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.

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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-1B	Electron Tubes	SIG & SH

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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

3.3.3 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

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.

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.

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.

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).

DOE b(3)

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

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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.

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.

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.