KS-19557 DETECTOR
(NUCLEAR BLAST)
DESCRIPTION

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1. GENERAL

1.01 This section describes the KS19557 Detector intended for use at any hardened communications facility to provide warning of the detonation of a nuclear device prior to the arrival of the associated shock wave.

1.02 This section is revised to change test voltage requirements in 4.02 (2) (a) and (b), to revise 6.01, to change ground at R36 from chassis ground to earth ground, and to add a lead from 04 to 05 in front panel.

1.03 The detector basically consists of a radiation sensitive detection unit installed in a blastproof enclosure above ground level with the associated electronic equipment installed in a hardened facility below ground level. The detection unit and associated electronic equipment are connected by signal lines and dc power lines enclosed in one specially designed cable.

1.04 The KS-19557 Detector is designated list numbers 1 through 16 and 28 through 43. The list number to be used at any given facility is determined by the available dc supply voltage, whether the electrical equipment cabinet is to be wall or rack mounted, whether the facility is manned or unmanned, and whether the facility is situated above or below an elevation of 4500 feet. Each of the list numbers 1 through 16 and 28 through 43 identify a complete detection system. List numbers 17 through 27 and 44 through 47 identify the components of the system. List numbers 1 through 16 are for use at facilities located below 4500 feet in elevation and list numbers 28 through 43 are for use at facilities located above 4500 feet in elevation. List numbers 44 through 47 are special electrical equipment cabinets that are used in the high elevation detection systems of list numbers 28 through 43. All other components are interchangeable for high or low elevation systems.

1.05 The detector operates on power supplied by the facility batteries which prevent loss of protection provided by the detector should commercial power fail. The detection system is designed to operate on any one of the following: +152V dc, +130V dc, +48V dc, -48V dc, +24V dc, or -24V dc. For voltages other than ±24V dc, a separate voltage regulator unit is provided as a part of the detection system.

1.06 The electrical equipment cabinet can be mounted either in a 19-inch or larger equipment bay or on a wall. If mounted in the bay, shock mountings are not required on the electrical equipment cabinet since the entire equipment bay will be shock-mounted in accordance with standard hardening procedures. For wall

mounting, a special bracket with shock isolators is used.

1.07 For manned facilities, the detector is designed for manual reset after triggering. A three-minute time delay on reset is incorporated to prevent opening the blast valves as a shock wave is approaching. For unmanned facilities, automatic reset, after a 30 minute delay, is provided. For both manned and unmanned facilities, a key lock switch is provided to bypass the entire detector system allowing the blast valves to be opened if they have closed due to a failure in the detection equipment and also to allow the blast valves to be opened in an emergency. The key lock switch is designed so the key cannot be removed when the switch is in the MANUAL (bypass) position but can be removed with the switch in the AUTO position. Under normal operating conditions the key should be removed from the switch to prevent the detection system from inadvertently being bypassed.

2. DESCRIPTION

2.01 The KS-19557 Detector is a nuclear explosion detection system activated by the gamma radiation pulse released by the detonation of a nuclear device. The detection system consists of a detection unit, an electrical equipment cabinet, and a connecting cable.

2.02 The detection unit (Fig. 1) is shock-mounted within a shield assembly (Fig. 2) which is shock-mounted above ground. The detection unit and shield assembly are designed to withstand repeated blast overpressures of 50 pounds per square inch. The shield also provides adequate insulation to prevent high temperatures from damaging the scintillation plastic in the detection unit. The scintillation plastic can withstand temperatures up to 60°C for extended periods; however, the temperature of the plastic must never exceed 70°C.

2.03 Activation of the detection unit is caused by a gamma radiation pulse. The radiation pulse reacts with the scintillation plastic producing a light pulse which is picked up by a photomultiplier tube. After converting the light pulse to an electronic pulse, the tube and associated printed circuit board components amplify the signal and send it to the electrical equipment cabinet (Fig. 3) where an output relay is deactivated.

2.04 When the output relay opens, devices (blast shield, alarms, etc) connected to the detection system will operate to protect the facility. A fail-safe system is provided to ensure operation of the devices, should a dc power failure occur. The contact on the output relay is rated at a continuous 2-ampere resistive load at 250V dc.

Fig. 1—Detection Unit

Fig. 2—Upper and Lower Shield Assembly

2.05 The general location of the components of the KS19557 Detector is shown in Fig. 4 which depicts a typical hardened communications facility. Detailed installation information for the detector is given in KS-19557 Nuclear Blast Detector Installation Drawing, B-995326.

3. OPERATION

3.01 The following controls are provided on the front panel of the electrical equipment cabinet:

(a) ON-OFF switch—Controls all power to the detector.

(b) RESET switch—Following the proper time interval, resets the circuit after it has been tripped.

(c) TEST switch—Provides circuit test.

(d) TEST light—Flashing light when TEST switch is operated indicates proper functioning of detector. Continuous operation of the light indicates detector has tripped.

