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.

Page No.	Issue Date	Page No.	Issue Date
1	Original	15	Original
1a	6-22-53	16	Original
2	Original	17	Original
3	Original	18	Original
4	Original	19	Original
5	Original	20	Original
6	Original	21	Original
7	Original	22	Original
8	Original	23	6-22-53
9	Original	24	Original
10	Original	25	Original
11	Original	26	Original
12	Original	27	6-11-53
13	Original	28	Original
14	Original	29	Original

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

SECRET UNCLASSIFIED

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

SECRET

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.

SECRET

UNCLASSIFIED

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.

UNCLASSIFIED

SECRET

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.

XR SYSTEMS FOR OPERATION REDWING

INTRODUCTION

At the request of Los Alamos Scientific Laboratory and University of California Radiation Laboratory, Livermore Site, Sandia Corporation has prepared external initiator equipment for use in Operation REDWING. The external initiator equipment (XR) in general consists of a pulsed neutron source (S-Unit) similar to those used in Operation TEAPOT, designed and constructed by the General Electric X-Ray Department, a time delay circuit designed at Sandia Corporation and a power supply (MC 251 inverter). The purpose of this report is to describe the XR apparatus, systems and applications for Operation REDWING.

Requirements

The following is a summary of the shots for which XR is planned:

Shot Name	Ready Date	Responsible Laboratory	Device Being Initiated
LaCrosse	May 1	LASL	
Inca	June 8	UCRL	
Yuma	June 1	UCRL	
Kickapoo	June 18	UCRL	
Erie	May 23	LASL	
Seminole	May 28	LASL	
Flathead	June 2	LASL	
Blackfoot	June 7	LASL	
Mohawk	July 1	UCRL	
Huron	June 12	LASL	
Apache	July 1	UCRL	
Dakota		LASL	
Pawnee		LASL	

DOE 6(3)

For purposes of XR requirements the shots are broken into three groups. These groups are listed below with associated neutron requirements:

Type Group	Shot Name	Neutron Output per S-Unit	No. of S-Units Required
I			2
I			2
I			2
II			2
II			2
II			2
II			2
III			4
III			4
III			4
III			4
III			4
III			4

Four S-Units may be required

DOE 6(3)

Probability that the required number of neutrons will be furnished should be at least 95% and confidence level of this probability should be at least 95%.

DOE 6(3)

The exact desired time should be known three days prior to the ready date. This information should be directed to either B. J. Carr or N. J. Elliott, one of whom will be located on Paree Island, Building 415 after April 15, 1956.

Separation of the S-Unit from the HE systems has been left to the responsible laboratory in each case.

