL-type designation of the tube and the reference symbol to identify the particular tube. The symbol used in the circuit diagram and table of parts to identify the tube socket shall appear on the reverse side of the chassis adjacent to the socket.

If the available space does not permit such marking of tube , type designations and reference for tubes and tube sockets, a suitable locatlon diagram shall be placed where It is readily visible when viewing the tubes In place, or the bottoms of the~ tube sockets, as applicable.

3.12.32 Labels.- Labels for wiring or schematic diagrams, operating instructions, safety notices, lists Of tools or COntents, etc., shall conform to the following:

3.12.3.2.1 Lettering Lettering shall be in vertical Gothic type, with a minimum height 3/64 inch

3.12.3.2 Border- Where space permits, a border of 1/4 inch or more shall be provided on each edge of the label.

3

(a)

(b)

(c)

(d)

(e) Specification MIL-P-78.

3.12.3.2.4 Permanency.- Where required, specified tests on labels shall be performed with the labels on mounting surfaces simulating the mounting surfaces of the equipment.

3.12.3.2.5 Mounting.- Labels, except decalcomanias, shall be securely and permanently mounted by screws or rivets that will not stain the labels under specified service conditions. Adhesives and mounting processes used for decalcomanias shall be as recommended by the manufacturer.

3.13 Workmanship. - Workmanship of fire-control equipment shall be of a quality consistent with the highest existing production staandards and shall embody best instrument practices consistent with the intended use of the Item, All finished surfaces shall be protected against corrosion (see **3.9**) or injury during manufacture. All fins and other extra metal shall be removed from castings and forgings. All surfaces shall be free from burrs (see 3.8.1). Workmanship on spare parts and assemblies shall be such that no operations such as burring, snagging, breaking of sharp corners and edges, cleaning of chips and foreign matter other than preservatives, need be done by Ordnance maintenance personnel. All material shall be sound, of uniform quality and condition, and free from seams, cracks, and other defects which may adversly affect the strength, erdurance, or wear of the part. Any material hammered, filed, *or* treated in any other manner to conceal defects therein, shall be subject to immediate rejection. Welding or other methods of repairing defects In materials shall not be performed unless specifically authorized by the contracting officer.

3.13.1 Moving parts .- All moving parts shall function properly without Irregularities and excessive mechanical noise and shall conform to the specified torque values for the corresponding temperature requirements.

3.13.2 Securing screws. - Screws used for maintaining adjustment shall he secured by staking, use of dowel sets, pinning, by coating the threads and/or uder the heads with ah approved sealing compound to prevent vibrating loose. The use of shellac is specifically forbidden. Self-locking screws may be used where frequent disassembly is not required. The heads of flat head Screws shall be flush or *slightly below the* surface. Unless otherwise specif:ed, all exterior headless screws, except adjusting screws, shall be covered with sealing compound conforming to the requirements of Specifications MIL-S-I103O, type I, class 1, or MIL-S-l1031, whichever is applicable.

3.13.3 Rivets- **After** riveting, the joined parts shall be tight and undamaged and rivet heads shall be properly seated against their surface.

3.13.4 Clearing. - All interior parts and bearing surfaces of instrumental **be thoroughly cleaned, dried, and** freed from dust, burrs, chips. and grinding compound before lubrication or assembly. ***Grinding*** compounds that will Impregnate or adversely affsct the specified finish shall not be used. Metal parts, after fabrication shall be cleaned in accordance with good commercial ~r~cx.its, or as specified In an applicable document. Cleaning processes shall have no visible or latent deleterious effect on the equipment. *Corrosive* material shall be removed

completely before parts" are assembled into the equipment. After assembly, (or before assembly if necessary) components shall be cleaned thormghly and shall be free from particles of' solder, flux, and other foreign material (See 3.11.15.2).

3.13.5 Welding. PFarts to be welded shall be clean, free from rust, scale, corrosion, oil, and other foreign substances before welding operations are performed. Welds shall show good fusion without overlapping~ burnings or under-cuttiw and shall be stress relieved. Welding practice shall be in accordance with Specifications MIL-w-12683, MIL-w-13748 and MIL-w-13773.

4. QUALITY ASSURANCE PREVISIONS

4.1 Inspection. - All fire-control materiel, including materi

(a)
(b)
(c)

(d)
(e)
(f)
(g)
(h)
(i)
(j)
(k)

4.2 Tests .- All tests shall be conducted in accordance with test procedures specified in the contract and applicable specifications; or If not specified, the inspector shall specify the manner in which it will be determined whether fire-control materiel meet the specified requirements.

4.2.1 Test sequence.- Unless otherwise specified, the tests shall be performed in any sequence.

4.2.2 Performance record. - Prior to conducting any of the tests specified herein, the equipment shall be operated under Standard Ambient Test conditions and a record made of all data necessary to determine **compliance with the appliceble specifications.** These data shall provide the criteria for checking satisfactory performance of the equipment undergoing environmental tests.

4.2.3 Inspection of" equipment.- Deterioration or corrosicn of any internal or external components (after environmental tests) which could in any manner prevent the equipment from meeting operational requirements during service life shall provide reason to consider the equipment as having failed the test to which it was subjected.

