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DEVELOPMENT SPECIFICATION FOR XMC-364 (U)

JUNE 5, 1953

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ALBUQUERQUE • NEW MEXICO

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Listing of Pages Effective With Document Change #2

The following is a list of the page numbers and respective issue dates which are effective with Document Change #2 of this specification.

An issue date is not shown on any page of original issue.

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Changes from previous issue are flagged with an asterisk in the right margin on each page.

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DEVELOPMENT SPECIFICATION
FOR
XMC-364

1 PURPOSE AND CLASSIFICATION

1.1 Purpose.--The XMC-364 is a modulated neutron source which is designed for use as an external initiator of implosion type weapons.

2 APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 Applicable Specifications. -- The following specifications of the issue and amendment designated (amendment number is given in parentheses after the specification designation) form a part of this specification to the extent indicated in the text and on the procuring agency drawings:

Federal Specifications		Custodian
QQ-P-416(1)	Plating, Cadmium (Electrodeposited)	Fed
QQ-S-571b	Solder, Soft (Tin,Tin-Lead,Lead-Silver)	Fed
QQ-Z-325	Zinc Plating (Electrodeposited)	Fed
QQ-S-561(Z)	Solder, Silver	Fed
TT-C-595(1)	Colors: (for) Ready Mixed Paints	Fed
TT-V-119	Varnish, Spar, Phenolic-Resin	Fed

2.1.2	Military Specifications	Custodian
MIL-E-1F	Electron Tubes	SIG & SH
MIL-R-22A	Resistors, Variable (Wire-Wound,Power Type)	SH
MIL-T-27(3)	Transformers and Inductors (Audio,Power and Pulse)	SIG & SH
MIL R-93A	Resistors, Accurate, Fixed, Wire-Wound (Accurate)	SIG
MIL P 116A	Preservation, Methods of	O & USAF
MIL-V-173A	Varnish, Moisture-and Fungus-Resistant for the Treatment of Communications, Electronic, and Associated Electrical Equipment	SH

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	Military Specifications	Custodian
MIL-M-3171	Magnesium Alloy, Processes for Corrosion Protection of	O
MIL-G-3278	Grease: Aircraft and Instruments (for Low and High Temperatures)	USAF
MIL-S-5002(1)	Surface Treatments (except Priming and Painting) for Metal and Metal Parts in Aircraft	A
MIL-E-5272A	Environmental Testing, Aeronautical and Associated Equipment (General Specification for)	USAF & A
MIL-C-5541(1)	Chemical Films for Aluminum and Aluminum Alloys	USAF & A
MIL-X-6141	X-Ray Laboratories: Procedure for the Certification of (for inspection of Aircraft Components)	USAF & A
MIL-I-6181	Interference Limits and Tests; Aircraft Electrical and Electronic Equipment	USAF
MIL-P-6859	Plating, Nickel	USAF & A
MIL-P-6871	Plating, Chromium	USAF & A
MIL-S-6872	Soldering Process, General Specification for	USAF & A
MIL-P-6889A(3)	Primer; Zinc Chromate, for Aircraft Use	A
MIL-B-7883	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys	SIG
MIL-E-11237	Enamel, Synthetic, Lustreless	O
MIL-E-15090A (Ships)	Enamel, Equipment, Light-gray (Formula No. 111)	SH

2.1.3	Joint Army-Navy Specifications	Custodian
JAN-R-11(4)	Resistors, Fixed Composition	SIG & SH
JAN-C-25(5)	Capacitors, Direct-Current, Paper Dielectric Fixed (Hermetically Sealed in Metal Case)	SIG & SH

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	Joint Army-Navy Specifications	Custodian
JAN-R-26A(3)	Resistors, Fixed, Wire-wound, Power Type	SH
JAN-R-94(2)	Resistors, Variable, Composition	SIG & SH
JAN-L-73	Lacquer Enamel, Lustreless	SH & O
JAN-C-76(4)	Cable (Hook-up Wire), Electric Insulated, Radio and Instrument	SIG
JAN-T-152	Treatment, Moisture-and Fungus-Resistant, of Communications, Electronic and Associated Electrical Equipment:	SIG
JAN-R-184(3)	Resistors, Fixed, Wire-Wound	USAF
JAN-R-94(2)	Resistors, Variable, Composition	SIG & SH
JAN-I-225	Interference Measurement, Radio, Methods of, 150 Kilocycles to 20 Megacycles (for Components and Complete Assemblies.)	SH
JAN-C-490	Cleaning and Preparation of Ferrous Metal Surfaces for Organic Protective Coatings	O
2.1.4	Air Force-Navy Aeronautical Specifications	Custodian
AN-QQ-A-696a	Anodic-Films; Corrosion-Protective (for) Aluminum Alloys	USAF
2.1.5	U.S. Army Specifications	Custodian
2-89-A	Flux, Soft Soldering	USAF
2.1.6	U.S. Air Force Specifications	Custodian
7201	Test Procedure, Shock, Medium Impact	USAF
2.1.7	Sandia Corporation Specifications	Custodian
G-3077	Gold Plate, No. 3077 Finish	SC
G-3078	Silver Plate, No. 3078 Finish	SC
SCS-2	Classification and Mechanical Testing of Castings	SC
SCS-3	Inspection of Castings	SC
SCS-4	General Requirements for Electrical Cable	SC
SC-5107 (Sp)	Electronic Timer	SC

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2.1.8	Sandia Corporation Drawings	Custodian
DS(5330)24289	Initial Signal Wave Form	SC
DS(5330)24053	Geometry	SC
DS(5330)24288	XMC-364 Circuit Diagram	SC

2.4 Other Publications. -- The latest issues of the following publications form a part of this specification to the extent indicated in the text:

Publication	Custodian
USAF Specification Bulletin No. 23 Material and Process Specifications	USAF
ANA Bulletin No. 143-Specifications and Standards-Use of	USAF

2.5 Ordering Information. -- The custodians of the specifications and publications listed above and from whom copies may be obtained are listed below. Custodian symbols indicated in 2 correspond to those indicated in the following listing. When ordering give both title and number of the specification or publication and reference the prime contract number of the Sandia Corporation.

