



INSTRUCTIONS
TYPE RA-15 PRECIPITRON POWER PACK

Supplement To
I.B. 1495-1

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SUBSTITUTION OF RECTIFIER TUBES

SUBSTITUTION. Due to improved ratings, WL-481B rectifier tubes may now be used satisfactorily in place of WL-5934 tubes in the RA-15 power pack.

Late design RA-15 power packs are being equipped with WL-481B tubes.

RENEWAL PARTS. The older WL-5934 tube is being discontinued and as soon as stocks are depleted, the WL-481B tube will become the standard renewal part for all RA-15 packs.

MODIFICATION - EARLY DESIGN PACKS ONLY. A minor modification in the wiring connections is required when making the initial substitution in early design RA-15 packs. Both types of tube fit into the same base socket, but the WL-481B tube is shorter and has a smaller diameter cap at the top of the tube. Modification instructions are as follows:

1. Shorten and bend lead "A" to the shape shown in Fig. 1.
2. Reshape terminal clips "B" as shown in Fig. 2. For best results shape the offset (where clip threads through itself) so that the clip will fit snugly around the tube cap.

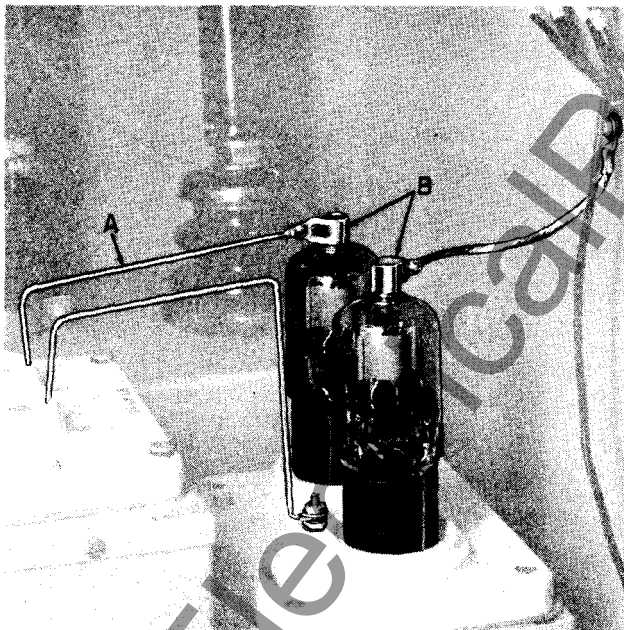


Fig. 1. RA-15 Power Pack Equipped with WL-481B Tubes.