4.2.4 standard ambient test conditions. - **Unless** otherwise SpeCified herein or in the individual specification, standard ambient tests shall be performed at a temperature of 15°C (60°F) to 32°C (90°F, at a barometric pressure of 28 to 32 inches of mercury, and a relative humidity not greater than 80 percent.

4.2.5 Test facilities.

4.2.5.1 General.- The apparatus used in conducting tests shall **be capable of** meeting the conditions required.

4.2.5.2 Volume.- The test facilities, unless. otherwise specified shall besuch that the equipment under test shall not exceed 50 Perter.t of the internal ***volume or*** the test chamber and no *portion* shall be closer than 6 inches from any surface of the chamber (see 4.2.7).

4.2.6 Measurments. - All measurements shall be made with instruments **Wriose accuracy has** been certified. If tests are Con$_n$-ducted at the contractor's plant the accuracy of the instruments and test equipment shall be certified periodically by the government.

4.2.6.1 Tolerances. - The maximum allowable tolerances on test conditicn measurements shall be as follows unless otherwise specified:

(a) Temperature: Plus or minus 2°C.
(b) Altitude: Plus or minus 5 percent in feet.
(c) Humidity: Plus or minus 5 percent relative.
1/ (d) Vibration Amplitude: Plus or minus 5 percent. This tolerance applicable only to the amplitude measuring instruments.
1/ (e) Vibration Frequency: Plus or minus 2 percent. This tolerance applicable only to the frequency measuring instruments.

4.2.7 Installation of equipment.- The equipment shall be installed in the chamber in a manner similar to its actual use in service. Plugs, covers and inspection plates used in service shall remain in place. When electrical or mechanical connections are not utilized, the connections normally protected in service shall be adequately covered.

4.3 Test procedures.- In each test procedure the conditions of the test are stated. Because of the complexity of fire-control materiel, it has been necessary to include more than one procedure for some tests. The applicable test procedure s~all be as specified in the contract or detail specification.

4.3.1 Low temperature

.3.1.1 Procedure I.- The equipment shall be placed within the chamber and the chamber cooled to and maintained at a temperature of minus 62°C (-80°F) for the specified condition of Table XV, at which time the equipment shall be examined in accordance with the requirements of 4.2.3. The temperature of the chamber shall be then raised to minus 54°C (-65°F) and maintained for an additional 24 hour period or until thermal stabilization 2/ is reached, whichever is the longer. At the conclusion of this exposure period and while at this temperature, the equipment shall be operated and the results compared with the data obtained in 4.2.2 and visually examined in accordance with 4.2.3.

1/ Tolerances om the equipment generating the vibration shall not exceed 10 percent.

2/ Thermal stablization has been reached when the temperature of the largest internal mass centrally located of the equipment does net vary more than 1°C from the ambient temperature.

Table XV

Condition	Time
A	3
B	4
C	5
D	6
T	Thermal stabilization

4.3.1.2 Procedure II - Operation.- The equipment shall be placed within a chamber and the equipment and chamber air-cooled to and maintained at the specified condition (B, C or D) of Table XVI until thermal stabilization 1/ is reached. At the conclusion of this exposure (or during this exposure if so specified in the detail specification) the equipment shall be visually examined in accordance with 4.2.3. The equipment shall then be operated at specified conditions and the results compared with the data obtained in 4.2.2.

Table XVI

Condition	Temperature
A	-62°C (-80°F)
B	-54°C (-65°F)
C	-40°C (-40°F)
D	-32°C (-25°F)
R	Room temperature
E	+52°C (+125°F)
F	+65°C (+150°F)
G	+71°C (+160°F)

1/ Thermal stabilization has been reached when the temperature of the largest internal mass centrally located of the equipment does not vary more than 1°C from the ambient temperature.

4.3.1.3 Procedure III - Storage test.- The equipment shall be placed within a chamber and cooled to and maintained at a temperature of minus 62°C (-80°F) for the specified condition of Table XVII. At the conclusion of this exposure period, the equipment shall be allowed to warm up to room temperature gradually, after which it shall be visually examined in accordance with 4.2.3 and then operated at room temperature and the results compared with the data obtained in 4.2.2.

Table XVII

Condition	Hours [f]
A	4
B	24
C	48
D	72

4.3.2 High temperature

4.3.2.1 Procedure I - Storage. The temperature shall be gradually raised to plus thermal stabilization and allowed to remain at this temp- 1s reached by the equipment, The temLpera- erature for the specified condition of Table XVII. to the specified condition E, F, or R of ture shall be reduced Table XVI until thermal stabilization Is again reached. equipment shall be tested to meet the specified requirement of the detail specification at this temperature.