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Custodian Symbol	Name of Custodian	Address of Custodian
USAF	Air Force	Commanding General Wright Air Development Center Attn: WCXSP Wright-Patterson Air Force Base Dayton, Ohio
A	Bureau of Aeronautics	Chief, Bureau of Aeronautics Technical Data Division Department of the Navy Washington, D.C.
FED	Federal	Superintendent of Documents U.S. Government Printing Office Washington 25, D.C.
O	Ordnance Corps	Office, Chief of Ordnance Washington 25, D.C.
SH	Bureau of Ships	Chief,Bureau of Ships Attn: Code 357 Department of the Navy Washington 25, D.C.
SC	Sandia Corporation	Sandia Corporation Attn: Purchasing Agent Sandia Base Albuquerque, New Mexico
SIG	Signal Corps	Commanding Officer Signal Corps Procurement Agency Attn: Technical Records Branch 2800 South 20th Street Philadelphia 45 Pennsylvania

3 REQUIREMENTS

3.1 Precedence

3.1.1 Precedence of this Specification and Related Documents. -- Whenever their requirements are in conflict, this specification and related documents shall take precedence in the following order:

a. The contract

b. This specification

c. Sandia Corporation drawings

d. Applicable specifications and standards

3.1.2 Precedence of Standard Materials, Parts, and Processes. -- Any material or process not covered herein shall conform with a specification listed in USAF Specification Bulletin No. 23. If the specifications listed in Bulletin No. 23 are not applicable, the material or process shall be selected in accordance with the order of precedence established by ANA Bulletin No. 143. Any standard part not covered herein shall be chosen to comply with specifications and standards selected in the order of precedence set forth in ANA Bulletin No. 143.

3.1.3 Precedence of Requirements of Military Organizations. -- When referenced government publications stipulate different requirements for several military organizations, the requirements of those organizations shall take precedence in the following order: U.S. Air Force, Bureau of Aeronautics, Bureau of Ordnance, U.S. Army Ordnance Department, Bureau of Ships, U.S. Army Signal Corps.

3.1.4 Requirements for Tests or Services. -- Whenever referenced government publications stipulate services to be performed by an agency other than Sandia Corporation, the assistance of Sandia Corporation in securing such service may be obtained, if necessary.

3.2 Certification and Substitution

3.2.1 Certification. -- The vendor shall certify in writing to the Sandia Corporation that the materials, processes and/or parts used in the assembly conform to the applicable specifications.

3.2.2 Substitution. -- No substitution for parts, materials, processes or designs, specifically called out herein, shall be made without the prior written approval of the Sandia Corporation. Request for approval of substitutions shall provide evidence that the substitution is equal or superior to the specified item. The Sandia Corporation may require samples from which the suitability of the substitution can be determined.

3.3 Materials

3.3.1 Inflammable Materials. -- Inflammable materials which will ignite or explode from an electrical spark or from heating should not be used. If materials which will ignite must be used, they shall not continue to burn after the removal of flame. Fireproof and explosion-proof insulation shall be used wherever a fire hazard exists.

3.3.2 Toxic and Corrosive Fumes. -- As installed in the XMC-36h and under the environmental conditions specified in 3.8. the materials shall not liberate gases which combine with the atmosphere to form corrosive acid or corrosive alkali, nor shall they liberate toxic fumes when burned. Any gas used to fill or pressurize any components, subassemblies or general assemblies shall not combine with the atmosphere to form corrosive acids or alkalies, and shall not form toxic or corrosive fumes when burned or decomposed.

3.3.3 Fungus Inert Materials. -- Materials which are not nutrients for fungus shall be used to the greatest extent practicable.

3.3.3.1 Fungus-Nutrient Properties of Materials. -- The following materials are arranged in groups in the order of their resistance to fungus growth. Materials in Group Ia should be used in preference to those in Group Ib. Materials in Group II shall not be used unless their other desired properties cannot be obtained from materials in Group I. If materials in Group II are used, they shall be treated in accordance with 3.3.3.2. The use of materials other than those in Group I requires the prior written approval of the Sandia Corporation.

Group Ia

Ceramics
Glass
Glass-silicone
Melamines (except formaldehydes)
Metals
Mica
Monochlorotrifluorethylene
Nylon
Polyethylene (unplasticized)
Polymethylemthacrylate
Polystyrene
Polyvinylidiene chloride
Silicones (pure)

Group Ib

Cellulose acetate
Cellulose acetate butyrate
Diallylphthalate
Ethyl cellulose
Phenolics laminated with glass fibers or nylon
Phenolics (mica-,glass-, or asbestos-filled)
Phenolics (without fillers)
Polyvinyl chloride (Dioctylphthalate or dibutylphthalate plasticizers preferred)
Polyester resins
Rubber (synthetic and natural)

Group IIa

Cotton or linen cloth laminates
Phenolics filled with cotton fiber, wood or wood flour
Melamine formaldehyde
Vinyl acetate

Group IIb

Cellulose nitrate
Cork
Cotton webbing
Hair and wool felt
Leather
Paper
Regenerated cellulose
Wood and wood products

3.3.3.2 Fungus Resistant Treatments. -- If materials in Group IIa are used, they shall be coated with one coat of varnish per TT-V-119. If materials in Group IIb are used they shall be treated by a process approved by the Sandia Corporation.

3.3.4 Hygroscopic Materials. -- The water absorption characteristic of any materials used in the XMC-364 shall be the minimum for that class of material having the other desired characteristics.

3.3.4.1 Treatment of Hygroscopic Materials. -- Materials used in the XMC-364 which will absorb more than 1 per cent of their weight of water when tested in accordance with 4.2.9 shall have their surfaces coated with one coat of varnish, per TT-V-119. This requirement does not apply to insulation sleeving used on wire and cable.

3.3.4.2 Treatment of Machined Plastics. -- All machined surfaces of parts that are fabricated from plactics containing laminations or fillers, shall be coated with one coat of varnish, per TT-V-119.