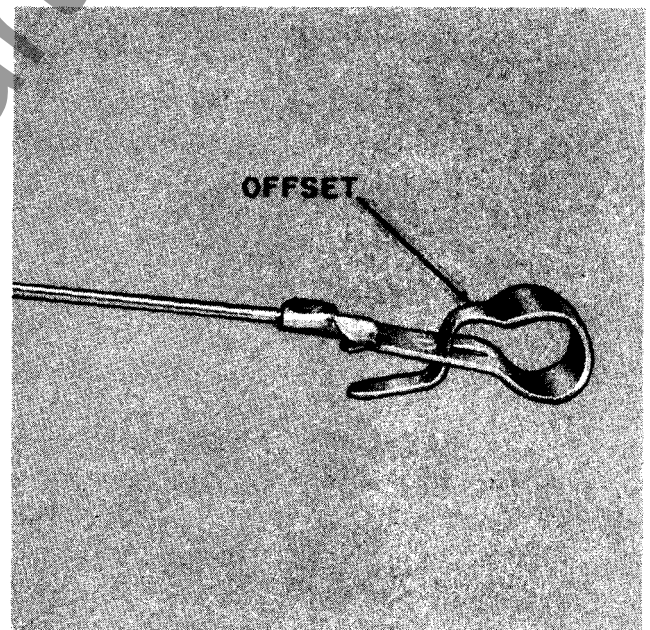


Fig. 2. Reshaped Terminal Clip

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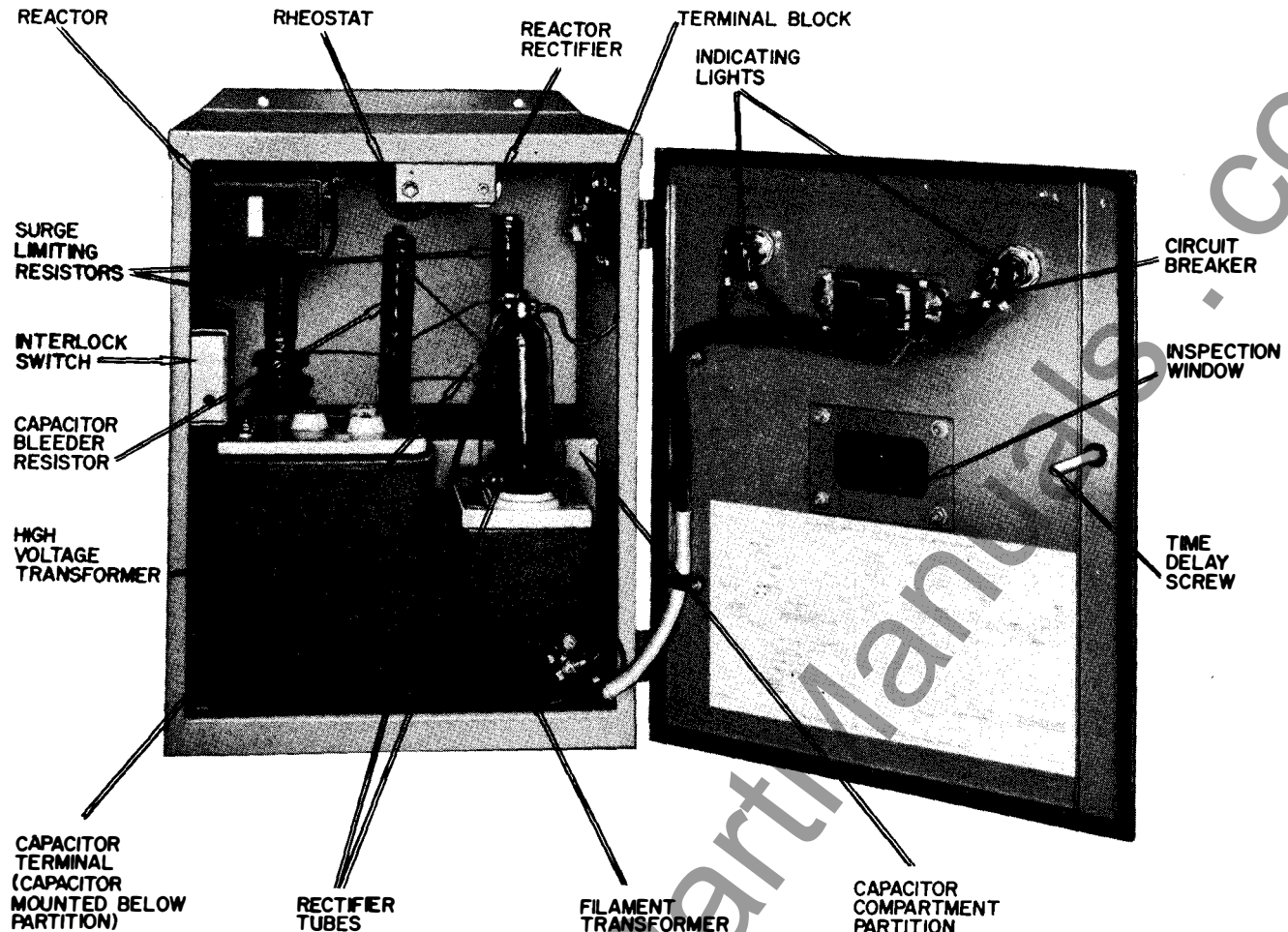


Fig. 2 Interior of Type RA-15 Power Pack

Stable Output Voltage is characteristic of the low reactance transformer T-1. Variations in load current have little effect on the output voltage of this transformer. Thus, as the PRECIPITRON draws more current due to normal atmospheric changes or heavier dirt loading, proper voltages are maintained on the ionizers and collector cells.