4.3.2.2 Procedure" 11 - Operation. The equipment shall be placed In a chamber at an ambient temperature of plus 5 1° (1125°F) and allowed to remain for 24 nours or until stabilized 1/ at this temperate. Solar radiation 2/ of intensity of 360 Btu/sq-ft/ shall then be introduced at the top surface of the equipment with the temperate

1/ Thermal stabilization has been reached when rally tceated of the equip- of the largest internal mass ten. from the ambient temperature. ment does not vary more than l°

2/ Solar radiation shall consist of 50-60% of the total energy in wavelengths above 7600 and 4.5 - 6.0% in wavelengths below 3800 A and the balance In visible light.

the ambient temperature maintained at plus 51°C (}125°F) , and the equipment subjected to this radiation for a period of 4 hours. The equipment shall then be placed in operation and shall be capable of meeting the specified requirements of the detail specification.

4.3.2.3 Procedure III - Transient effect, solar radiation.- The purpose or this test is to determine the transient thermal effects due to solar radiation. The equipment is subjected to a controlled ambient temperature conforming to condition E or G of Table XVI as specified. 360 Btu\sq-ft\hr of solar radiation 11 is introduced at the top surface of the equipment until temperature distribution In the equipment is stabilized 2/. The tests shall be wade at periodic intervals after subjection to solar radiaticn as specified in the detail specification.

4.3.3 Temperature cycling

4.3.3.1 Procedure I - Operational test.- The equipment shall be conditioned in an air tem erature of minus 62°C (-80°F) for a period of 3 days. The air temperature shall then be raised 3/ tc a value conforming to the specified condition of Table XVI until thermal stabilization 2 of the equipment Is reached at which time the equipment shal41 be visually examined in accordance with 4.2.3, operated at specified conditions, and the results compared with data obtained in 4.2.2. The temperature of the air shall then be raised to plus 71°C (\160°F) until thermal stabilization is reached by the equipment and allowed to remain at that temperature for a period of 4 hours. The air temperature shall then be reduced to plus ~l°C (\125°F) until thermal stabilization of the equipment is reached. Solar radiation 1/ of intensity of 360 Btu/sq-ft /hr shall then be introduced at the top surface of the equipment with the ambient temperature maintained at plus 51°C (/l25W), and the equipment subjected to this radiation for a period of 4 hours. The equipment shall then be placed in operaticn and shall be capable of meeting the performance requiarments of the detail specification. This cycle shall be re - peated 5 times or as specified in the detail specification.

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1 / Solar radiation shall ccnsist of 5O-60 percent of the total energy in wavelengths above 7 6o o A and 45.6.o percent. in wavelengths below 3800 A and the balance in visible light.

2/ Thermal stabilizaticm has been reached when the temperature of the largest internal mass centrally located of the equipment does not vary more than l° from the ambient temperature.

3/ Start of cycle.

4. 3.4 Humidity

4. 3.4.1 Procedure I.- Distilled or demi eralized water having a ph value between 6.5 and 7.5 at 25°c (77 F) shall be used to obtain the desired humidity. The equipment, prepared for normal operation, shall be placed In the test chamber so that It is no closer than 6 inches from the sides of the chamber, and Is not being subjected to radiant heat. The humidity of the chamber shall be adjusted to 95 5 percent and maintained at that value during the remainder of hj test unless otherwise specified. The temperature of the chamber is raised at a linear rate for a period of 30 minutes until a temperature of 46 ± 1°C (115 / 2°F) is reached and maintained at that temperature for a period of 4-1/2 hours . The temperature of the test chamber is reduced at a linear rate for a period of 1.0 hour until a temperature of 27 ± 1°C (80 / 2°F) is reached. The chamber temperature shall then be varied / 5°C (/ 9°F) at least once each hour for the change shall be optional, consistent with maintenance of the maximum temperature not in excess of 20 minutes out of each how. At least once each hour the relative humidity shall be 100 percent with condensation, the duration of which shall be optional and reed not necessarily coincide with the maximum temperature phase of the hourly cycle. The above noted 12 hour cycle shall be repeated 20 times. During the low temperature period of the tenth and twentieth cycles, the equipment shall be tested as specified In the detail specification. At the conclusion of the test, the equipment is returned to normal ambient temperature and tested as specified in the detail specification.

4.3.4.2 procedure II.- The equipment shall be placed in a test chamber and the temperature in the chamber raised from a temperature between 20°c and 38°c (68°F to 100°F) to 71°C (160°F) and at 99 percent relative humidity during a 2 hour period. The temperature of 71°C (160°F) and a relative humidity of 95 percent shall be maintained during the next 6 hour period. During the following 16-hour period, the temperature in the chamber must drop at a uniform rate to 20°C to 38°c (68°F to 100°F) which constitutes one cycle. The cycle shall be repeated a sufficient number of times to extend the total time of the test to 360 hours (15 cycles) or as specified by the detail specification. At the conclusion of the 360 hour period, the equipment shall be operated and the data compared to that obtained in 4.2.2 and a visual examination made in accordance with 4.2.3. Distilled or demineralized water having a pH value of between 6.5 and 7.5 at 25°C (77°F) shall be used to obtain the desired humidity

4.3.4.3 Procedure III.- The equipment shall be placed in a test chamber and the temperature in the chamber raised to 55°C (131°F) with a relative humidity no greater than 30 percent and

maintained for a period of 24 hours. The porformance of the equipment shall be checked and readjusted or realigned if necessary, to meet requirements specified in the detail specification only when such realigment or readjustment is permitted by the standard operating procedure for such equipmcnt and for which readily accessible controls are provided on the operating panels of the equipment. The equipment shall then be cycled in accordance with Method 106 Standard MIL- STD-202 "starting with step 1, except that the relative humidity shall be 95 + 5 percent wherever 90-95 percent RH is specified.