3.3.5 Corrosion Resistance. -- All materials used shall be corrosion resistant or shall be treated to resist corrosion and shall cause a minimum of corrosion of other materials in the XMC-364 under the conditions specified in 3.8.

3.3.5.1 Additional Protection of Base Metals. -- Gold, nickel, chromium, rhodium, corrosion-resistant steel (12 per cent or more chromium), copper, tin, lead-tin alloys, or sufficiently thick platings of these metals are satisfactory without additional protection or treatment other than buffing or cleaning. In general, aluminum, magnesium, iron, steel, cadmium, and zinc require additional protection in accordance with 3.5.2.

3.3.5.2 Dissimilar Metals. -- Dissimilar metals shall not be used in contact unless suitably protected against electrolytic corrosion. When it is necessary that any combination of dissimilar metals be assembled, an interposing material compatible with each shall be used. Dissimilar metals are defined as follows:

a. Grouping of metals

Group I	Group II	Group III	Group IV
Magnesium alloys	Aluminum	Zinc	Copper and its alloys
	Aluminum alloys	Cadmium	Nickel and its alloys
	Zinc	Steel	Chromium
	Cadmium	Lead	Stainless steel
		Tin	Gold
			Silver

b. If metals within any one group are in contact, they shall be considered as similar. If a metal of one group and a metal of any other group are in contact, they shall be considered as dissimilar.

c. Unless their use is specifically approved by the Sandia Corporation, all other metals shall be considered dissimilar with respect to any of the metals listed above.

d. The above grouping is intended to serve as a guide in selecting materials to be used in electromechanical equipment and shall not be construed as waiving requirements herein as to corrosion resistance of components and assemblies. In particular, care shall be exercised in using aluminum alloys against each other or against dissimilar metals as defined herein.

e. When reference is made to a metal in a particular group, the reference applies to the metal on the surface of the part, that is, zinc means zinc castings as well as zinc electroplate, zinc hot dip, or zinc metal spray.

f. Dissimilar metal contact does not apply to contact between metals which interfuse at their interface when such a process must be employed in fabrication. For instance soldering of copper wires, the use of pretinned copper parts and the sweat-soldering of sheet metal parts to obtain a sealed enclosure are acceptable.

g. Different metals in contact, even though similar, shall be employed in assemblies in such a manner that the smaller part is cathodic (protected) and the larger part is anodic (corroded) if any corrosion takes place.

3.3.6 Lubricants. -- Lubricants used shall cause no degradation of performance of the XMC-364 or deterioration of other materials in the XMC-364 under conditions of 3.8.

3.3.7 Cadmium. -- Cadmium shall not be used in enclosures with phenolic resins.

3.4 Standard Parts. -- Unless otherwise specified, standard parts shall be chosen in accordance with 3.1.2 and they shall meet the requirements of this specification.

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3.4.1 Electrical and Electronic Parts. -- The vendor shall submit to the cognizant Sandia Corporation design engineer two copies of a list of the electrical or electronic parts he intends to use in the assembly. This list should be submitted as soon as his design is established. If any non-standard parts are used in lieu of MIL-JAN-AN parts, the contractor shall submit his reasons for their use together with their specifiec characteristics. Samples of these parts shall be submitted to Sandia Corporation for test and approval, if and when requested by the design engineer. Should any changes occur during the development stage in types of parts previously submitted in the list for approval, the cognizant design engineer's approval shall be obtained.

3.5 Workmanship. -- Materials or parts used in the XMC-364 shall be processed by workers skilled in each process involved or under their direct supervision. Processes which are used that are not covered herein shall conform with recognized practices associated with the highest quality of workmanship and product of the particular trade.

3.5.1 Forming of Parts

3.5.1.1 Forming of Metal Parts. -- All methods of forming metal parts shall be such as to ensure the quality of performance required in 3.7 under conditions as indicated in 3.8.

3.5.1.2 Forming of Plastics. -- Laminated plastics shall be formed so that the laminate is securely bonded in the plastic material. There shall be no parting of the laminate and the plastic or degradation of the formed plastic when subjected to the conditions of 3.8 or any natural combinations of these conditions.

3.5.2 Finishes. -- Parts of the XMC-364 which are not covered by subsidiary specifications and which have protective finishes shall be resistant to corrosion; there shall be no destructive corrosion of such parts after test in accordance with 4.2.5. Destructive corrosion shall be construed as being any type of corrosion which in any way interferes with mechanical and electrical performance. Bright finishes shall not be used on external parts. When cleaning operations on metal parts are not specified in detail, they shall be in accordance with commercial practices which will not cause subsequent destructive corrosion.

3.5.2.1 For Magnesium. -- The surfaces of magnesium and magnesium alloy parts shall be treated in accordance with MIL-M-3171, Type III or IV.

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3.5.2.2 For Aluminum. -- The surfaces of aluminum or aluminum alloy parts shall be anodized in accordance with AN-QQ-A-696a. When such parts contain steel inserts and cannot be anodized, they shall receive a chemical treatment in accordance with MIL-C-5541 and be painted in accordance with 3.5.2.7.

3.5.2.3 For Corrosion- and Heat-Resistant Steel. -- The surfaces of corrosion- and heat-resistant steel shall be passivated in accordance with MIL-S-5002.

3.5.2.4 For Other Ferrous Alloys. -- The surfaces of ferrous alloys, other than corrosion- and heat-resistant steel, which are to be painted shall be treated in accordance with JAN-C-490, Grade I, prior to painting.

3.5.2.5 For Copper and Copper Alloys. -- The surfaces of copper or copper alloys require no protective coating or finish. This requirement does not exclude consideration of their galvanic reaction with other metals and consequent use of interposed materials to reduce this reaction.