Self Protection, in the event of overload or short circuit in the PRECIPITRON, is obtained by using saturable reactor L-1 in series with the high voltage transformer T-1. In this arrangement, the applied line voltage is divided between the reactor and the transformer. As the voltage drop in the reactor increases, less voltage is available for the transformer - as the reactor drop decreases, more voltage goes to the transformer. Thus, the reactor controls and limits the transformer input and hence the power pack output.

For initial adjustment to a given size PRECIPITRON, rheostat R-1 is set so that the reactor voltage drop is low, and the transformer receives sufficient voltage to develop proper operating voltages for the ionizers and cells. If an overload or short circuit develops, the voltage drop in the reactor increases rapidly. This lowers the voltage applied to transformer T-1, automatically reducing the output of the power pack to a safe value until the fault is cleared. With a 60 cycle supply the automatic self protection is obtained without tripping the circuit breaker. For 50 cycles, the effect is somewhat reduced, but overload protection is provided up to the point of dead short circuit, at which time the circuit breaker will trip.

Indicating Lights on the power pack show the operating status of the PRECIPITRON unit. The green "normal operation" light actually indicates the voltage applied to transformer T-1 primary winding and the red "short circuit" light indicates the voltage across the reactor L-1. With normal conditions the green light glows and the red light does not glow. On overload, T-1 voltage decreases and L-1 voltage increases causing the green light to dim and the red light to glow slightly. Such a condition might occur if the collector cells were allowed to become excessively dirty. A short circuit causes the green light to go out and the red light to glow brightly. This might happen if the collector plates become bridged with a large particle or if the end of a broken ionizer wire becomes grounded.

Door Switch. For safety of the operator, the cabinet door is equipped with a screw operated interlock switch. This opens the 115 v supply circuit and purposely delays access to high voltage parts for a minimum of 20 seconds while the capacitor charge is dissipated by the discharge resistor. This switch should not be tampered with even though the time consumed in turning the screw may seem unreasonable. The screw may be pushed into place without turning, but must be fully unscrewed to open the door.

RECEIVING AND HANDLING

The power pack is shipped complete, bolted to the rear panel of a reinforced plywood box. When unpacking remove all but the rear panel of the box for access to the shipping bolts. Two resistors and an instruction book are packed inside the cabinet.