XR SYSTEM COMPONENTS

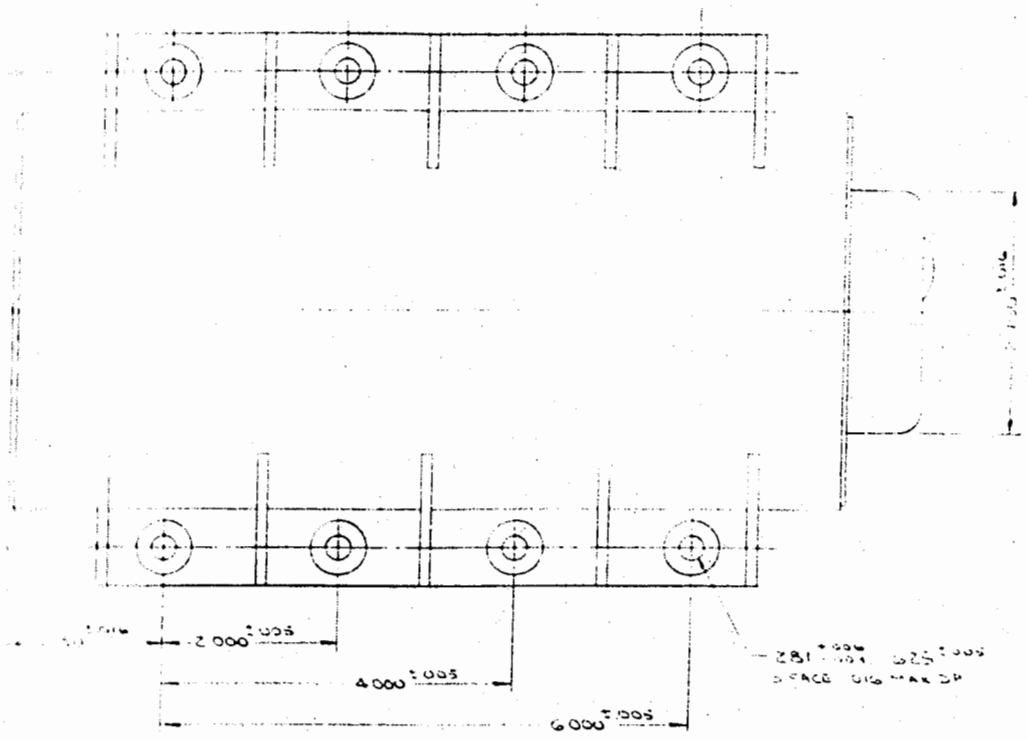
Each of the three XR systems to be used consists of several building blocks. These are (1) the neutron source (S-Unit), (2) the unit "B" junction box, and (3) the XR timer control box with time delay Unit "A". These parts are described in the next three sections.

The S-Unit

The pulsed neutron source unit S to be used in Operation REDWING is the S-5D unit which was developed by the General Electric X-Ray Department for Sandia Corporation. This unit has been described previously in the preliminary TEAPOT reports. It consists of a small pulsed linear accelerator which produces 14 MEV neutrons from an TD reaction.

DOE 6(3)

The entire unit is welded shut and is pressurized with SF_6. An outline drawing is shown in Figure 1. The size of



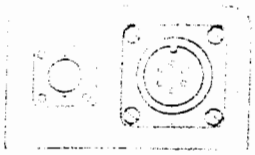
FIGUR

-5-

NOTES

PART NO. TABLE	REVISIONS				
	SYM	ZONE	DESCRIPTION	DATE	APPROVED
				1-6-84	

REF. SYM: 7223 (301)



A A

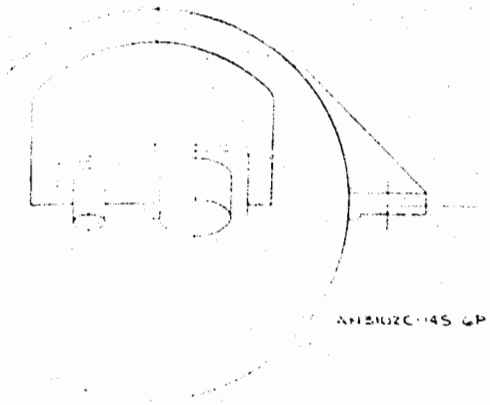


FIGURE 1

PART NO	MFR'S NO	DESCRIPTION	MATERIAL	MATERIAL SPEC	NOTE	ZONE	ITEM

LIST OF MATERIAL

PART CLASSIFICATION

DWG. CLASSIFICATION

OFFICIAL USE ONLY

UNCLASSIFIED

REQUIRED PER NOTED ASSY. (V DENOTES AS REQD)

MATERIAL APPD

ADDITIVE FINISH APPD

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
LIMITS APPLY OVER FINISH
SURFACE ROUGHNESS EXPRESSED AS RMS MICROINCHES
FOR TOLERANCES ON HOLES, RAW STOCK AND OTHER MFG. INFO. SEE SC-7012 ISPI
TOLERANCES ON:
FRACTIONS | DECIMALS | ANGLES

DRAWN
CHECKED RBM
APPD
APPD
APPD
APPD
APPD

CONTRACTOR APPROVAL
DRAWN | CHECKED | ENGR

TITLE
OUTLINE DRAWING FOR
XMC 624 (MOD S-5)

MFR'S DWG NO.