(e) EMERGENCY VALVE CONTROL, MANUAL/AUTO—A key lock switch that is operated to the AUTO position for normal operation. In the MANUAL position, the detector is bypassed ***and is no longer protecting the facility.***

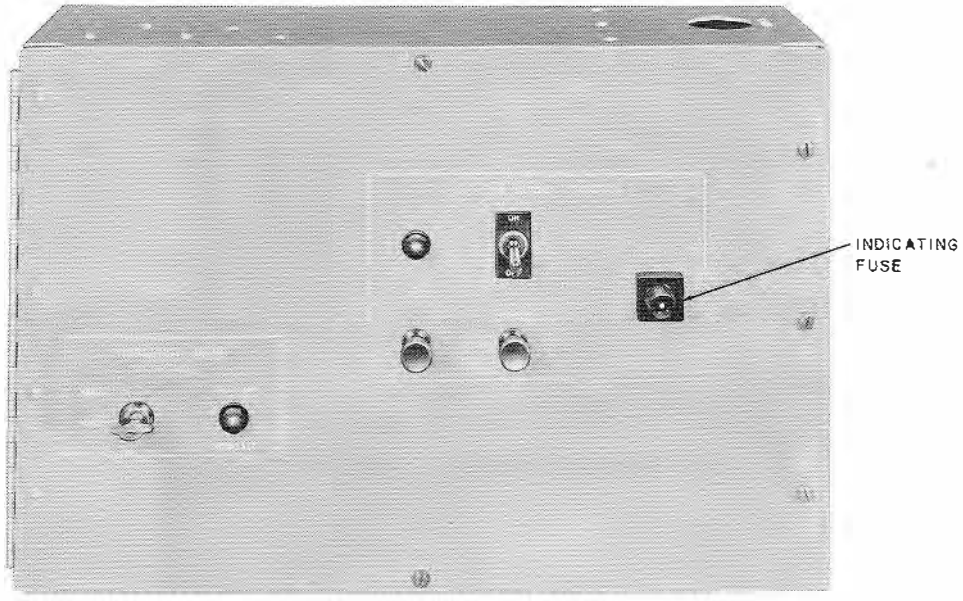


Fig. 3—Electrical Equipment Cabinet

(f) DETECTOR BYPASSED light—When lighted, indicates detector is bypassed.

(g) Indicating fuse—When operated, indicates overload or short circuit in equipment.

3.02 ***Operational Test on Detector System After Installation:***

(1) Test is to be performed prior to the attachment of station equipment that is to be detector controlled.

(2) Check to be sure B-995325 cable, connecting the electrical cabinet to the detection unit, is properly connected.

(3) Install the proper fuses in the electrical equipment cabinet and in the facility power distribution board at the designated location.

(4) EMERGENCY VALVE CONTROL switch should be in the AUTO position.

(5) Operate the detector ON-OFF switch to the ON position. The TEST light should light and glow continuously.

(6) After approximately 3 minutes, on most models, push the RESET switch. The TEST light should go out. In detectors wired for automatic reset, this step will be performed automatically by the equipment after a 30-minute interval rather than the 3-minute interval.

(7) Push and hold TEST switch. The TEST light should flash at approximately 1/2-second intervals.

(8) Operate the EMERGENCY VALVE CONTROL key lock switch to the MANUAL position. The DETECTOR BYPASSED light should light. Return the switch to the AUTO position.

(9) Station equipment may now be attached to the detector output.

4. TROUBLESHOOTING

4.01 Operate detector ON-OFF switch to the ON position. The TEST light should glow continuously. If it does not light, there is no power to the detector, the fuse is open, or the bulb is burned out.

4.02 Wait approximately 3 minutes then push RESET switch. (On the appropriate model, a 30-minute wait will be required.) If the detector fails to reset or if the TEST fails see 3.02 (7)]