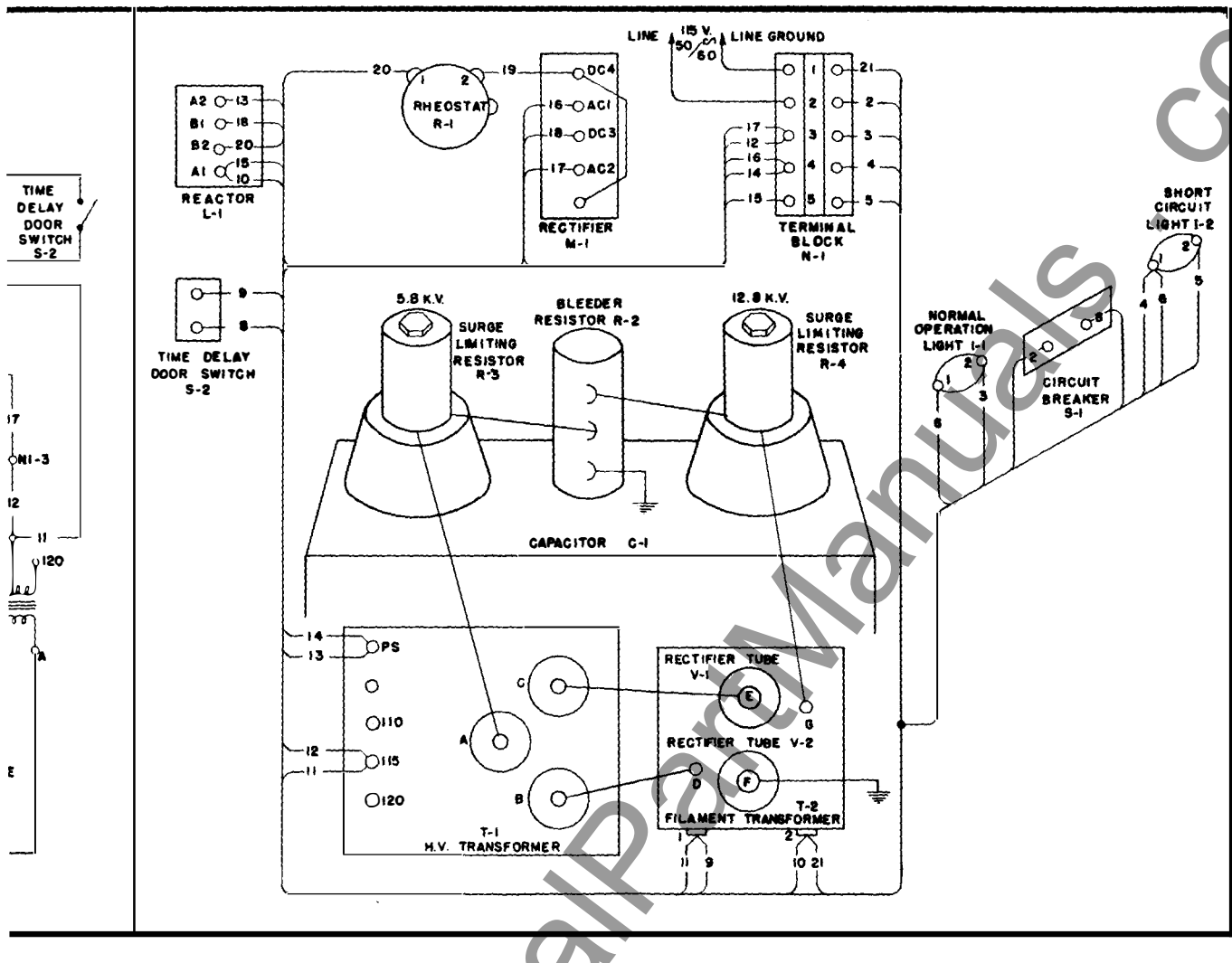


Fig. 3 Schematic and Detailed Wiring Diagrams

Preparation For Use After wiring is complete, remove the cardboard shipping brace on the rectifier tubes. Examine the rectifier tubes and other in-

ternal parts of the power pack for mechanical damage or loose wiring. The power pack is now ready for adjustment by a service engineer.

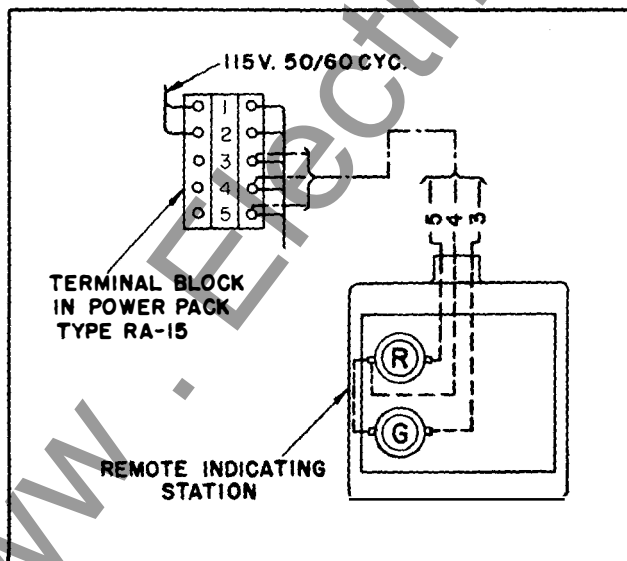


Fig. 5 Remote Indicator Connections

Caution. The power pack produces dangerously high voltages. Keep well away from all high voltage parts while the power pack is energized and at least 20 seconds after it is switched off. This time delay is necessary to bleed the capacitor. Discharge high voltage parts with a grounded prod before touching.