4.3.4.4 Procedure IV. - The equipment shall be placed in a test chamber and the temperature raised to 46° C ± 1°C (115° F ± 2° F) with a relative humidity of 95 percent ± 5 percent. The equipment shall remain at these conditions for a period of 6 hours. The temperature of the chamber shall then be lowered to 27°C ± 1°C (80° F ± 2° F) and the equipment shall remain at this condition for a period of 6 hours. The above cycle shall then be repeated 10 times for a total of 120 hours, exclusive of transitional periods. The requirements of the equipment at the end of any portion of the above cycle or at the conclusion of the cycle shall be as specified in the detail specification .

4. 3.5 Altitude

4.3.5.1 Procedure I - Ground. - The equipment shall be placed within the test chamber and the internal absolute pressure reduced to 22.58 inches of mercury (corresponding to an altitude of 6000 feet above sea level) with the ambient temperature conforming to the specified condition (B, C or R) of Table XVI. The duration of the test period shall be in accordance with the detail specification. At the conclusion of this period and while the altitude and temperature conditions are maintained, the equipment shall be operated for conformance to the results of 4.2.2.

4.3.5.2 Procedure II. - The equipment shall be placed within the test chamber and the absolute internal pressure of the chamber reduced to 3.44 inches of mercury (corresponding to an altitude of 50,000 feet above sea level) and an ambient temperature of minus 54° C (-65° F). The equipment shall be maintained under these conditions for the period specified in the detail specification. At the conclusion of this period the equipment shall be returned to sea level at a temperature conforming to the specified condition (B or R) of Table XVI. The equipment shall be operated for conformance to the results of 4.2.2.

4.3.6 Fungus resistance. - The fungus resistance of the equipment shall be determined as follows:

4. 3.6.1 Test organisms. - The following test **organisms** shall be used: -

	American Type Culture Collection No.	Quartermaster Culture Collection No.
a Chaetomlum globomun	6205	QM.459
b Aspergillus verslcalor	11730	QM-432
c Aspergillus flavus	9643	QM-380
d Penicillium luteum	9644	W-391
e Rhizopus nigricans	10404	w-387

These organisms may be obtained from the American Type Culture Collection, 2029 M Street, N. W. Washington 6A D. C. or for Service **use,** From Quartermaster General Laboratories, 2800 South 20th Street, Philadelphia 45, Pa.

4.3.6.2 Maintaining stock cultures.- Cultures of these fungi **shall be** maintained separately on an appropriate medium such as potato dextrose agar. The stock cultures may be kept for not more than 4 months in a refrigerator at approximately 3 to 10°C 37 to 50°F) . Subcultures Incubated at 28 to 30°C (82 to 8&°F) for 7 to 20 days, shall be used **in** preparing the spore suspension.

4.3.6.3 Spore suspension. - A spore suspension shall be prepared of each of the five fungi to be used (see 4.3.6.1) as follows: A sterile 10 milliter portion of distilled water shall be poured into a subculture of the fungus. A sterile platinum needle shall then be used to scrape the surface growth from the culture of the test organisms. The spore charge shall then be poured into a sterile 125 ml glass stoppered Erlenmeyer flask containing 50 ml of sterile distilled water and 10 to 15 solid glass bevels, 5 mm in diameter. The flask shall be shaken vigorously to liberate the spores from the fruiting bodies and to break the spore clumps. The shaken suspension shall then be filtered through a thin layer of sterile glass wool in a glass funnel to remove mycellal fragments. The filtered spore suspension shall then be centrifuged at 2500 r.p.m. and the supernatant discarded. The **residue** shall be resuspended in 50 ml of sterile distilled water and centrifuged. The spores shall be washed in this manner three times. The final washed residue shall be diluted with a sterile mineral salts solution, conforming to Table XIX In such a manner that the resultant spore suspension shall contain 1,000,000 200,000 spores per milliliter as determined with a counting c#amber. This operation shall be repeated for each organism used in the test and equal volumes of the resultant spore suspensions shall be blended to obtain the final mixed spore suspension. The spore suspension may be prepared fresh

each day or may be held in the refrigerator at 3° to 10°C (37° to 50°F) for not more than 4 days.