SCALE | RAW STK WT LBS | UNIT WT /LBS

SHOWN
OPPOSITE
SUPERSEDES
5Y | DWG SIZE D
DWG NO.
DS(1424)55088
SHEET OF

DS(1424)55088

the unit is approximately 4½" OD x 9" long. Figure 2 is a circuit diagram of the unit with abbreviated operating instructions included.

DOE 6(3)

[redacted] the quantity of neutrons produced varies from unit to unit and from shot to shot. Figures 3 and 4 show typical shot to shot records of two S-Units.

Units selected for use in Operation REDWING have been tested at least 100 times prior to their being shipped to the Pacific Proving Grounds. A record of these tests are recorded for each unit similar to those shown in Figures 3 and 4.

DOE 6(3)

The method of determining operation limits can be described by reference to Figure 5. This graph was taken from an article "Non-Parametric Tolerance Limits" by R. B. Murphy and may be used for analysis of a group of data which is continuously distributed (for all practical purposes this describes S-Unit test data).

This graph is plotted for $\alpha = .95$ or a confidence level of 95%. [redacted]

DOE 6(3)

[redacted] In Figure 5 the population, n is plotted on the abscissa and 124 is circled. One traces the curve fan M=3 from b to B where it crosses the population number.

DOE 6(3)

[redacted] In Figure 5, the population is 100 and M is 1. Follow the curve for M=1 from c to C where it crosses n = 100.

DOE 6(3)

Operating Instructions: XR Timer - Control Box

The XR timer Control Box is a junction box for all XR equipment and contains (1) a 115V, 400 cps. power supply which operates from 28 VDC, (2) and interlock circuit which determines that the 115V supply is operating properly, (3) connections for the unit "B" plug - in time delays and (4) cable junctions to distribute power to the rest of the XR system.

A Block diagram of the control box is shown in Figure 6. This diagram shows the MC-251 inverter whose output can be set by a Variac. Current through the interlock relay is set so that if the inverter voltage is within operational tolerances the firing line is closed. The firing line is opened if the voltage is above or below the desired level. The input current to the control box is approximately 5 amperes and the system will operate properly if the DC voltage is from 24 to 32 volts at the inverter terminals. A photograph of an XR timer - control box with timers installed is shown in Figure 7. A Unit "B" is shown on top of the control box. A photograph of the control box with the cover removed is shown in Figure 8. In this view, the two plug-in timers can be seen, the MC-251 inverter, the variac, and the socket for the interlock relay.

FIGURE 3

DOE b(3)

FIGURE 4

DOE
6(3)