3.5.2.6 Plating. -- Plating shall be done in accordance with 3.3.5 with the following applicable specifications for the plating materials:

a.	Cadmium	QQ-P-416	(Type II or III)
b.	Zinc	QQ-Z-325	(Type II or III)
c.	Nickel	MIL-P-6859	(Type II only)
d.	Chromium	MIL-P-6871	(Type II only)
e.	Gold	G-3077	
f.	Silver	G-3078	

3.5.2.7 Painting. -- Surfaces of magnesium, aluminum and ferrous alloys other than corrosion- and heat-resistant types shall receive an organic coating in addition to the treatment specified for the particular metal involved. Zinc and cadmium plated surfaces that will not withstand the corrosive conditions of 3.8 after suitable chemical treatments specified under 3.5.2.6 shall be given a pre-painting treatment as specified under 3.5.2.6 and shall receive an organic coating. However, organic coatings on a surface or portions of a surface that would interfere with mechanical or electrical operation shall not be applied.

Exterior and interior surfaces of the materials specified herein shall be primed. Exterior surfaces of these materials shall be painted. Painting of interior surfaces is optional.

3.5.2.7.1 Primer. -- Two cross coats of zinc chromate primer, per MIL-P-6889A shall be applied to surfaces specified above.

3.5.2.72 Paint. -- One coat of lacquer enamel, per JAN-L-73, Grade I or III, shall be applied to surfaces specified above. The color of the enamel shall be Gray, Color No. 2630, per TT-C-595.

3.5.3 Screw Assemblies. -- No self-tapping screws shall be used except for indentification plates. All screws shall be secured by self-locking nuts, lock-washers, or safety wires. When tapping is necessary, the tapped material shall be of ample thickness to assure adequate strength of the threads. Where aluminum alloys or alluminum is tapped for screws larger than number 4, suitable steel inserts shall be provided. All screws, studs, spade bolts, and nuts shall be AN hardware of corrosion-resisting steel, zinc plated steel or cadmium plated steel except when used as electrical connections. Screws shall be tight which means that the screw cannot be appreciably tightened further without damage or injury to the screw threads. The final criteria shall be the ability of the assembly to meet the requirements of 3.7 when subjected to the conditions of 3.8.

3.5.4 Riveting. -- Riveting operations shall be carefully performed to ensure that rivets are tight and satisfactorily headed.

3.5.5 Clean-Up. -- The XMC-364 shall be throughly cleaned of metal chips and other foreign materials after final assembly. Burrs and unnecessary sharp edges shall be removed from all parts prior to assembly.

3.5.6 Soldering. -- Solder joints shall be such that both a positive electrical and a strong mechanical connection is assured. Soft soldering shall be done in accordance with MIL-S-6872, with the exception of the solder and flux limitations specified in 3.5.6.3.

3.5.6.1 Mechanical Strength. -- No assembly of soldered joints shall depend solely on soft solder for mechanical strength. Joints shall be mechanically secure before soldering, except when mechanically secure connection of small parts is impracticable.

3.5.6.2 Soft Solder. -- Soft solder shall be in accordance with QQ-S-571b, composition Sn70, Sn60, or Sn50. Compositions are indicated in the order of preference.

3.5.6.3 Solder Flux. -- Only rosin or rosin and alcohol in accordance with U.S. Army Sepcification 2-89A, Grade I shall be used as a flux for soft soldering or for cleaning soldering irons.

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3.5.7 Wiring

3.5.7.1 Hook-Up Wire: -- All hook-up wire shall conform to JAN-C-76, except as indicated by the responsible engineer of the Sandia Corporation. The size of wire shall be compatible with the electronic circuit in which it is used. No smaller wire than #22 shall be used without the approval of the responsible engineer. All special wires which are used in high current, video circuits shall be approved by the responsible engineer before being used.

3.5.7.2 Wire Connections. -- All wire ends shall be soldered at points of electrical connections and shall be mechanically secured before soldering, except when the small size of the wire or member to which the wire attaches makes a mechanically secured connection impractical, however such small mechanical connections shall be ample to hold the wire in place before soldering. Lugs or similar devices soldered to wire ends shall be used when electrical connections are made by clamping the conductor between parts. Such connections shall not be made by clamping wire ends between parts. Lugs or similar devices shall not be clamped between a metallic and an insulating material but shall be clamped between metallic members. Lugs of either the soldered or solderless type and similar devices may be used but shall be soldered to the wire ends and shall be mechanically secured to the wire by crimping the wire upon the terminal or the terminal upon the wire before soldering.

3.5.7.3 Insulation Hazards. -- Whenever wires are run through holes in metal partitions, shields and the like, less tha 1/8 inch in thickness, the holes shall be equipped with suitable grommets for mechanical protection of insulation otherwise subject to abrasion. Panels 1/8 inch or more in thickness either shall have grommets or shall have the hole edges rounded to a radius equal to one-half the thickness of the material or equal to the diameter of the largest wire running through the hole. Care shall be exercised in the running of hook-up wire to ensure that it is not carried over or bent around any sharp corner or edge which might in time cut through the insulation. In order to prevent deterioration of the conductor by heat, care shall be taken to ensure that wiring is not exposed to local temperatures and that it cannot come in direct contact with heated parts.

3.5.7.4 Interior Cabling. -- Conductors shall be bound into a cable whenever possible and securely held by means of wraplock, cord, or other suitable means. Cables shall be securely held in place by cable clamps.

3.5.7.5 Exterior Cabling. -- Cables used to interconnect equipment outside of enclosing cabinets shall be fabricated in accordance with SCS-4.

3.5.7.6 Coding. -- All wiring shall be distinctly coded by means of numbers on each end and color coded.

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3.5.8 Brazing. -- Brazing shall be in accordance with MIL-B-7883.

3.5.9 Welding. -- All welding shall be performed in accordance with Chapter 60, Standard Qualification Procedures, of the American Welding Society Handbook (1950 Edition). The vendor shall have established his Procedure Qualification in accordance with Part I, and shall employ welding operators who have been qualified under Part II, Operator Qualification. The vendor shall be responsible for the quality of the welding performed by his organization and for the welding of his subcontractors.

3.6 General Design. -- The vendor shall design the XMC-364 subject to the requirements of this specification. This specification is detailed only to the extent considered necessary to obtain the desired mechanical, electrical, and performance characteristics and ensure the continuance of these characteristics. The design, layout, and assembly of the XMC-364, its components and their parts shall be such as to facilitate quantity production.