Table XIX

Composition of mineral salts solution	
Material	Amount
KH_2PO_4	0.7 g
K_2HPC_4	0.7 g
$MgSO_4.7H_2O$	0.7 g
NH_4NO_3	1.0 g
NaCl	0.005 g
$FeSO_4.7H_2O$	0.002 g
$ZnSO_4.7H_2O$	0.002 g
$MnSC_4.7H_2O$	0.001 g
Distilled water	1.0 liter

4.3.6.4 Inoculation and incubation.- The entire surface of each piece of equipment to be tested shall be inoculated with the composite spore suspension by spraying the mixed spore suspension from an atomizer in such a manner that the entire surface is moistened with the spore suspension. The equipment, including applicable external connections shall then be incubated in a chamber maintained at 25° to 29°C (77° to 84°F) and a relative humidity of 97 percent plus or minus 2 percent. The test period shall be 28 days.

4.3.6.5 Evaluation of results.- At the end of the test period, the parts shall be examined in accordance with 4.2.3.

4.3.7 Sunshine.- The equipment shall be mounted within the test chamber in the manner prescribed by the detail specification and subjected to radiant energy at the rate of 100 to 120 watts per square foot for a minimum of 4 hours or as specified in the detail specification. 50 to 60 percent of the total energy shall be in wavelengths above 7600 angstrom units and 4.5 to 6 percent in wavelengths below 3800 angstrom units and the balance in visible light. The test chamber temperature shall be maintained at 45°C (113°F) during the course of the test. Upon completion of the test period specified by the detail specification, the equipment shall be examined for conformance to the results of 4.2.2.

4.3.8 Rain

4. 3.8.1 Procedure I. - The equipment shall be mounted In the test chamber to simulate installation conditions. The rain test chamber temperature shall be maintained between 20°C to 30°C (68°F to 86°F) throughout the test period. A simulated rainfall of 4 / l.- 0 inches per hour as measured at the surface of the equipment with a U. S. Weather Bureau type gage shall be produced by means of a water spray nozzle of such design that the water Is emitted In the form of small droplets rather than a fine mist. The tern erature of the water shall be maintained between ll°C to 20 C (52°F to 68°F). The rainfall shall be dispersed uniformly over the test area within the limits as specified above. Direction of rainfall shall be variable from vertical to 45° from vertical in any direction. The simulated rainfall shall be directed on all surfaces which are normally subJected to rain. Duration of the test shall be 2 hours at the completion of which the equipment shall be examined for evidence of water penetration or damage.

4.3.8.2 **Procedure** II. - Equipment shall be mounted In a test chamber and exposed to.a simulated 24 hour rainfall totaling 32 inches made up of the following intensities with the indi-. cated durations and other properties, both air and rain, at 21°C (70°F) .

Amount (In.) 1	12	2	11 2	7
Duration (hr:min.)	11:55	0.05	11:00	1:00
Rate (in/hr)	1	24	1	7
Drop Size(mm) Min.	2.55	4.0	2.25	3.2
Std Dev.	0.77	1.68	18	1,1
Min. ht. **of** fall(rt)	18	26	18	25.1

4.3.9 Sand and dust 3 . . The equipment shall **be** placed within the test chamber and the sand and dust density raised **and maQt-** talned at 0.1 to 0.5 grams per cubic foot within the test space. The relative humidity shall not exceed 30 percent at any time during the test. Sand and dust used **in** the test shall be of angular structure and shall have characteristics as follows:

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1 As measured at the surface of the equipment. with a U. & Weather Bureau type gage.

2 Wind speed of 40 mph during this portion of the cycle.

3 This test may be used as a substitute for driving snow.

(a) 100 percent of the sand and dust shall pass through a 100-mesh screen, U S Standard Sieve Series.
(b) 98/2 percent of the sand and dust shall pass through a l40-mesh screen U S Standard Sieve Series.
(d 90 / 2 percent of the sand and dust shall pass through a 200-mesh screen, U S Standard Sieve Series.
(d) 75 / 2 percent of the sand and dust shall pass through a 325-mesh screen, U S Standard Sieve Series.
(e) Chemical analysis of the dust shall be as follows:

SUBSTANCE	PERCENT BY WEIGHT
SiO_2	97 to 99
Fe_2O_3	0 to 2
Al_2O_3	0 to 1
TiO_2	0 to 2
MgO	0 to 1
Ign Losses	0 to 2

The Internal temperature of the test chamber shall be maintained at 25°C (77°F) for a period of 6 hours with sand and dust velocity through the test chamber between 200 / 100 feet per minute, (2, 300 / 500 feet per minute if so specified by the detail specification). After 6 hours at the above conditions, (during all Or part of which time the equipment shall be Operating, if so specified by the detail specification) the temperature shall be raised to and maintained at 71°C (160°F). These conditions shall be maintained for 6 hours At the end of this period, the equipment shall be removed and allowed to cool to room temperature and shall be operated and the results shall conform to those obtained in 4.2.2 and examined in accordance with 4.2.3. Thes test shall be repeated at 0°F If so specified In the detail specification

4.3.10 Vibration.- Filters used in vibration tests shall have Cut-off frequencies selected to eliminate all harmonics above the fundamental from the measured values. The procedures for the vibration tests shall, at the option of the detail specification, be operated at high /160°F) or low (-40°F or -65°F) and standard ambient temperatures. The equipment shall or shall not be 0perated during the test, In accordance with direction as specified in the detail specification.. If the eqUipment is not operated during the test period, then at the conclusion of the period the equipment shall be operated and the results shall conform to those of 4.2.2..