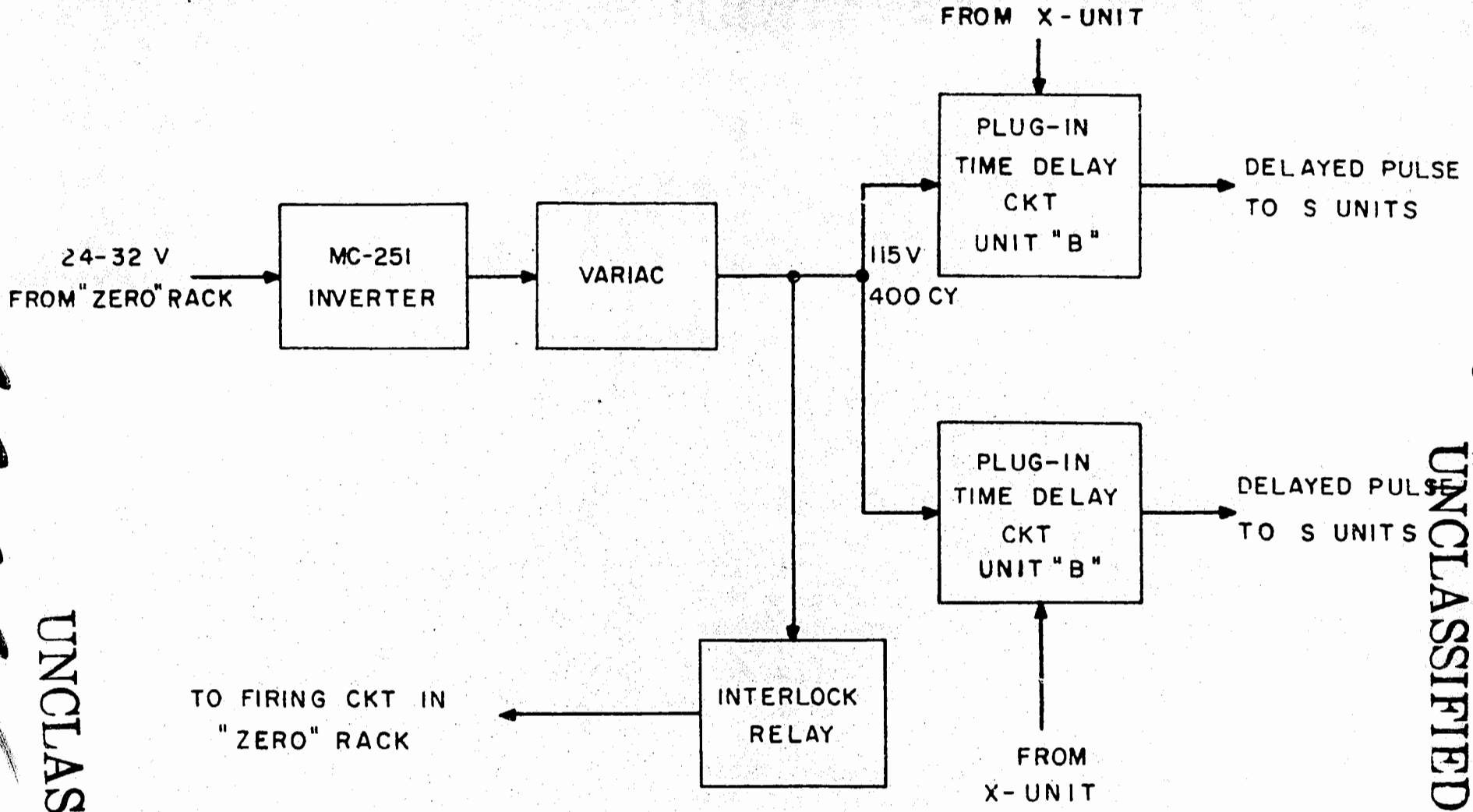


FIG. 6

BLOCK DIAGRAM OF XR-TIMER CONTROL BOX.

Ref. Sym: 7223 (301)

FIGURE 9

DOE
b(3)

UNIT "A" TIMER
TABLE I

DOE b(3)

DOE b(3)

This unit uses components with reasonably low temperature coefficients and no attempt has been made to temperature compensate the overall timer. It is suggested that warm-up times be limited to only five minutes as the unit will warm up about 20 degrees during the first hour and 10 degrees more during the next two hours. In any case one can expect repeatable time delays if the unit is operated under similar conditions of ambient temperature and warm-up time.

DOE b(3)

photograph of a complete time delay unit (Unit "A") is shown in Figure 10.

Operating Instructions - Unit "B"

Unit B is a combination junction box and pulse generating unit. It is intended to furnish AC power and triggering pulses to four S-Units. A circuit diagram of Unit "B" is shown in Figure 11.

400 cycle 115 volt power is delivered from the XR timer control box and timer output pulses are brought into the unit from the control unit.

These pulses are fed directly out again at trigger output plugs numbers 1 and 2. However, these two pulses are also used to produce delayed output pulses at trigger output, plugs numbers 3 and 4 respectively. Since the pulses are negative, pulse transformers are used to invert them.

DOE b(3)

It will be noted that the tubes have separate power supplies so that an output pulse is still produced if either system fails. In the event one tube fails the other tube should still give an output pulse.