3.6.1 Interchangeability. -- Where suitable standard parts satisfy the requirements of the design of the XMC-364, the design shall not be based upon parts of special design. When equivalent parts are available from several manufacturers, the design shall not preclude the use of any of these parts. Limitations on the operation of parts and tolerances on dimensions included in the design shall be sufficient to accomodate a maximum use of various replacement parts that will operate in accordance with the requirements of this specification.

3.6.2 Adjustments. -- The XMC-364 shall be designed so that it requires a minimum of adjustment after it has been assembled. If adjustments are required after final assembly, they shall be convenient to effect under all service conditions, including those under which an operator is required to wear standard service gloves.

3.6.3 Mechanical Stability. -- The XMC-364 including its adjustment controls, shall be so designed that the position of a part or control does not change, except as required for the assembly to function as required in 3.7 when subjected to the conditions of 3.8.

3.6.4 Operating Temperature of Parts. -- When tested in accordance with 4.2.2, the maximum operating temperature, for each standard part and permitted nonstandard part shall not exceed the maximum temperature for which the part is designed.

3.6.5 Size, Shape and Weight. -- The maximum size of the XMC-364 shall be within a cylinder 24 inches in diameter and 24 inches in length. This is the maximum over-all outside dimension including mounting structures and cable connector protrusions. The maximum weight of the XMC-364 shall be 150 pounds. This weight shall include the weight of any pressurizing agent at 30 to 60 psi gage, if used.

3.6.6 Expected Life. -- The XMC-364 shall be capable of 46 operations in accordance with 4.2.1 without degradation of performance specified in 3.7 under the conditions of 3.8. Any of the first 45 operations may occur during or after the storage periods indicated in 3.8.3. The probability that the 46th operation shall be a malfunction shall not exceed 1 in 200 operations. The probability of malfunction occuring in any of the operations prior to the 46th operation shall also be 1 in 200 operations.

3.6.7 Safety. -- The XMC-364 shall be designed to provide maximum safety for maintenance and operating personnel. Adequate markings shall be located on equipment as warnings of mechanical, electrical, and nuclear radiation safety hazards as near the hazardous points as possible.

3.6.8 High Voltages. -- The XMC-364 or any of its components that is operative when separated from the XMC-364 shall either be designed so that operating or maintenance personnel cannot intentionally or accidentally contact voltages that are dangerous to life, or be suitably marked to warn personnel of the location of such voltages.

3.6.9 Convenience. -- The XMC-364 shall be designed to afford maximum accessibility for the replacement, adjustment and testing of its components without the necessity for disconnecting or removing interposed electrical or mechanical parts.

3.6.10 Interference. -- The XMC-364 shall comply with the requirements of MIL-I-6181 governing generation of and susceptibility to radio frequency interference voltages and fields.

3.7 Performance Requirements

3.7.1 Primary Power

a. The XMC-364 shall operate from a 400 cps ± 5 per cent power source at 115-v ± 10 per cent.

b. The XMC-364 shall operate to its intended use, in any position after a 30 second warm up period. The XMC-364 power load shall not exceed 140 watts except during short surges. Two such short surges shall be allowed in a 30 second period; the time between surges shall be a minimum of 10 seconds. A short surge shall not exceed 225 watts peak and its duration shall not exceed 3 seconds before falling off to one half of the peak of the surge. Power as a function of time requirements are shown in Figure 1. At time A the XMC-364 is turned on; at time B auxiliary equipment used with the XMC-364 is turned on. Time B shall occur at least 5 seconds before time C. The XMC-364 shall operate to its intended use after time C. Time B shall follow time A by a minimum of 10 seconds.

c. No fuses shall be used in the primary power circuit for protective purposes.

d. The XMC-364 shall not malfunction or operate prematurely to its intended use in accordance with 1.1 from signals generated in the primary power supply.

e. A regulator is required to maintain the specified voltage. The voltage regulator shall be capable of the output requirements as given in Figure 1. Regulation during short surges is not required to the accuracy indicated in (a) above. The output voltage of the regulator will nominally be 90 volts ± 1 per cent. All circuits in the XMC-364 which operate directly from the AC power supply shall be designed for 90 volts ± 1 per cent input.

f. The intended use of the XMC-364 shall be in accordance with 1.1. The performance of the XMC-364 shall be tested either by the initiation of a nuclear weapon, or by a measuring device which indicates the proper magnitude of the neutron yield at the proper time.