4.3.10.1 Procedure I.- This procedure Is intended for equipment weighing less than 150 pounds. The equipment shall be

clamped on the vibration table in Its normal mounting or operating position The equipment shall. be vibrated successively , along each of the three mutually perpendicular directions that are respectively parallel to the edges of the equipment with an amplitude, durations and frequency which "varies cOntinuously between the limits shown) conforming to the specified condition of Table XX. The rate of change of applied frequency shall not exceed one cycle per second per second. The equipment shall not "be operated during the test. At the conclusion Of the test the equipment shall be operated and the results shall conform to those of 4.2.2.

Table XX - Ground Equipment Vibration Test - Procedure I

Shock Isolators	Condition	Frequency Limits	Amplitude (1/2 total excursion)	Duration in Each of Three Directions
Unblocked	A	10-20 cps	1/32 in.	1 hr
Blocked	B	10-55 cps	1/64 in.	1 hr
Equipment without shock Isolators	C	10-55 cps	1/64 in.	2 hrs
	D	10-55 cps	1/32 in.	1 hr
	E	10-55 cps	1/16 in.	1/4 hr

4.3.10.2 Procedure II.- This procedure Is intended for equipment item weighing over 150 pounds; The equipment shall be clamped on the vibration table in its normal mounting or operating position. The equipment shall be vibrated successively along

respectively parallel to the edges of the equipment with an acceleration, duration, and frequency (which varies continuously between the limits shown) conforming to the specified condition of Table XXI. As the Conclusion- of the test the equipment shall be operated and the results compared to those of 4.2.2.

4.3.10.3 Procedure III.- This procedure is intended for equipment weighing less than 150 pounds. The equipment shall be clamped on the vibration table in its normal mounting or operating position. The equipment shall be vibrated successively along each of the three mutually perpendicular directions with accelerations and excursion conforming to Table XXII. The applied frequency shall be changed at a uniform rate between the limits indicated; the rate of change shall not exceed one cycle per second per second.

Table XXI - Ground Equipment Vibration Test - Procedure II

Shock Isolators	Condition	Frequency Limits	Acceleration	Duration in Each of Three Directions
Unblocked	A	10-20 cps	2G	1/2 hr
Blocked	B	20-55 cps	3.5G	1/2 hr
Equipment without Shock Isolators	C	10-20 cps 20-55 cps	2G 3.5G	1/2 hr 1/2 hr
Equipment without Shock Absorbers	D	10-20 cps 20-55 cps	4G 7G	1/2 hr 1/2 hr
Equipment without Shock Absorbers	E	55-2000 cps	10G	1/2 hr

Table XXII - Procedure III

Frequency Limits	Amplitude (1/2 total excursion)	Acceleration	Time (Each Direction)
0-10 cps	0.030 in.	-----	1 hr
11-20 cps	0.015 in.	-----	2 hrs
21-400 cps	-----	4.5G	2 hrs

4.3.10.4 Procedure IV.- This procedure is intended for equipment weighing more than 150 pounds. Same as procedure III except that accelerations and excursion shall conform to Table XXIII.

Table XXIII - Procedure IV

Frequency Limits	Amplitude (1/2 total excursion)	Acceleration	Time (Each Direction)
0-10 cps	0.030 in.	-----	1 hr
11-20 cps	0.015 in.	-----	2 hrs
21-400 cps	-----	2.5G	2 hrs

4.3.10.5 Procedure V.- Same as Procedure 10 However, weight Is Ignored and amplitude is at maximum frequency. Amplitude . and **duration** of vibration shall conform to the specified condition of Table XXIV.

Table XXIV - Ground Equipment Vibration Test - Procedure V

Shock Isolators	Condition	Frequency Limits	Amplitude (1/2 total excursion)	Duration in Each of Three Directions
Equipment without Shock Isolators	A	10-55 cps	1/32 in.	1 hr
Equipment without Shock Isolators	B	10-55 cps	1/16 in.	1/4 hr

4.3.11 shock- The filtered shock pulse shall have a wave form approximating a half sine wave. Filters used shall have cut-off frequencies selected to eliminate all harmonics above the fundamental from the measured record of shock pulse.

4.3.11.1 Procedure I.- The shock testing machine, designed and fabricated according to Standard MIL-STD-202, shall be set up to produce the magnitude and duration of shock specified in the detail specification. Figure 1 shall be used to determine the drop height and carriage weight for the specified conditions of shock. The number of shocks and position of the test specimen shall be as specified in the detail specification. Functional tests shall be conducted during shock applications according to the requirements of the detail specification. The tests shall be performed at reduced and/or elevated temperatures when so required by the detail specification. There shall be no mechanical failure due to the applied shocks.