Adjustment. Before the PRECIPITRON unit is placed in operation, each power pack must be adjusted with an approved high voltage dc meter, a 0-150 v ac voltmeter and a 0-10 amp ac ammeter. Note: Observe the "caution" (Page 4) throughout the adjustment.

1. Measure the ac supply voltage (terminals 1 & 2) and connect leads 11 & 12 to transformer tap closest to the average supply voltage.

2. Switch "off" circuit breaker. Connect ammeter to read supply current (terminal 1 or 2). Connect high voltage meter to 12.8 KV terminal (R-4) and ground. Remove locking cap and turn rheostat shaft to full counterclockwise position (min. output volt-

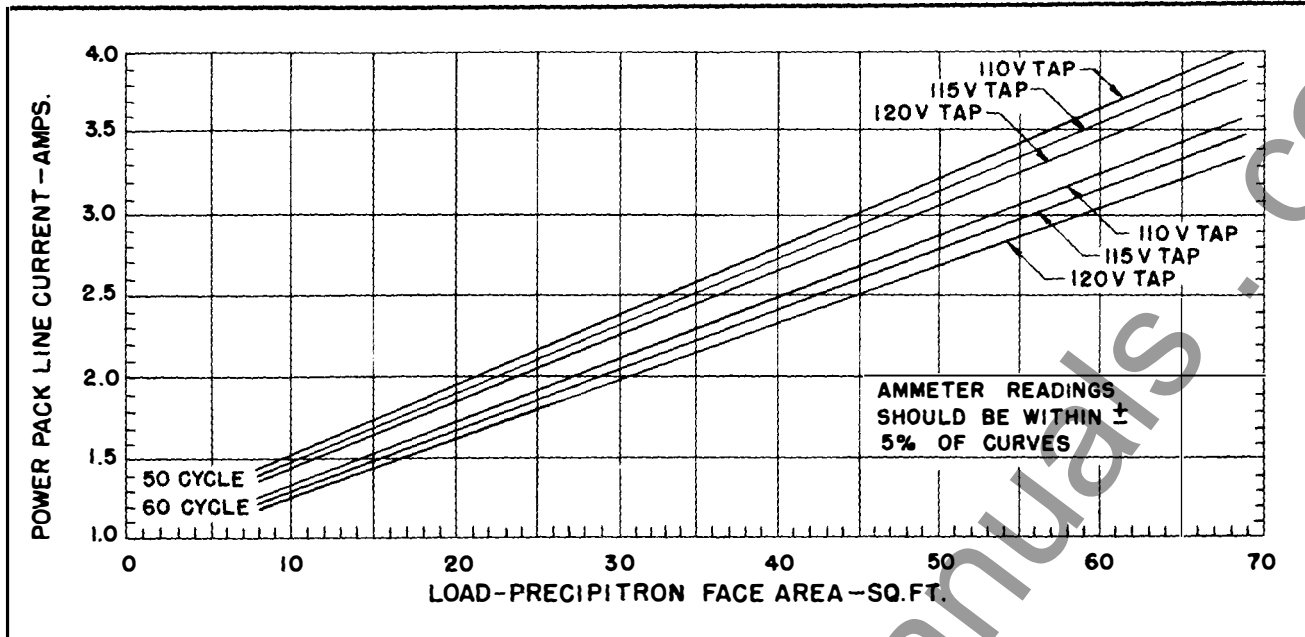


Fig. 6 Power Pack Input Current VS Precipitron Load

age). Switch "on" door time delay switch S-2 by inserting a 3/8-16 bolt or screw driver.

3. Observe the "caution" (Page 4) and switch "on" circuit breaker. Both rectifier tubes should light and the green light should glow after an initial flash of the red light. If these conditions do not exist, see maintenance and correct fault before proceeding.

4. Being sure not to touch any other part, turn the rheostat shaft clockwise (with an insulated screw driver) until high voltage meter reads 12.8 KV. If voltage is too low over full range, see maintenance and correct fault before proceeding. Low voltage indicates a short circuit.

5. Record ammeter reading and compare with load curves in Fig. 6. Significantly high current indicates electrical leakage in the cells, ionizers or power pack. Low current indicates some ionizers or cells are not connected. See maintenance for correction of fault.