Watts Required by XMC-364 and Auxiliary Equipment

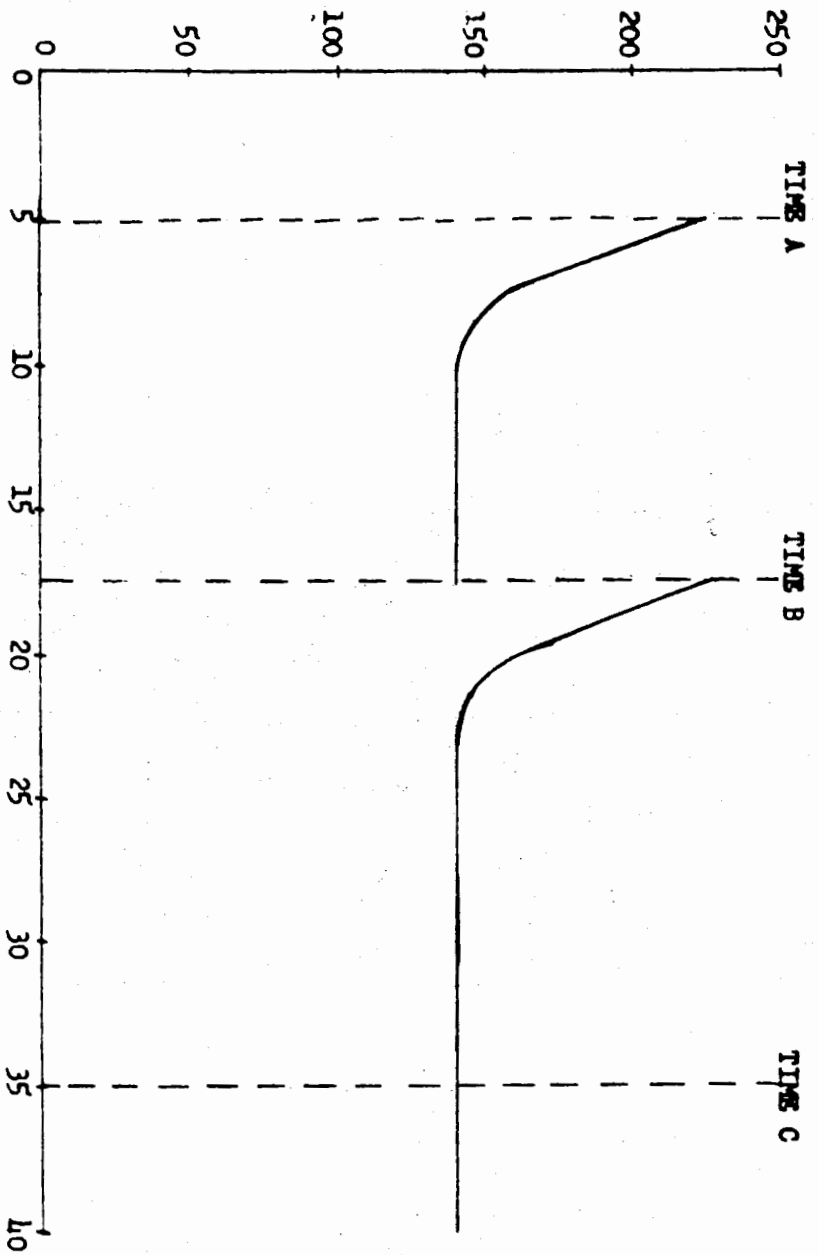

FIGURE 1

3.7.2 Output Intensity. -- The XMC-364 neutron yield and timing requirements are specified as follows:

DOE
b(3)

3.7.3 Operation. -- The XMC-364 shall be capable of the specified output when the following signals are supplied to the XMC-364 and when the following conditions exist in the XMC-364.

3.7.3.1 Initial Signal. -- The XMC-364 including the precision timer shall be capable of the specified output 30 seconds after the primary power is available and after being supplied by a suitable pulse. The initial signal shall be an electronic device which generates signals of the form shown in DS(5330)24289. One of these signals shall be used as the initial pulse. The initial pulse shall be reshaped for use as required. The initial signal shall have the following characteristics:

a. The amplitude of the initial signal shall be a minimum of 300 volts and a maximum of 750 volts.

b. The rise time of the initial signal shall be a maximum of .05 microseconds. The rise time of the signal is the time required for the amplitude of the signal to increase from 0.1 to 0.9 of its maximum value.

c. The maximum length of the pulse shall be 30 microseconds and the minimum length shall be 0.5 microseconds. The pulse length is the time interval between the two 0.1 maximum value points of the signal.

d. The output impedance of the signal generator shall not exceed 2500 ohms. A signal of less than 10-v peak amplitude shall not initiate the operating cycle of the XMC-364.

3.7.3.2 Precision Timer. -- The initial signal shall start a precision

DOE 6(3)

3.7.3.3 Source Gap Circuit. -- Upon receipt of the delayed signal from the precision timer, a 0.015 microfarad capacitor which has been charged to 17 kv ± 3 per cent shall be discharged into the source of the accelerator tube. This energy produces ions in the vicinity of the source. The discharge shall be initiated by a spark-gap.

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3.7.3.4 Target Pulse Delay. -- The delayed signal from the precision timer shall be delayed so that maximum yield from the XMC-364 results, and this delayed signal shall be used to fire the target spark-gap.

DOE 6(3)

delay does not include the target spark-gap delay.

3.7.3.5 Target Pulse Generator. -- Upon receipt of the delayed signal in 3.7.3.4, a 0.21 ± .03 microfarad capacitance which has been charged to 17 kv ± 3 per cent shall be discharged into the primary of a step-up pulse transformer. The output of the pulse transformer shall be such that the neutron yield in 3.7.2 is obtained. The capacitor is discharged by a spark-gap.

3.7.4 XMC-364 Components. -- The XMC-364 shall consist of the following major components.

3.7.4.1 Voltage Regulator. -- The input to the voltage regulator shall be obtained for a power supply which is capable of supplying the required power as specified in 3.7.1. The voltage regulator shall supply 90-v RMS at 400 cps ± 5 per cent with a maximum variation in voltage of ± 1 per cent. The voltage regulator shall also supply peak regulated power which is proportional to the RMS power. The power supplied shall be as follows:

1. 90-v RMS - 100 watts

2. 90-v Peak - 40 watts

The time required for the voltage regulator to smooth a stop load of 50 watts shall be a maximum of 2 seconds. The voltage regulator shall be capable of the specified output up to and after 90 days storage with no adjustments made when the regulator is removed from storage.

3.7.4.2 High Voltage Power Supply. -- The input to the high voltage power supply shall be obtained from the voltage regulator. The input shall be:

90-v peak proportional to RMS and 90-v RMS AC ± 1 per cent, 400 cycle ± 5 per cent.

The output voltage shall be used to charge the source capacitor and the target capacitor. The target capacitor, which is .21 microfarad ± 0.05 microfarad, shall be charged to a minimum of 16,500-v and a maximum of 17,500-v. The voltage shall not vary more than ± 1 per cent when set between these limits. The target capacitor shall charge to within 98 per cent of the set voltage in a maximum of 10 seconds. The maximum charging current shall be 6 ma. The source capacitor which is a .015 microfarad ± .005 microfarad shall charge to a minimum of 16,500-v and a maximum of 17,500-v. The voltage shall not vary ± 1.0 per cent when set between these limits. The source capacitor shall charge to within 98 per cent of the set voltage in a maximum of 10 seconds. 5 kv RMS ± 10 per cent at 500 microamperes shall be supplied to the accelerator tube's modified Phillips Ion Gage.