It is intended that the timers (Unit "A") will be set so that four pulses will result and so that the pulses will interlace, i.e., 1 and 3 with 2 and 4. S-units may be paired up to take care of small differences in delay they may introduce. The short 0.4 to 1.0 usec delays are made from HH 4000 cable. A length of 4.25 inches provides 0.4 usec delay when used with the pulse transformer and 5727/2D21W output thyratrons.

When making up delay cables, care should be taken to avoid introducing inductance by having an unshielded coil. That is, the delay wire should be brought straight out from under the shield wires and not come out as a coil.

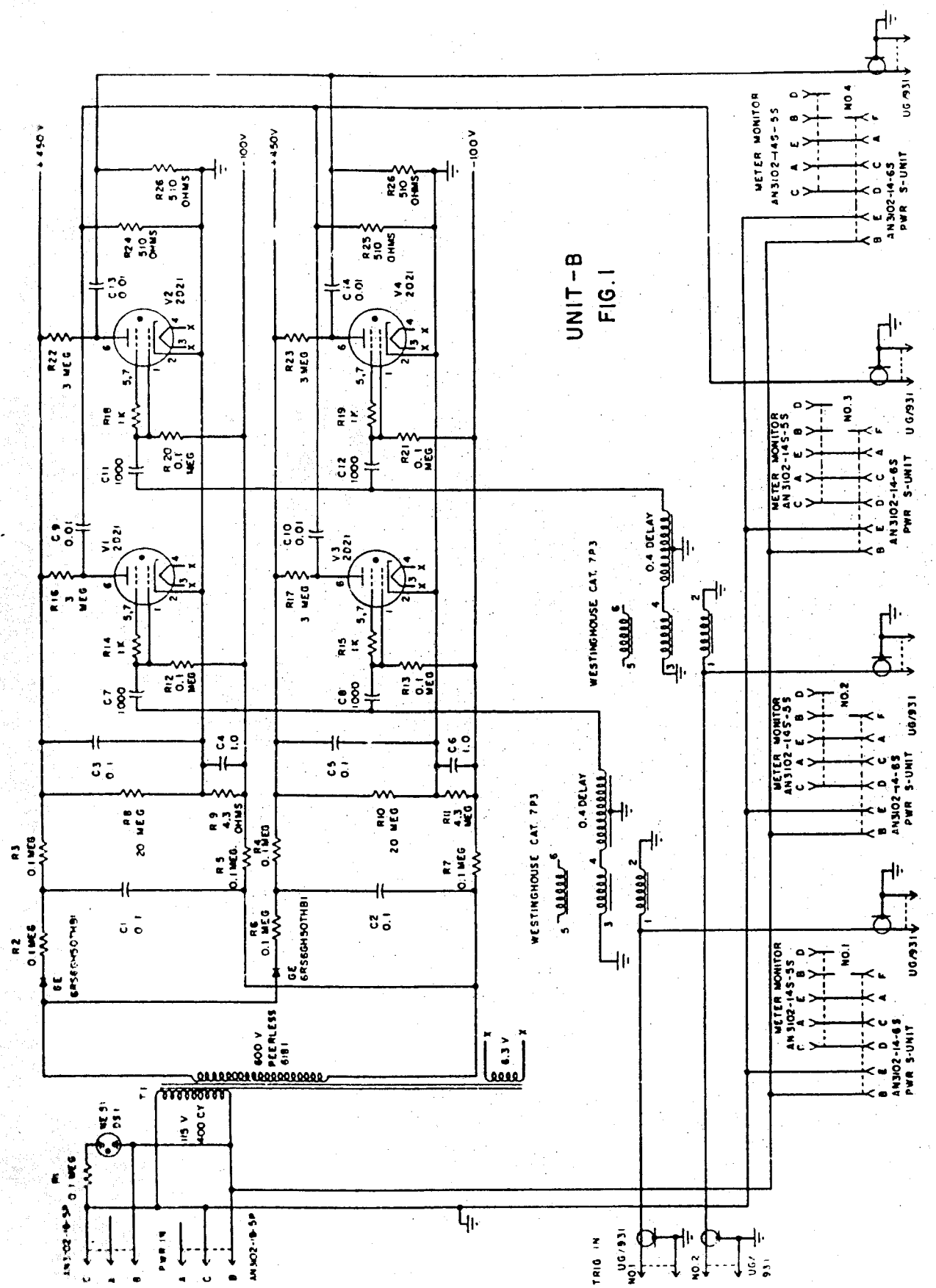

UNIT-B
FIG. 1
+450 V
-100 V
R22 3 MEG
R23 3 MEG
R16 3 MEG
R17 3 MEG
R24 510 OHMS
R25 510 OHMS
R26 510 OHMS
R18 1K
R19 1K
R14 1K
R15 1K
R20 0.1 MEG
R21 0.1 MEG
R12 0.1 MEG
R13 0.1 MEG
C13 0.01
C14 0.01
C9 0.01
C10 0.01
C11 1000
C12 1000
C7 1000
C8 1000
V1 2021
V2 2021
V3 2021
V4 2021
C3 0.1
C4 1.0
C5 0.1
C6 1.0
R8 20 MEG
R9 4.3 OHMS
R10 20 MEG
R11 4.3 MEG
R3 0.1 MEG
R5 0.1 MEG.
R6 0.1 MEG
R7 0.1 MEG
R2 0.1 MEG
C1 0.1
C2 0.1
GE 6RS6GH50THBI