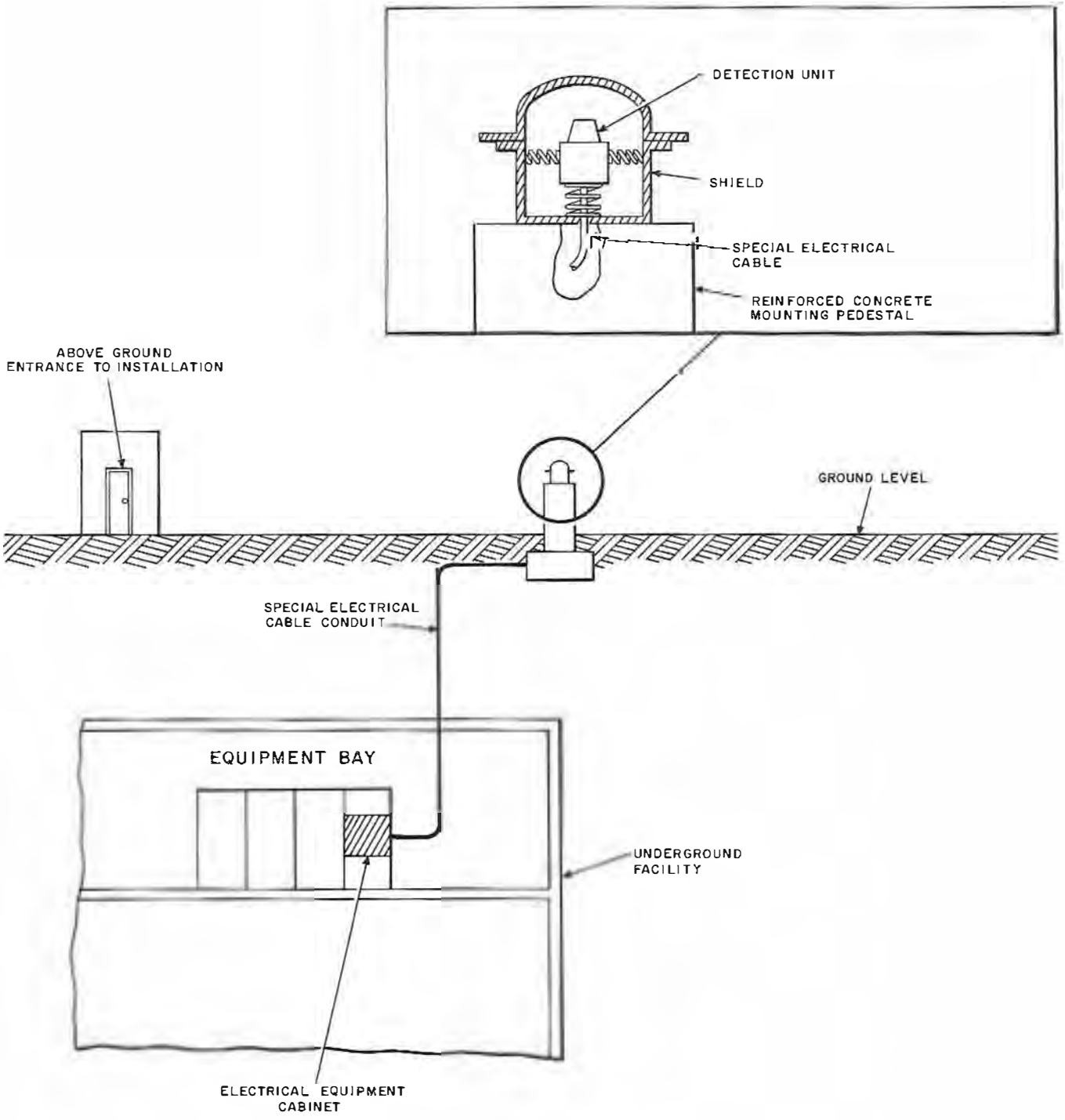


Fig. 4—Typical KS-19557 Detector Installation

after resetting is accomplished, proceed to the following steps:

(1) Keep the power on the detector.

(2) Set a VOM or VTVM to measure +24V dc.

(a) Connect the positive lead to TS2 terminal 1. Connect the negative lead to the chassis. If the voltage is ▶22◀ to 28 volts, the proper power is reaching the detector input.

(b) Move the positive lead to TS1 terminal 1. The voltage should be ▶24◀ to 26V dc.

Note: If the voltages (2) or (3) are incorrect, disconnect the cable that goes to the detection unit and remeasure the voltages. If the proper readings are then present, the cable, its connectors, or the detection unit are at fault.

(3) Set a VOM to the 250V dc scale. Connect the negative lead of the meter to TP1 located on the side of the high voltage compartment. Connect the positive lead to the chassis. For detectors designed for high elevation use, the meter should indicate between 119 to 137V dc. Voltages for all other detectors should be between 121 to 152V dc. The voltage for a given detector system is determined by the detection unit. One specific voltage is required for each detection unit [see 6.28 (5)]. If the meter indication is correct, the proper high voltage is being generated.

(4) Set a VOM to measure -130V dc. Connect the negative lead to the lower terminal of resistor R38. Resistor R38 is located on the bracket next to switch S4, on the inside of the front panel. It is the resistor farthest away from the switch. Connect the positive lead to the chassis. Depress the TEST button. The meter should indicate greater than 90V dc.

4.03 If the tests in 4.01 and 4.02 are satisfactorily completed and an oscilloscope is available, perform the following:

(1) Set oscilloscope as follows:

Horizontal—100 μsec/cm

Vertical—5 volts/cm

Trigger—internal positive

(2) Connect the ground lead to the chassis and the input lead to TB3 terminal E3.

(3) Depress and hold the TEST switch. The observed pulse should be at least 3.5V dc. If this pulse is present, the detector trouble is probably in the multivibrator circuit or the output relay (K1). If this pulse is not present, the trouble is in the cable or connectors to the detection unit or the detection unit itself.

5. MAINTENANCE OF ENVIRONMENTAL SHIELD

5.01 For the detector to function properly, should a nuclear explosion occur, the flame sprayed aluminum surfaces of the environmental shield must be kept clean.

5.02 The flame sprayed aluminum surfaces may be cleaned with soap and water and a soft bristled brush. Under no circumstances should these surfaces be given an organic finish.

6. PROCEDURE FOR DETECTION UNIT REPLACEMENT

6.01 ▶Should it become necessary to replace a detection unit, the high voltage converter located in the electrical equipment cabinet must be adjusted to the operating voltage requirement for the new detection unit. This adjustment must be made prior to using the detection system. The required operating voltage, which is stamped on the side of the detection unit directly below the serial number, should be recorded in place of the old requirement in the electrical equipment cabinet. It is imperative that this adjustment be made, as covered in 6.28, since each detection unit has a different operating voltage requirement.◀

6.02 ***List of Tools and Materials Required for Detection Unit Replacement:***

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
R-2812	3/16-Inch Allen Wrench
R-1060	Putty Knife
—	1-1/8 Inch Socket Wrench

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	Ratchet Wrench
—	6-Inch Screwdriver, Captive Type (see note)
—	Automobile Bumper Jack
—	P Long-Nose Pliers
—	Torque Wrench (capable of measuring 106 foot pounds)
—	Wood Blocks 3- by 1- by 1/4-inch thick (approximately) 2 required.
	Note: If a captive type screwdriver is not available use a 6-inch C screwdriver and a 606 Screw-Starter.
MATERIALS	
—	Heavy gauge plastic, cardboard, or other similar material to be used for padding on the lifting jaw of the bumper jack. Also, a large enough piece of the same material to be placed on the ground and used as a mat to protect the flame sprayed surface of the upper shield from chipping after it has been removed.
—	EC-1020 Sealer, Minnesota Mining and Mfg. Co., St. Paul, Minn.
—	8451 "O"-Ring, 15.50-inch O.D., Minnesota Rubber Co., Minneapolis, Minn. or Parker Seal Co. equivalent.
—	Protect-Sorb 121 Silca Gel, two 8-unit Lantuck Bags, Davison Chemical Co., Baltimore, Maryland.