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3.7.4.3 Low Voltage Power Supply

3.7.4.3.1 Input. -- 90-v ± 1 per cent RMS AC, 400 cycle ± 5 per cent.

3.7.4.3.2 Output. -- The output shall include all regulated DC voltages to the precision timer, the voltage regulator, and the trigger circuits in the source gap. The voltage shall be as follows:

+ 500 volts unregulated	10 milliamperes
+ 300 volts regulated	75 milliamperes -1 per cent regulated
- 105 volts regulated	10 milliamperes - VR tube regulated

The filament power for all tubes in the XMC-364 will be obtained from a 6.3-v, 10 ampere source.

3.7.4.4 Source-Gap Circuits. -- The source-gap circuit shall include:

a. Source capacitor of 0.015 ± .005 microfarads

b. Source spark-gap

c. Source spark-gap trigger, trigger transformer

The source-gap circuit shall be in accordance with drawing DS(5330)24288.

3.7.4.5 Target Pulse Delay. -- The function of the target pulse delay is given in 3.7.3.4. The target pulse delay circuit shall be in accordance with drawing DS(5330)24288.

3.7.4.6 Target Gap Circuit. -- The target gap circuit shall consist of:

a. A 0.21 ± .05 microfarad capacitor which is charged to 17 kv ± 3 per cent negative with respect to ground.

b. A target spark-gap which when triggered discharges to 0.21 microfarad capacitor in (a).

c. A spark-gap trigger transformer which when supplied with a pulse triggers the spark-gap in (b).

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3.7.4.7 Precision Timer. -- The precision timer specifications shall be in accordance with SC-5107-Sp.

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3.7.5 Pressurized Tank. -- Should the XMC-364 be pressurized, a maximum of 75 psig is allowed. A dry insulating gas shall be used for pressurizing. There shall be no loss of pressurizing gas under all environmental conditions for a minimum period of 90 days such that will produce an electrical failure, malfunction or degradation of performance.

3.8 Environmental Conditions. -- The XMC-364 shall be designed to function as specified in 3.7 without malfunctioning under the conditions in 3.8.1 and after being subjected to the conditions of 3.8.2.

3.8.1 Operating Environment

3.8.1.1 Temperature. -- Temperatures ranging from -90° to +165°F. *

3.8.1.2 Humidity. -- Moisture conditions including:

a. Relative humidities ranging from 30 to 100 per cent and/or condensation at any temperature from -90° to +165°F. *

b. Relative humidities decreasing linearly from 30 per cent at +85°F to 2 per cent at +165°F.

3.8.1.3 Altitude. -- Barometric pressures ranging from 30 to 3.44 inches mercury absolute, (50,000 ft.), for 20 hours at any temperature between -90° to +165°F. The unit shall operate in its pressurized container.

3.8.1.4 Vibration. -- For as long as a total of 20 hours at any temperature between -90° and +165°F in any direction as follows. (Maximum amplitudes or accelerations occur for only a small percentage of the 20 hours. During the remainder of the 20 hours, the amplitude or acceleration may vary between zero and the maximum given below.)

Condition	Frequency range(cps)	Constant acceleration or double amplitude (g or inches)
1	3-10	0.098
2	10-30	0.109
3	30-60	0.054
4	60-500	10 g

3.8.2 Nonoperating Environment

3.8.2.1 Rain. -- Rainfall of approximately four inches per hour for a two hour period.

3.8.2.2 Marine Atmosphere. -- Exposure and storage conditions generally encountered on a wharf or dock adjacent to a large body of salt water for six consecutive days.

3.8.2.3 Dust and Sand. -- Conditions encountered in desert atmospheres containing sand and dust particles.

3.8.2.4 Fungus. -- Tropical atmospheres containing fungus spores.

3.8.2.5 Altitude. -- Barometric pressures ranging from 30 to 3.44 inches mercury absolute (50,000 ft.).

3.8.2.6 Transportation Vibration. -- Vibration from 10 to 200 cps at amplitudes to produce an acceleration of approximately 5 g in any direction with the assembly installed in its shipping container.

3.8.2.7 Handling Shock. -- Handling shocks which may occur with the assembly installed in its shipping container up to 30 g.

3.8.3 Storage Conditions. -- The XMC-364 may be subjected to the following storage conditions. These conditions are included as information to be considered in the design.

a. Storage for five yeats at temperatures ranging from ± 20° to +90°F and at relative humidities of less than 40 per cent.

b. Storage for six months at temperatures ranging from -90° to +165°F. Moisture conditions may consist of relative humidities ranging from 30 to 100 per cent and/or condensation between -90° and +85°F to approximately 2 per cent at 165°F.

c. Storage for fifteen consecutive days at temperatures ranging from 85°F +112°F with humidities ranging from 30 to 90 per cent.

4 SAMPLING, INSPECTION AND TEST PROCEDURES

4.1 Authorized Inspector, Test Facilities and Records. -- Inspection of the XMC-364 in accordance with the requirements of this specification may be performed at the vendor's establishment by an inspector designated by the Sandia Corporation. The vendor shall place inspection facilities at the disposal of the inspector and shall assist him as required. Tests required of the vendor shall be performed using test equipment having accuracies commensurate with the requirements of this specification. Tests required to be performed by the vendor may be performed by an agency chosen by the vendor and approved by the Sandia Corporation. Accurate records of all tests shall be kept by the vendor and shall be available to the Sandia Corporation at all times. Signed copies of these test records shall be supplied the Sandia Corporation upon request or at the completion or termination of the contract.

4.2 Tests. -- Test chambers shall have a volume of at least twice that of the equipment being tested therein and shall be arranged so that no radiant heat or circulating air impinges directly on the equipment. Unless otherwise specified, tests shall be performed at ambient laboratory atmospheric conditions.

Unless otherwise specified, maximum allowable tolerances on test condition measurements shall be as follows:

Barometric Pressure: ±5 per cent of the pressure specified in inches of mercury.

Temperature: ±5°F.