6. Switch "off" circuit breaker, observe the above "caution" and connect high voltage meter to 5.8 KV terminal. Switch "on" circuit breaker and note voltmeter reading. Should be 5.5-5.9 KV.

7. Switch "off" circuit breaker, remove bolt or screw driver from door time delay switch and remove meters. Make a scribe mark, in line with slot in rheostat shaft, on bracket to indicate proper setting. Replace locking cap and close door. The PRECIPITRON may now be placed in service by switching on the circuit breaker.

MAINTENANCE

Inspection. A simple inspection of the power pack is recommended at least once a day to assure continuous operation of the PRECIPITRON unit:

1. "Normal" (green) indicating light should glow.
2. "Short Circuit" (red) indicating light should not glow.
3. Both rectifier tubes should glow.

If these conditions do not exist, the PRECIPITRON unit or the power pack needs servicing.

Servicing. See "caution" on Page 4. Table No. 1 includes helpful hints in locating and correcting faults. These points should be checked first before going to the more complicated procedures. For short circuits, the fault should be localized either to the PRECIPITRON cells and ionizers or the power pack as indicated in the table.

No - Load Check of the power pack is helpful in localizing short circuits. First check step 1 of "Adjustment." Set rheostat to extreme counterclockwise position and remove both high voltage cables from R-3 and R-4. Connect H.V. meter between 12.8 KV terminal and ground. When a trouble free pack is energized, the green light should glow (after initial flash of red light) and the H.V. meter should read 12.6 - 14.4 KV. Significantly low voltage indicates a short circuit. Adjust rheostat and reconnect H.V. cables prior to operating the PRECIPITRON unit again.

Isolating Defective Parts. When a continuous "short circuit" or low output voltage indication has been localized to the power pack, proceed with the following steps as far as necessary to locate the defective part. (Observe "caution" Page 4).

1a. Disconnect H.V. cables and remove both rectifier tubes. "Normal" light indication shows there is a short circuit or ground in the tubes, bleeder resistor, capacitor or filament transformer.

1b. Install known good tubes. "Normal" indication shows one or both tubes were defective.

1c. Disconnect H.V. bus leads from bleeder resistors R-2. "Normal" indication shows R-2 is defective and should be replaced.

CAUTION, with R-2 disconnected, be sure to ground both capacitor high voltage terminals before touching and after each test.

1d. Remove H.V. bus leads connecting capacitor C-1 and transformers T-1 and T-2 and check oper-

TYPE RA-15 POWER PACK

Upon receipt of shipment, any evidence of damage should be reported immediately to the last carrier for inspection by an agent of the transportation company. A claim should be filed by the customer against the carrier to cover shipping damage.

INSTALLATION

Application . The operating range of the Type RA-15 Power Pack is such that it may be applied to various combinations of PRECIPITRON ionizers and cells, where the total cell face area per pack is not more than 60 sq. ft. or less than 10 sq. ft. Larger face areas require two or more packs. Smaller face areas require a smaller power pack.

The primary supply voltage must be steady (± 3 volts max. fluctuation) and within the limits provided by the primary transformer taps, i.e. 110, 115 or 120 volts. If the supply voltage exceeds these limits, it should be corrected to assure proper operation of the PRECIPITRON unit.

Mounting . Locate the power pack so that it is protected from weather, close to the PRECIPITRON unit, and convenient for inspection and maintenance. Avoid locations where the ambient temperature may exceed 104°F. (40°C), or where severe mechanical vibration exists. At least 6" clearance below the cabinet is required for removal of the capacitor. Mount the power pack outside the duct on any vertical surface strong enough to support the weight of the pack (130 lbs. net), using four 3/8" mounting bolts.

Electrical Connections . Wiring to and from the power pack should be in 1/2" conduit. Three conduit holes are provided in the cabinet. Important to assure proper electrical clearance between cables and wires, conduits must terminate as follows: 12.8 KV conduit to right top hole (facing door), 5.8 KV conduit to left top hole and 115 v supply conduit to right side hole.