REMOVING THE DETECTION UNIT

6.03 Remove the twelve 3/4 inch bolts.

6.04 Place a protective pad under one of the four handhold lugs of the upper shield and emplace the bumper jack with its lifting jaw under the lug.

6.05 Slowly jack up the upper shield until there is enough clearance to emplace the wooden blocks.

6.06 Remove jacks.

Caution: When handling the upper shield, exercise care to prevent chipping the flame sprayed surface. The shield cannot function properly under nuclear blast conditions unless its surface is clean and free from defects.

6.07 Partially lift out the upper shield and detection unit assembly and rest it at an angle in the lower shield to allow removal of the cable through the 4-1/2 inch hole in the bottom of the inner container. If properly placed, the operator should be able to see the connectors through the hole. Disconnect the two connectors and the ground wire.

6.08 Lift out the upper shield and detection unit assembly, invert, and place on the protective mat.

6.09 Remove the 15.50-inch "O"-ring and discard.

6.10 Remove silica gel packets. They can be reactivated for later use or discarded.

6.11 Clean off the majority of the EC-1020 sealant with a putty knife.

6.12 Through the hole in the bottom of the inner container, remove the five screws holding the detection unit to the 5-inch diameter spring. Save the screws.

6.13 Remove and save the 12 socket head screws from the upper shield, then remove and invert the inner container.

6.14 Release the 6 springs by applying the long-nose pliers on the loop at the detection unit end of the spring. Use care so as not to crush the insulation since it is easily damaged.

6.15 Remove detection unit. Do ***NOT*** lift using scintillator cone.

REPLACING THE DETECTION UNIT

6.16 Place the detection unit on the large spring properly oriented so the 8-pin connector is located next to the spring plate cutout.

6.17 Engage the 6 springs.

6.18 Place the inner container carefully on its side and secure the detection unit to the 5-inch diameter spring using the screws removed in 6.12.

6.19 Place the inner container on the inverted upper shield and attach it with the 12 socket head screws. Two 1/4-20 setscrews placed 180 degrees apart can be used to orient the container for easier assembly. They need not be removed if their height is equal to or less than the head height of the socket screws they replace.

6.20 Place a new 15.50-inch diameter "O"-ring in the groove on the lower shield.

6.21 Place the EC-1020 sealant on the lower shield.

6.22 Position the assembly at an angle as in 6.07 and attach the ground wire and connectors.

6.23 Remove the two 8-unit silica gel bags from their foil wrap and place in the bottom of the lower shield in the well created by the lower mounting ring.

6.24 Check the EC-1020 sealant placement.

6.25 Lower the upper shield assembly carefully into the lower shield orienting the bolt holes properly. Once the two surfaces meet with the entire weight of the upper shield, it will be impossible to reorientate them without again using the bumper jack as a lifting aid. (EC-1020 may also have to be replaced.)

6.26 Tighten the 3/4-inch bolts to 106 foot pounds of torque.

6.27 Check to be sure that the EC-1020 has squeezed out uniformly all around flange. Surface areas of the flange, which are not coated with the sealant, will rust since they contain no other protective coating.

ADJUSTING THE HIGH VOLTAGE CONVERTER

6.28 After replacing a detection unit, adjustment of the high voltage converter on the electrical equipment cabinet is necessary. The method of adjusting the high voltage converter is given in the following steps:

(1) Operate the ON-OFF switch on the front panel to the OFF position.

(2) Remove fuse from the front panel.

(3) Remove the screws and open the front panel.

(4) Remove the screws from the high voltage compartment cover located in the upper left hand corner of the electrical equipment cabinet, and remove the cover. The high voltage compartment is illustrated in Fig. 5.

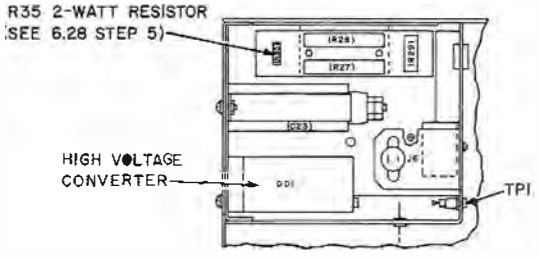


Fig. 5—High Voltage Compact—Cover Removed

(5) Refer to the correct detection unit voltage as stamped on the new unit. In some instances adjusting the electrical cabinet high voltage may require changing resistor R35. Check the value of R35. The following list shows values for R35 based on the required detection unit voltage and the limits of the high voltage converter.

R35 IN OHMS	DETECTION UNIT VOLTAGE
56,000	740 through 830
33,000	830 through 910
10,000	910 through 960

If necessary, change resistor R35.

(6) Remove the cap from the adjusting screw of DD1.

(7) Push out the adjusting hole plug in the right side of the compartment.

(8) To determine the correct voltage at TP1, multiply the high voltage required by the detection unit by 0.161. For example, a detection unit requiring 850V dc will produce a test point reading of 137V dc. Set the meter accordingly. Connect the negative lead of a dc voltmeter to TP1. Connect the positive lead to the chassis.