600 V PEELESS 6181
6.3 V
T1
115 V 400 CY
WESTINGHOUSE CAT. 7P3
0.4 DELAY
METER MONITOR AN3102-145-5S
AN3102-14-6S PWR S-UNIT
UG/931
NO.1
NO.2
NO.3
NO.4
TRIG IN

FIGURE 11

INDIVIDUAL TIMER TEST PROCEDURE

Date_____ Timer S/N _____

Precision Timing Rack S/N _____

I. Preparation

(A). Precision Timing Rack

1. Connect AC power cable between regulated AC(105-125V) and Junction Box. _____

2. Turn on AC and DC Switches.

Model I power supply. _____

Model II power supply. _____

Junction Box _____

(allow fifteen minute warm-up time)

3. Turn on the Tektronix Scope and allow warm-up time of 10 minutes. _____

4. Turn on the SP-600 Receiver and perform 100KC Crystal Oscillator check with WWV (This check should be performed once a day before starting timer tests.) _____

5. Check divide by 10 circuit by observing wave shapes with scope. (Only once per day.) _____

(B). Cabling

1. AC power cable between timer and "S"-Unit Power Panel. (400 cycle 115V source.) _____

2. Trigger cable between timing Rack start connector and timer input. _____

3. Trigger cable between Timer output and Early-Late Timer input. _____

Ref. Sym: 7223(301)