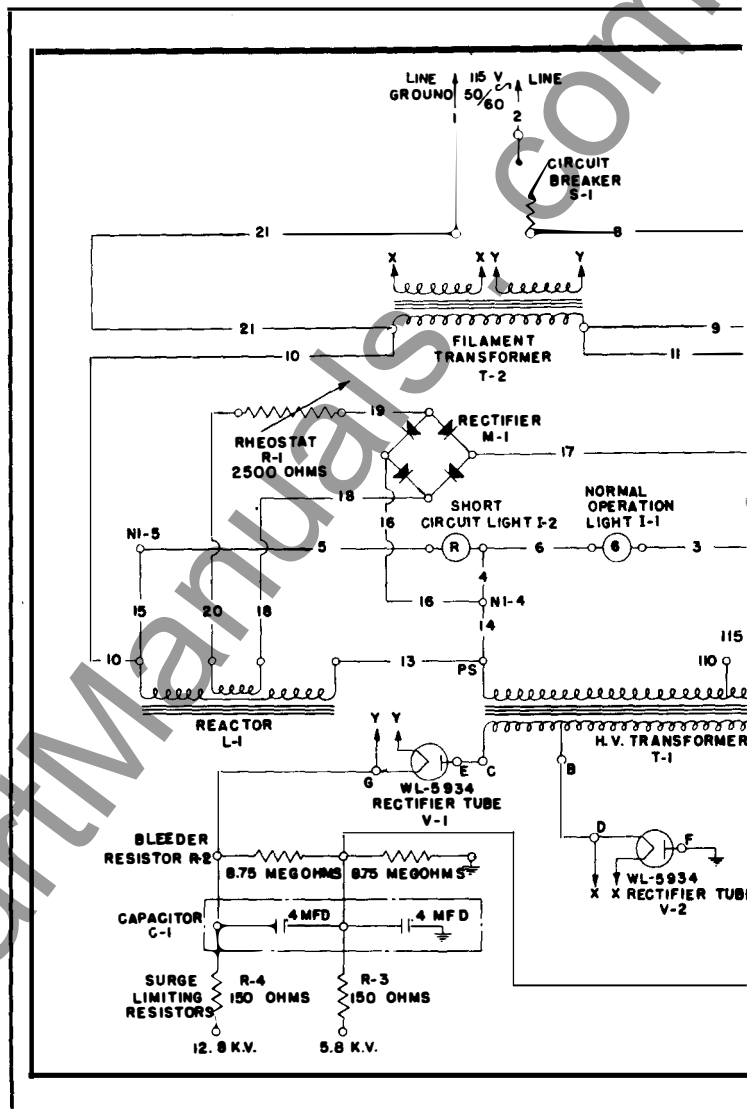
High Voltage Connections.(See "caution" on Page 4). Connect the high voltage cables to the lugs provided at the top of the surge limiting resistors. Solder lugs to cables. These resistors screw onto the capacitor terminals. The terminal marked 12.8 KV is for the PRECIPITRON ionizer cable, the 5.8 KV terminal for the cell cable. (See Fig. 3).

Low Voltage Connections. Connect the incoming low voltage supply to terminals 1 & 2. (See Fig. 3). Note: Refer to PRECIPITRON unit wiring diagram for overall installation connections.

Electrical Grounding . Both the power pack cabinet and the PRECIPITRON unit framework require a common earth ground connection, to complete the high voltage circuit and for safety purposes. Use one of the capacitor mounting bolts (at lower side of cabinet) as a terminal for the ground connection.

Remote Indicating Station.The "normal and "short circuit" indicating lights on the power pack provide a significant index to the operating condition of the PRECIPITRON unit. In some instances, it may be desirable to provide this same indication at some supervisory point reasonably remote from the power pack. Remote Indication Station S#1559589 may be procured for this purpose. (See Fig. 4).

One station is required for each RA-15 power pack. The two indicating lights respond the same as the power pack lights. Printing on the decorative cover explains the significance of each light. A space on



the nameplate may be marked to identify the power pack served when several stations are used. Station may be located up to 150 feet away from the power pack. Three wires are required as shown in Fig. 5.