(9) Insert an insulated tool through the hole in the right side of the compartment and into the alignment screw in DD1. The tool should have a 1/8-inch wide screwdriver type end.

(10) Replace the high voltage compartment cover in order to engage the interlock.

(11) Replace the front panel fuse.

(12) Operate the ON-OFF switch to the ON position.

(13) Adjust DD1 by turning the insulated tool slowly until the meter indicates the correct test point voltage. (Turn clockwise to increase voltage.)

(14) Operate the ON-OFF switch to the OFF position.

(15) Remove high voltage compartment cover and replace the cap on the adjusting screw in DD1.

(16) Replace the plug in the side of the compartment.

(17) Replace the high voltage compartment cover.

(18) Replace the front panel.

7. SCHEMATIC AND WIRING DIAGRAM

7.01 Fig. 6 and 7 give the schematic and the wiring diagram for the KS-19557 Detector, respectively.

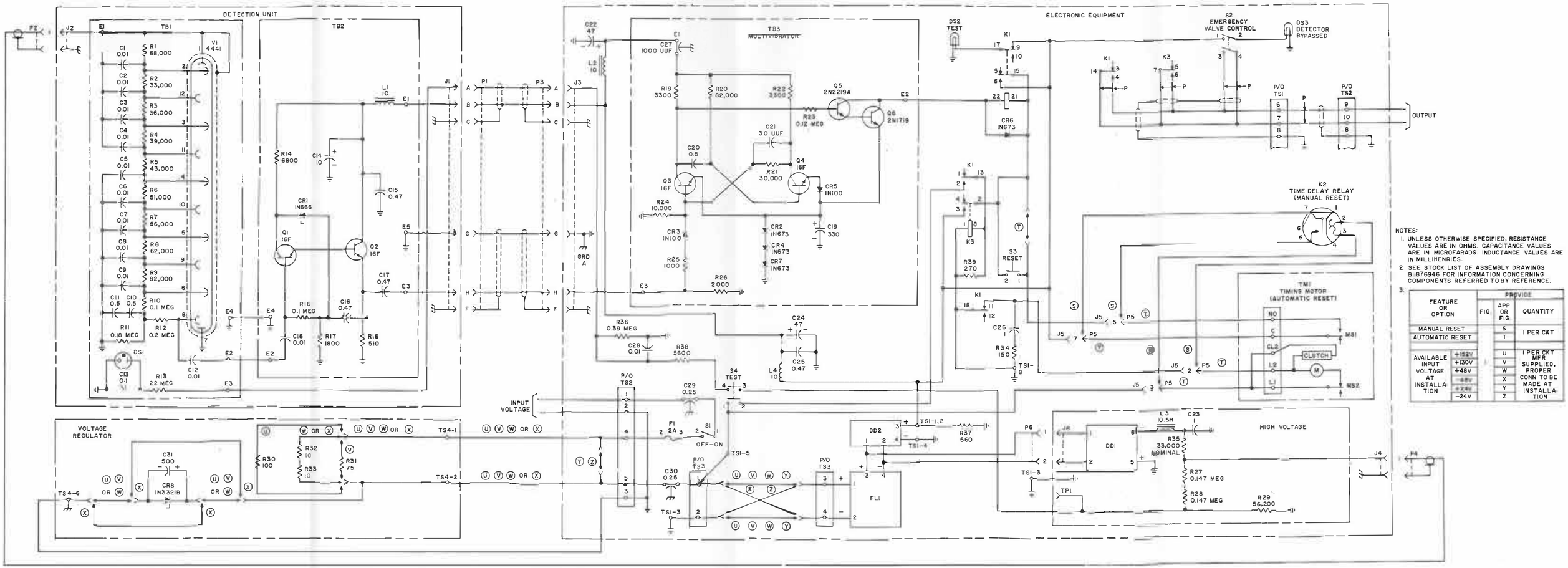


Fig. 6—KS-19557 Detector (Nuclear Blast) Schematic

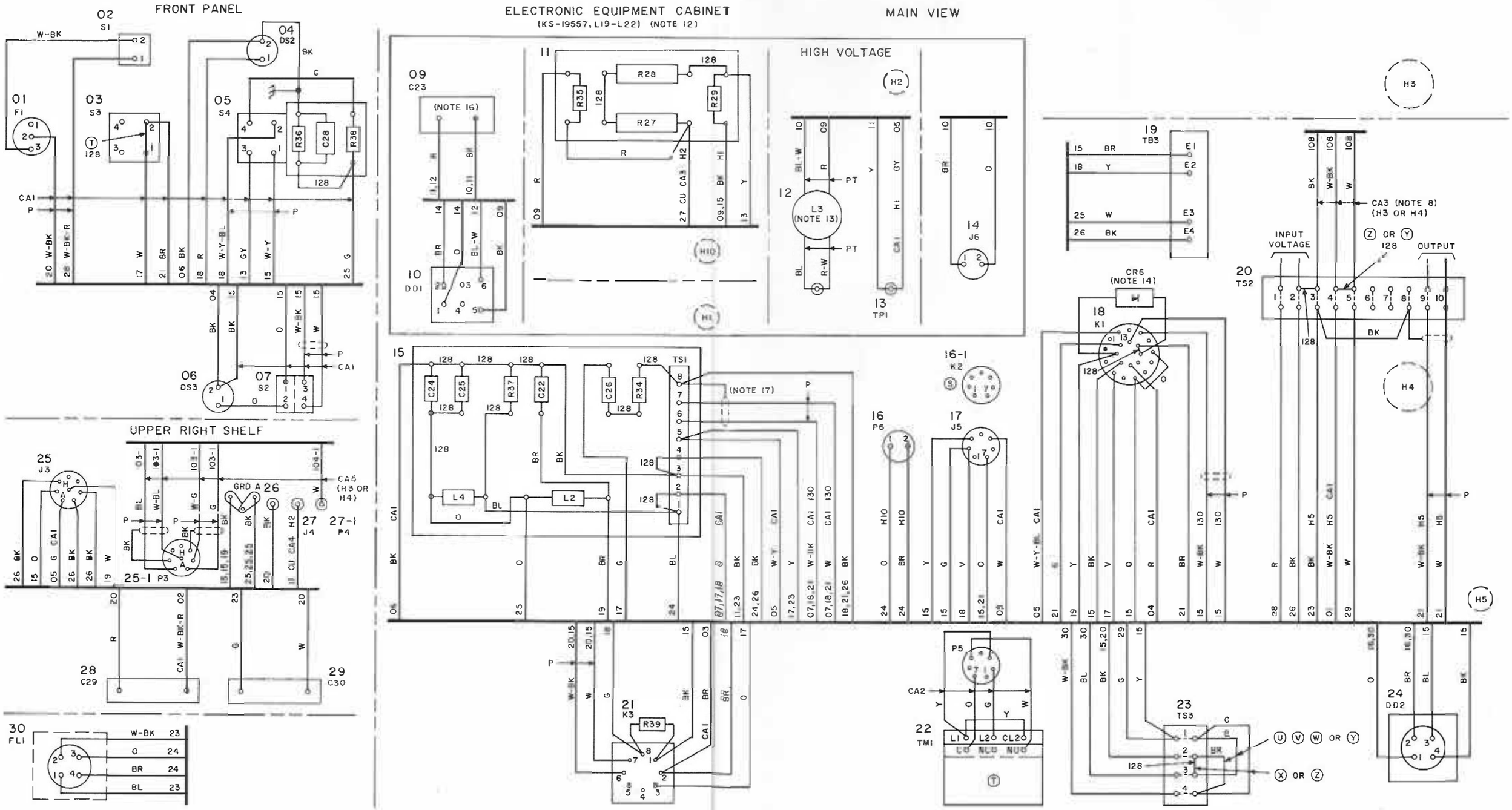
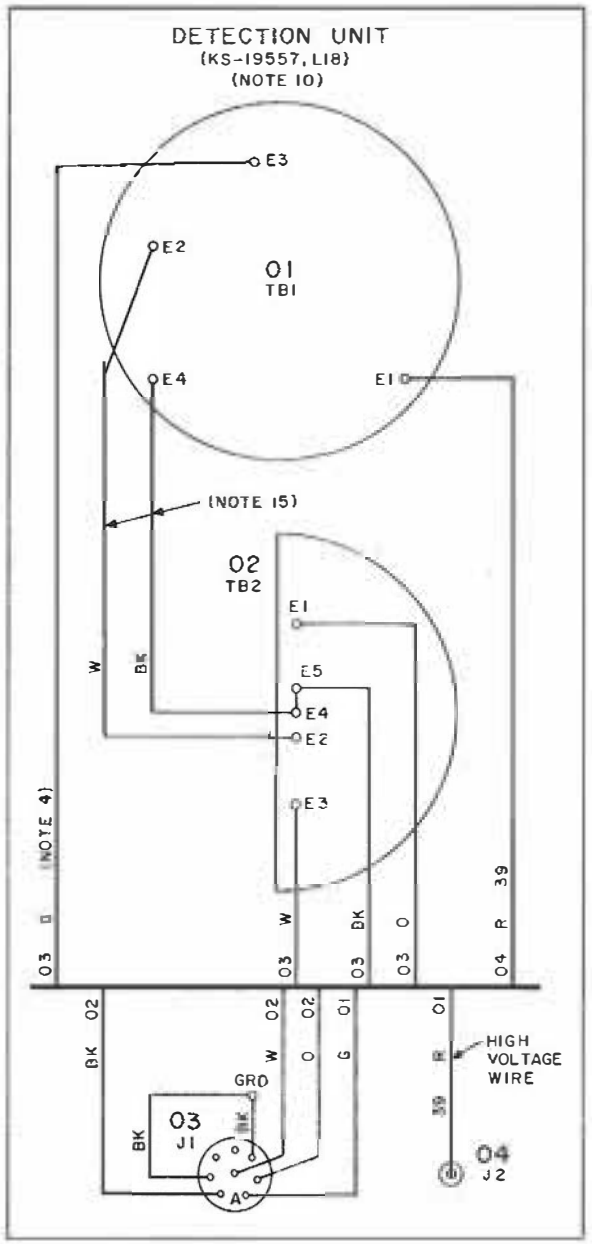
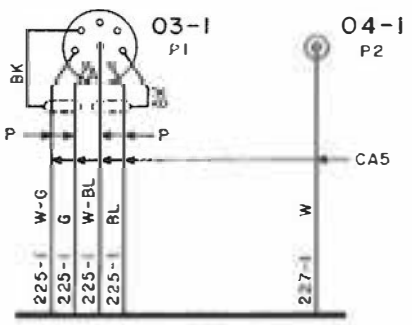
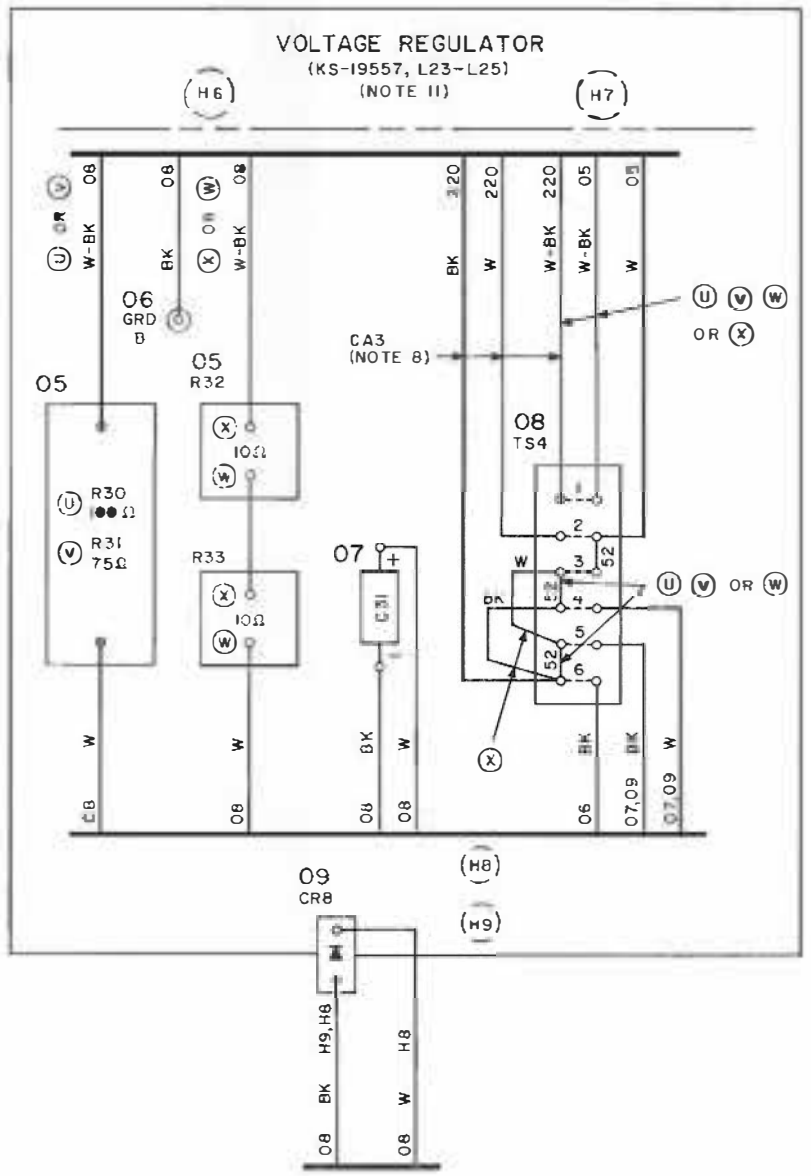