"S" UNIT TEST PROCEDURE

Date_____ "S" Unit S/N_____

"Z" Unit S/N_____

"S" Unit Tester S/N_____

I. Preparation

(A). "S" Unit

1. Number of times "S" Unit previously fired. _____

2. No apparent physical damage to "S" Unit case or connectors.

3. Connect power cable between "S" Unit & tester 400 cycle A.C. power. _____

4. Connect trigger cable between "S" Unit and tester. _____

5. Connect current monitor panel to "S" Unit. _____

6. Position "S" Unit in tester mount against the moderator block. _____

(B). "S" Unit Tester

1. Connect A.C. power to scaler, scintillator power supply, and delay tester. _____

2. Connect D.C. power to inverter panel. _____

3. Connect power cable between the scintillator and the scintillator power supply. _____

4. Connect trigger cable from "Det Out" connector of delay tester to scintillator negative output connector. _____

Neg.-Positive SW on scintillator to Negative. _____

5. Position scintillator adjacent to "S" Unit. _____

(B). X.R. Control Box

1. X.R. Control chassis removed from X.R. carrying case. _____

2. Variac CCW. _____

(C). X.R. Timers

1. Connect jumper (or jumpers) for correct capacitance in LC timing circuit to give desired time range. _____

2. Install X.R. timers in X.R. control panel. _____

(D). Z-Units

1. Warm-up time (15 minutes) _____

2. Calibrate meters. _____

3. Place in position next to associated "S"-Units. _____

(E). Cabling

1. Connect D.C. power cable between X.R. Control Box and 30 Volt power supply. _____

2. Connect monitor cable between X.R. Control Box and Control Box Monitor. _____

3. Connect power cable (Channel #1) to X.R. Control Box, X.R. Timer and "S" Unit.

4. Connect power cable (Channel #2) to X.R. Control Box, X.R. Timer and "S" Unit. _____

5. Connect Current Monitor Panels

(a). Current Monitor Panel #1 to #1 "S" Unit. _____

(b). Current Monitor Panel #2 to #2 "S" Unit. _____

6. Scintillator

(a). Scintillator H.V. cable connected from power supply to input connector of scintillator. _____

(b). Scintillator output switch on positive. _____

(c). Scintillator output cable connected from positive output connector to "Photo-Mult" connector of early-late indicator. _____

Record the final time bracket as shown by the Early-Late Indicator.

High _____ Sec.

Low _____ Sec.

(I) JB trigger output #1 cable removed from Early-Late Indicator timer input and replaced with JB trigger output #3 cable. _____ Sec.

(J) Measure the JB output #3 time as close as possible with the Early-Late Indicator.

Record the final time.

High _____ Sec.

Low _____ Sec.

V. Timer Set #2

(A). J.B. trigger output #3 cable removed from the Early-Late Indicator timer input and replaced with J.B. Trigger output #2 cable. _____ Sec.

(B). Overall required XR time #2. _____ Sec.

(C). "S"-Unit #2 time delay _____ Sec.

(D). Approximate #2 timer set necessary to provide overall XR time. _____ Sec.

(E). Adjust V.F.O. until Display Counter reads #2 XR timer time. _____ Sec.

(F). Adjust timer controls until Early-Late indications flicker back and forth. _____

(G). Now vary the V.F.O. either side of the #2 XR timer time and establish the smallest possible Early-Late time bracket.

NOTE

(DOE b(3)

_____ Dial No's

VII. Functional Test (#3 S-Unit)

(A). Place Scintillator Adjacent to S-Unit #3. _____

(B).) DOE b(3)

_____ Sec.

(C). Fire S-Units by means of Manual trigger generator switch.

The Early lamp lights on the Early-Late indicator. _____

(D). Record output and reset the Z-Units) DOE b(3)

#1 _____ Reset _____

#2 _____ Reset _____

#3 _____ Reset _____

#4 _____ Reset _____

(E).) DOE b(3)

_____ Sec.

(F). Fire S-Units by means of Manual trigger generator switch.

The Late lamp lights on the Early-Late indicator. _____

(G). Record and Reset the Z-Units) DOE b(3)

#1 _____ Reset _____

#2 _____ Reset _____

#3 _____ Reset _____

#4 _____ Reset _____

(H). Overall XR time bracket. High _____ Sec.

Low _____ Sec.

VIII. Functional Test (#2 S-Unit)

(A). Place Scintillator adjacent to S-Unit #2. _____

(B).) DOE b(3)

_____ Sec.

NOTE

) DOE b(3)

XR ZERO POINT CHECKS

Shot _____

Date _____

I. Equipment

(A). Firing

1. "S" Units S/N #1 _____
#2 _____
#3 _____
#4 _____

2. X.R. Control Box S/N _____

3. Timers S/N #1 _____
#2 _____

4. Junction Box S/N _____

5. "S" Unit Trigger Cables:
L.R. Signal to Timers (2) _____
Timers to Junction Box (2) _____
Junction Box to "S" Unit (4) _____
OR Timers to "S" Unit (2) _____

6. "S" Unit Power Cables:
X.R. Control Box to Junction Box (2) _____
Junction Box to "S" Unit (4) _____
OR X.R. Control Box to "S" Unit (2) _____

7. X.R. Control Box to Zero Rack Cable _____

8. Record required time readings on page 5. _____

separation of 18".