Fig. 4 Remote Indicating Station (For type RA-15 Power Pack Only)

TABLE NO. 1 OPERATION CHECK CHART

Note: Observe "CAUTION" (see page 4) when making the following checks.			
Trouble Indications	Possible Troubles	Verification Check	Correction
1. NORMAL OPERATION and SHORT CIRCUIT lights out, rectifier tubes lighted.	a. Burned out lamp in NORMAL OPERATION light. b. Loose connections to NORMAL OPERATION light socket or defective socket.	Replace lamp with known good one. Check leads 3 and 6 and connections at both ends. Test lamp socket.	Install new lamp. Repair wiring, connections, or lamp socket.
2. SHORT CIRCUIT Light glows when power pack is energized. NORMAL OPERATION light out or dim. Circuit breaker may trip after several minutes.	a. Short circuit in PRECIPITRON cells or H.V. cable. b. Short circuit in PRECIPITRON ionizers or H.V. cable. c. Faulty rectifier tube. d. Faulty wiring or component in power pack.	Disconnect H.V. cable to cells from 5.8 KV terminal in power pack. If power pack then indicates normal operation, check cells or H.V. cable for short circuits. Disconnect H.V. cable to ionizers from 12.8 KV terminal in power pack. If power pack then indicates normal operation, check ionizers or H.V. cable for short circuits. Check tubes for fluorescent glow between plate and filament. Substitute known good tube if necessary. Check wiring and components.	Locate and correct fault in PRECIPITRON cells or H.V. cable. Locate and correct fault in PRECIPITRON ionizer or H.V. cable. Replace defective tube. Repair wiring or replace defective components.
3. Circuit breaker trips immediately.	Short circuit in power pack wiring or component.	Check wiring and parts.	Repair wiring or replace defective part.
4. NORMAL OPERATION light glows but one or both rectifier tube filaments do not glow.	a. Defective rectifier tube. b. Defective filament transformer connections (both tubes do not light). c. Defective filament transformer.	Replace defective tube or interchange tubes in sockets. Check leads 7, 9, 10 and 11 and connections at both ends. Check filament transformers for open windings.	Install new tube. Correct wiring or connections. Replace filament transformer.
5. Power pack indicates normal operation but there is no high voltage output. Both rectifier tubes lighted.	a. Faulty wiring or loose connections. b. Faulty rectifier tube(s). c. Defective high voltage transformer.	Check wiring and connections. Check operation with known good tubes. Check H.V. transformer for open windings.	Repair wiring or connections. Replace defective tube(s). Replace defective transformer.

ation. "Normal" light indication shows that capacitor C-1 or transformer T-2 is defective. Check C-1 and T-2 for short circuits or ground using a megger and replace the defective component. A good capacitor will initially show low resistance, but after a few seconds, as it is charged by the megger, will show an open circuit.

2a. If a short circuit indication persists after the above checks, there may be a short circuit or ground in T-1, open circuit in L-1, or M-1 may be defective.

2b. Check transformer T-1 insulation with a megger. Check windings with ohmmeter. Approximate resistances should be 0.3 ohms PS-120; 860 ohms A-B; 160 ohms B-C. Replace transformer if found defective.

2c. Check reactor L-1 with an ohmmeter. Approximate resistances should be .06 ohms A1-A2; 330

ohms B1-B2. Replace reactor if found defective.

2d. Check rheostat R-1 with an ohmmeter. Approximate resistances should be 2500 ohms when set to extreme counterclockwise rotation. Replace rheostat if found defective. Note: This rheostat was 1600 ohms in early design units.

2e. Examine rectifier M-1 for signs of damage or overheating and replace if found defective.

2f. Check "normal operation" light socket I-1 for short circuit and repair or replace if defective. When the fault has been corrected, reassemble power pack, connect H.V. cables and adjust to load as described under "Adjustment."

Replacement Rectifier Tubes. Westinghouse WL-5934 rectifier tubes are recommended. In an emergency type 8013A tubes will work as a substitute.

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