Fig. 7—KS-19557 Detector (Nuclear Blast) Wiring Diagram (Sheet 1 of 2)







NOTES:

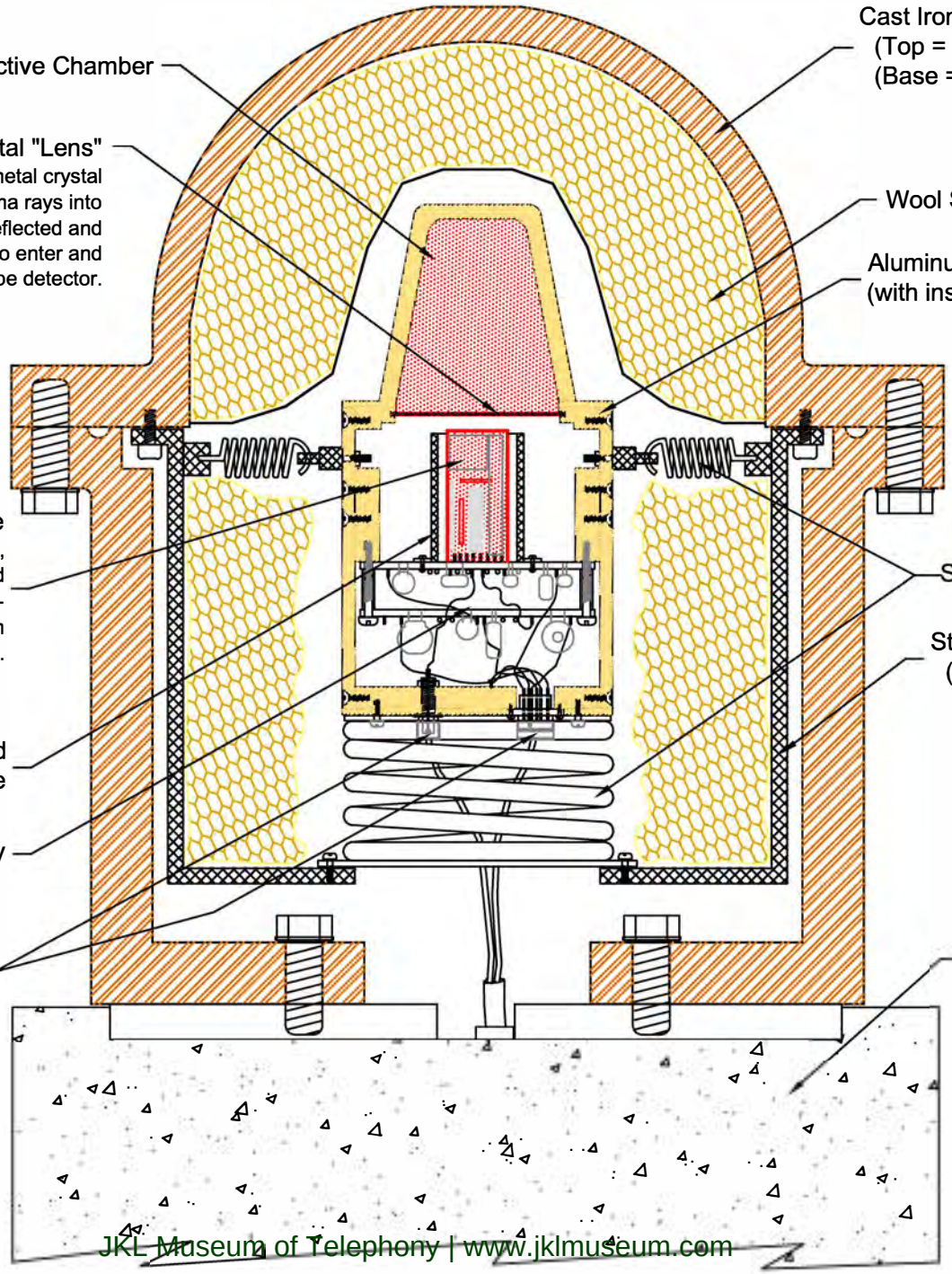
1. ITEM NUMBERS AND REFERENCE DESIGNATIONS SUCH AS C1, CA1, R1 ETC. REFERRED TO ARE SHOWN IN STOCK LIST OF ASSEMBLY DRAWINGS B-B76946, B-995280, B-995281, B-995285, B-995294, B-995297 AND B-995327.
2. ALL WIRING NOT IN CABLE SHALL BE DRESSED AGAINST MOUNTING SURFACE.
3. P – PAIR
4. LENGTH OF WIRE SHALL NOT EXCEED 5.50 INCHES.
5. PT-LEADS FURNISHED WITH COMPONENT.
6. (H1, H2) ETC-WIRES RUN THROUGH CORRESPONDING DESIGNATED HOLES.
7. (⏥) - SHIELD CONNECTION.
8. WIRES DESIGNATED AS (CA3) SHALL BE CONNECTED DURING INSTALLATION. SITE TO SUPPLY 22 AWG WIRE.
9.