4.3.11.2 Procedure II.- This procedure shall be used to determine the equipment operating characteristics as well as its structural integrity under conditions of shock. The equipment shall be subjected to the shock conditions as normally used in service, including any shock mount assembly. The shock testing machine, designed and fabricated according to Specification MIL-S-4456 shall be used. Shock and time duration may be changed at the option of the detail specification. The test specimen shall be subjected to 18 impact shocks of 15G or as specified, each shock impulse having a time duration of 11 ± 1 milliseconds. The intensity shall be within ± 10 percent when measured with a filter having a cut-off to eliminate all harmonics.

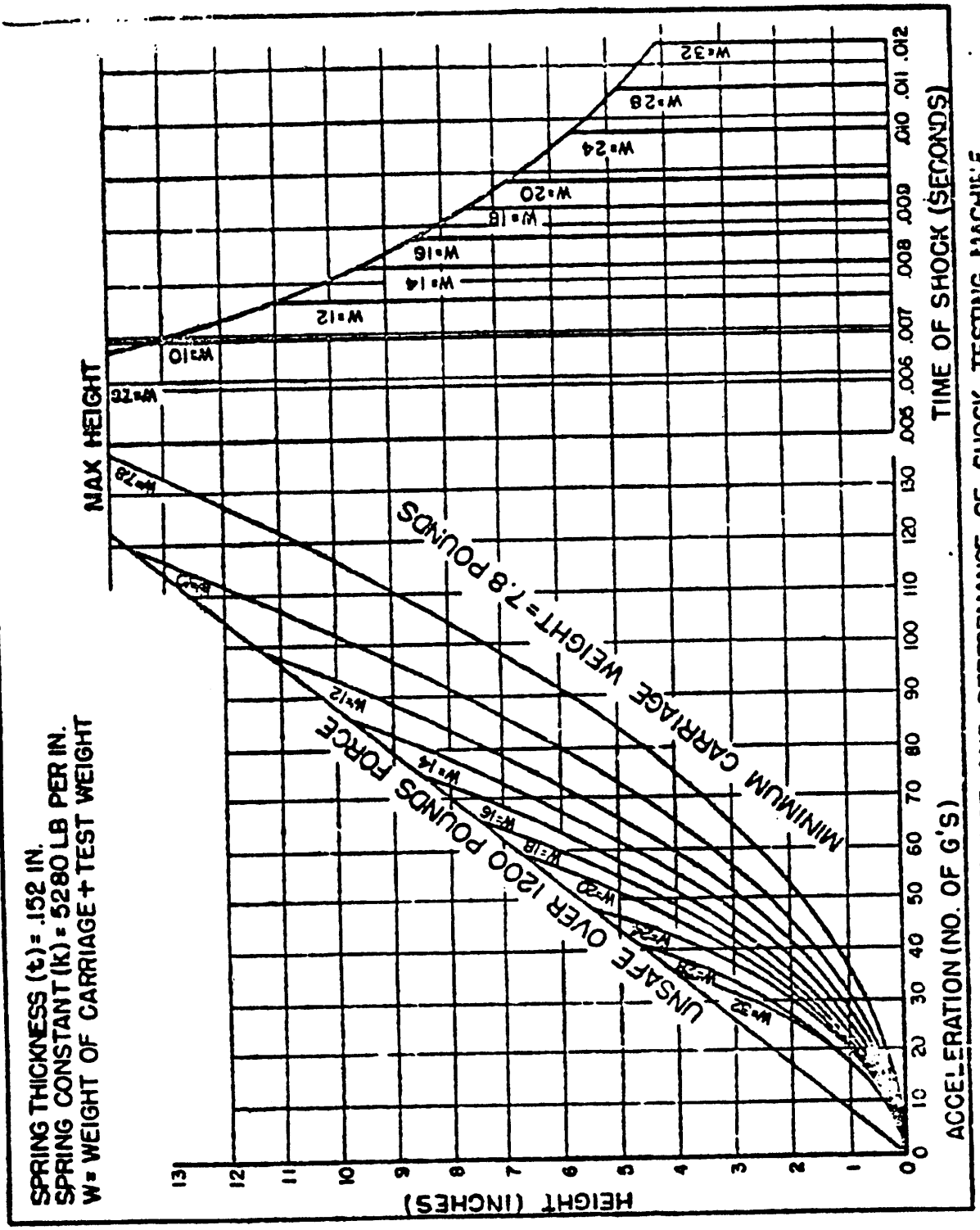

FIGURE 1. RANGE AND PERFORMANCE OF SHOCK TESTING MACHINE

The maximum G shall be reached in approximately 5-1/2 milli seconds. The shock shall be applied in the following directions:

a. Vertically, 3 shocks in each direction.
b. Parallel to the major horizontal axis, 3 shocks In each direction.
c. Parallel to the minor horizontal axis, 3 shocks In each director..

The test specimen shall not suffer damage or subsequently fall to provide the performance specified by the detail specification.

4.3.11.3 Procedure 111. - A high impact shock testing machine designed and fabricated according to Specification MIL-S-901 shall be set up to produce the magnitude and duration of shock specified in the detail specification. The number of shocks and position of the test specimen shall be as specified In the detail specification. Fuctional tests shall be conducted during shock applications according to the requirements of the detail specification. There shall be no mechanical failures due to the applied shocks.