2. Connect "Z" Units to A.C. Power.

3. Turn on "Z" Units to allow three minutes warm-up.

4. Connect power cables from the X.R. Control Box to the Junction Box and from the Junction Box to the "S" Units.

   OR connect power cables from the X.R. Control Box to the "S" Units.

5. Connect D.C. Test power cable from the X.R. Control Box to the Zero Rack Battery.

6. Connect the Control Box Monitor to the X.R. Control Box.

7. Connect the "S" Unit Current Monitor Meters to the Junction Box.

   OR To the "S" Units.

8. Connect "S" Unit trigger cables from the Timers to the Junction Box, and from Junction Box to the "S" Units.

   OR Connect from Timers to the "S" Units.

9. Connect trigger cables from the Pulser to the Timers.

10. Remove X.R. Control Box Chassis from carrying case and turn Variac completely CCW.

11. Check all equipment for proper geometrical arrangement.

B). Test

1. Turn on D.C. Power to the X.R. Control Box and adjust

Variac for 115 V. A.C. output. _____

2. Check the "S" Unit Monitor Currents:

	Initial P.I.G.	Charge
#1	_____ µamps	_____ µamps
#2	_____ µamps	_____ µamps
#3	_____ µamps	_____ µamps
#4	_____ µamps	_____ µamps

3. Check the setting of the Under-voltage relay:

Pull-in _____ Volts.

Drop-out _____ Volts.

4. Adjust Variac for 115 V. A.C. Output _____

(A). Record AC Voltage reading (X.R. Control Box) _____

5. Calibrate and reset "Z" Units _____

6. Fire the "S" Units with the Output from the Pulser and record "Z" Unit readings:

	Reading	Output
#1	_____ amps	_____
#2	_____ amps	_____
#3	_____ amps	_____
#4	_____ amps	_____

DOE b(3)

7. Disconnect D.C. Power to X.R. Control Box. _____

III. Functional Dry-Run

(A). Preparation:

1. Remove control box Monitor along with cable and place protective cap over control box connector.

2. Remove "S" Unit Current Monitor Meters and place protective caps over vacant cable connectors of Junction Box or Cable. _____

3. Remove "Z" Units and power cables. _____

4. Remove D.C. test cable between X.R. Control Box. _____

5. Connect cable between Zero Rack and X.R. Control Box. _____

6. Remove trigger cables from the Pulser and connect to Load Ring or the Isolation Boxes. _____

7. Place X.R. Control Chassis in carrying case and secure all latches. NOTE: Be careful not to disturb Variac dial setting. _____

8. Place "S" Units in mounts and check for proper spacing and location on the device. _____

9. Check geometry in relation to the Neutron Detectors with Project 13.3 Personnel. _____

10. Check final arrangement and all cable connections. _____

(B). Test

1. Required times for this shot:

#1_____Sec. #2_____Sec.

#3_____Sec. #4_____Sec.

2. Time Variation by the Microdial: _____

DOE b(3)

3. ~~Receive Arm Signal~~ from Control Point _____

Record D.C. Voltage. _____

Record Inverter Output Voltage. _____

4. Receive Fire signal from Control Point: _____

Record timing and output per Project 13.3

(a) Detector 1 _____ Sec. _____

_____ Sec. _____

(b) Detector 2 _____ Sec. _____

_____ Sec. _____

DOE b(3)

5. Check the delay times as recorded against those required:

(a) The times agree. _____

(b) If the time is off, adjust the Timer Microdial the correct amount as shown in step 2. _____

Repeat steps 3 and 4:

Receive Arm Signal: _____ V.

Record D.C. Voltage. _____ V.

Record Inverter Output _____ V.

Receive Fire Signal: _____

Record timing and output:

Detector 1 _____ Sec. _____

_____ Sec. _____

Detector 2 _____ Sec. _____

_____ Sec. _____

DOE b(3)

6. Disconnect equipment and place in case for protection.

Replace cover on control box. _____

Tests Conducted by: _____

Completion time: _____