FEATURE OR OPTION		PROVIDE FIG.	APP OR FIG.	QUANTITY
MANUAL RESET			S	1 PER CKT
AUTOMATIC RESET			T	
AVAILABLE INPUT VOLTAGE AT INSTALLATION	+152V	1	U	1 PER CKT MFR SUPPLIED, PROPER CONN TO BE MADE AT INSTALLATION
	+130V		V	
	+48V		W	
	−48V		X	
	+24V		Y	
	−24V		Z	

10. UNLESS OTHERWISE SPECIFIED ALL WIRING IN DETECTION UNIT KS-19557, L18 SHALL BE ITEM 34.
11. UNLESS OTHERWISE SPECIFIED ALL WIRING IN VOLTAGE REGULATOR KS-19557, L23-L25 SHALL BE ITEM 49. ALL CONNECTIONS TO TS4 SHALL TERMINATE WITH ITEM 54.
12. UNLESS OTHERWISE SPECIFIED ALL WIRING IN ELECTRONIC EQUIPMENT CABINET KS-19557, L19–L22 SHALL BE ITEM 118. ALL CONNECTIONS TO TS2 AND TS3 SHALL TERMINATE WITH ITEM 138.
13. ITEM 136 SHALL BE USED ON ALL COMPONENT LEADS OF L3.
14. ITEM 134 SHALL BE USED ON ALL COMPONENT LEADS OF CR6.
15. KEEP THESE LEADS AS SHORT AS POSSIBLE.
16. LEADS TO C23 SHALL TERMINATE WITH ITEM 139.
17. TERMINATE SHIELDS USING ITEMS 118, 140 AND 141.

Fig. 7—Continued (Sheet 2 of 2)

Atomic Blast Detector from AT&T Autovon Site at Lyons, Nebraska



Aluminum Reflective Chamber

Potassium Acid Phthalate Crystal "Lens"
- by defraction, the organic metal crystal transforms high energy gamma rays into lower energy waves that are reflected and then pass through the crystal to enter and stimulate the photomultiplier tube detector.

Photomultiplier Vacuum Tube
- a very early, experimental, "Multiplier Photo Tube" used to detect and amplify electro-magnetic waves entering from Potassium Acid Phthalate Crystal.

Magentic Shield around Photomultiplier Tube

Pulse Stretching Circuitry

Power (1000 VDC) for Detector and Signal Output from Detector.
- the signal was used to notify Cheyenne Mountain of atomic blast, and to initiate sequence to "shut down" the communication site from outside world including igniting explosive bolts at incoming air ducts to shut out exterior air from facility.

Cast Iron Enclosure
(Top = 90 lbs)
(Base = 150 lbs)

Wool Shock Insullation

Aluminum Housing
(with insturment = 5 lbs)

Spring Isolation

Steel Case
(55 lbs)

Concrete Base

Atomic Blast Detector
Enclosure: KS-19557-L17
Detector: KS-19557-L18

Note:

The drawing behind the 'opened' Atomic Blast Detector Display was on 24"x36" paper.

The Detector Display was about 5 feet tall and weighed over 400 pounds. The concrete base supporting it was about 30" tall and weighted another 250 pounds.