4.3.11.4 **Procedure** IV. - The equipment In the regular transportable position in its trailer or trailers shall be transported five times over the sections of a test course in the order and at the indicated speeds of Table XXV.

Table XXV - ShocK Test

1	Coarse washboard (6-inch waves spaced 72 inches apart)	5 mph	time duration or distance traveled to be specified
2	Belgian block	20 mph	
3	Radial washboard (2-inch tc 4-inch waves)	15 mph	
4	Any short sections between the above sections	20 mph	

At the conclusion of the test the equipment shall be operated and the results compared to those obtained In 4.2.2.

4.3.12 Immersion

4.3.12.1 Procedure I.- The equipment shall be immersed In a suitable liquid, such as water. The absolute pressure of the

air above the liquid shall then be reduced to approximately 1 inch of mercury and maintained for 1 minute or until air. bubbles substantially cease to be given **off** by the liquid, whichever is the longer. The absolute pressure shall then be increased to 2-112 inches cf mercury. Any bubbles coming from within the equipment case shall be considered as leakage. Bubbles which are the result of entrapped air on the various exterior parts of the case shall not be considered as a leak. A helium leak detecter or other means of test, equal or superior in sensitivity to the immesion test method described above, may be used upon approval by the procuring agency.

4. 3.12.2 Procedure II.- Same as procedure I. However, In lieu of evacuation, a pressurized system IS used using clean, dry air or nitrogen having a dew point of' at least minus 32°C (-25°F) to pressurize the equipment under test to a pressure of 10" Hg before immersion of the equipment In the test liquid.

4.3.12.3 Procedure III.- Clean, d , inert gas having a dew point of at least minus 32°c (-25°F shall be used to pressurize The equipment under a test pressure of 2 psi. An appropriate leak detector shall be used in order to determine if the equipment IS watertight (leakproOf).

4. 4.3.13 High potential

4.3.13.1 Procedure I A potential of 750 volts (rms) plus twice the rates voltage shall be applied instantaneously for a period not less than 5 seconds nor more than 30 seconds. after this test, the equipment shall conform to results of %.2.2.

4.3.13.2 PRocedure 11.- Same as procedure I, except that test voltage shall be 1000 volts (rms) plus twice the rated voltage.

4.3.14 Insulation resistance.- Insulation resistance shall be measured between mutually insulated parts by means of a meg-ohm bridge or other approved method, at a dc potential of 800 volts.

5. PREPARATION FoR *DELivery*

j.1 Preservation., packaging and packing.- The contractor shall furnish all necessary labor and materials to properly preserve, package, and pack for shipment in accordance with the require-ments of the contract, the detail specification, cr any other applicable speCification. In the absence of detail packaging specifications, Specification MIL-P-116 shall be used as a guide in providing adequate protection for items (or materiel) involved.

5.2 Unit packaging. - Unless otherwise specified, all fire-control materiel shall be individually unit packaged unless combinations of items are required to make a complete, serviceable Item, in which case the combination shall be packaged or packed In a unit. Where applicable materiel shall be protected by the use of proper cleaning methods, followed **by the** application of the specified corrosion-preventive compounds and protective wrapping or by dehydrated packaging. (Materiel specifically designed for arctic use do not require corrosion-preventive compounds). Unit packages shall be so designed as **to** immobilize fully and cushion the item against shock and damage.

5.3 Type of shipment.- The contract or contracting officer shall specify the Level of packing required.

5.4 Marking. - All markings shall conform to Standard MIL-STD-129 unless otherwise specified

6. NOTES

6.1 Ordering data.- The invitation for **bids, the** contract, the letter order, or other fire-control materiel purchasing documents should Include the following:

6. Spare parts .- Statement of the spare parts and equipment to be furnished with the fire-control item.

6.2 qualification.- In the procurement of products requiring qualification, the right Is reserved to reject bids on products that have not been subjected to the required tests and found satisfactory for inclusion on the **Qualified** Products List. The attention of suppliers is called to this requirement and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification In order that they be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Frankford Arsenal, Fire Control Instrument Group, Philadelphia 37, Penna.

6.3 Models - Prospective bidders should be allowed to examine available models. **They** should also be allowed to study the manufacturing methods and facilities of the Government establishment which produced the model at the discretion of the Government.

6.4 Synchros:- The synchros preferred for new design shall consist of the following

15TR4a	C7674777	23TX6a	F8212778
15CT4a	C7674781	23TX4a	F8212762
15CDX4a	C7674782	23TR6a	F8212781
15TDX4a	C7674778	23TR4a	F8212766
15CX4a	C7674780	23CDX6a	F8212786
16TRB4a	A7631931	23CDX4a	F8212772
23CT6A	F8212789	23TDX4a	F8212807
23CT4a	F8212775	23TDR4a	F7674785
23CX6a	F8212794	31TX6	C7667343
23CX4a	F8212801	31TR6	C7667342
23TDX6a	F8212797		

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DOCUMENT IDENTIFIER *(Number)* AND TITLE

MIL-F-14252 FIRE CONTROL MATERIEL

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

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