Relative Humidity: ±5 percentage points.

Vibration Tolerance:

Amplitude: ±5 per cent.

Frequency: ±2 per cent.

4.2.1 Functional Test. -- A signal generator which simulates the initial signal 3.7.3.1 shall be connected to the XMC-364 for this test. Apply the 400 cycle ±5 per cent, 115-v ± 3 per cent power. After 30 seconds a pulse from the initial signal generator shall be applied to the input of the XMC-364. The resulting output shall be equal to or better than that described under 3.7.2 when measured with the neutron counting system. DOE 6(3)

The pulse shape shall be measured in accordance with 3.7.2 (a).

4.2.2 High Temperature Test. -- The XMC-364 shall be placed in a suitable chamber. The chamber shall be raised to 165°F at a relative humidity of not more than 5 per cent and the XMC-364 stabilized at this temperature. While the XMC-364 is at this temperature it shall meet the requirements of 4.2.1.

4.2.3 Low Temperature Test. -- The XMC-364 shall be placed in a suitable chamber having a relative humidity of 50 per cent at a temperature of 73°F. The temperature shall be reduced to -90°F and the mechanism stabilized at this temperature. While the XMC-364 is at this temperature it shall meet the requirements of 4.2.1.

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4.2.4 Humidity Test

4.2.4.1 Preconditioning. -- The XMC-364 shall be placed in a chamber which has been preheated to 130°F and has a relative humidity of 15 per cent. The XMC-364 shall remain in the chamber for a period of 24 hours. Immediately upon withdrawal the XMC-364 shall be placed in a suitable humidity chamber and subjected to five humidity cycles in accordance with 4.2.4.2.

4.2.4.2 Humidity Cycle. -- While the XMC-364 is in the chamber, the humidity shall be maintained at 90 to 98 per cent relative humidity throughout the following cycle:

a. The temperature shall be raised to 149°F within 4 hours and maintained at this point for 8 hours.

b. The temperature shall then be reduced to 86°F within 4 hours and maintained at this point for 21 hours. Between the 8th and 12th hours after stabilization at 86°F, the XMC-364 shall meet the requirements of 4.3.1.

c. The temperature shall be reduced to 68°F within one hour and maintained at this point for 4 hours.

d. The temperature shall then be raised to 86°F within one hour and maintained at this point for 5 hours.

4.2.4.3 Inspection Following Test. -- Upon completion of the humidity test, the XMC-364 shall meet the requirements of 4.2.1. Parts thereof shall be inspected for deterioration of materials, such as corrosion and water absorption, or potential deterioration because of accumulation of moisture.

4.2.5 Salt Spray. -- The XMC-364 shall be tested in a salt spray chamber in accordance with MIL-E-5272, Section 4.6 for 50 hours. Upon completion of the test the assembly shall meet the requirements of 4.2.1 and shall be visually inspected for deterioration of materials, e.g., corrosion.

4.2.6 Dust and Sand. -- The XMC-364 shall be tested in a dust chamber in accordance with MIL-E-5272, Section 4.11, Procedure I. Upon completion of the test the XMC-364 shall meet the requirements of 4.2.1.

4.2.7 Vibration

4.2.7.1 Resonant Frequencies. -- Prior to the vibration tests specified herein, the mechanical resonant frequencies of the assembly and/or its components shall be determined by cycling through the frequency ranges of 10 to 60 to 10 cps and 60 to 500 to 60 cps at low amplitude. If any serious resonant conditions (as evidenced by extreme amplitudes) are detected, the assembly and/or its components shall be redesigned to eliminate or minimize resonance. Prior to redesign the Sandia Corporation shall be consulted. Upon the written approval of the Sandia Corporation, vibration isolators (e.g., shock mounts) may be used.

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4.2.7.2 Equipment Operating/Nonoperating Tests. -- The complete assembly (with its approved vibration isolators if any) shall be secured to a vibration table in the manner it will be mounted in service, and shall be vibrated in each of three mutually perpendicular planes under the following test conditions:

Condition	Frequency range(cps)	Constant Acceleration or double amplitude (g or inches)	Duration of cycle (minutes)	Duration of test (minutes)
1	3-10-3	.098	5	25
2	10-30-10	.109	5	25
3	30-60-30	.054	15	25
4	60-500-60	10 g	15	45

The assembly shall meet the requirements of 4.2.1 during the last few minutes of vibration under each condition in each of three planes.

4.2.8 Acceleration and Shock

4.2.8.1 Acceleration. -- The assembly shall be mounted on a spin table and subjected to a constant acceleration of 50 g for at least one second applied in both the fore and aft directions. The fore and aft line is defined by the mounting arrangement of the assembly with respect to and is parallel to the line of forward motion of the carrying vehicle. The assembly shall meet the requirements of 4.2.1 during the acceleration period.

4.2.8.2 Shock. -- The assembly shall be dropped 5 times from a height such as to produce an acceleration of 30 g in 11 ± 1 milliseconds in accordance with Figure 5 of USAF 7201. The assembly shall meet the requirements of 4.2.1 after this test.

4.2.9 Water Absorption Test. -- Materials which may absorb water shall be tested to determine the necessity of treatment in accordance with 3.3.4.1. Test strips of the material 1/8 inch thick 1 inch wide and 3 inches long shall be dried in an oven at 90°F for 24 hours. They shall then be immersed in water for a period of 24 hours. The strips shall be removed from the water, wiped dry, and immediately weighed. This weight shall be compared with the weight of the predried sample before immersion to obtain the water absorption characteristic (in per cent).

4.2.10 Rain Test. -- The assembly shall be tested in accordance with MIL-E-5272, Section 4.10.1. Upon completion of the test, the assembly shall meet the requirements of 4.2.1.

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5 PREPARATION FOR DELIVERY

5.1 Packaging. -- The XMC-364 shall be packaged to prevent damage in shipment by common carrier and ensure delivery in such a condition as to conform with all the requirements of this specification.

5.2 Marking. -- Each package shall be marked 'FRAGILE-HANDLE WITH CARE'.

6 NOTES

None

Notice: When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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