INSTRUCTION BOOK
1493-2

Precipitron®

TYPE RF 3 POWER PACK

DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

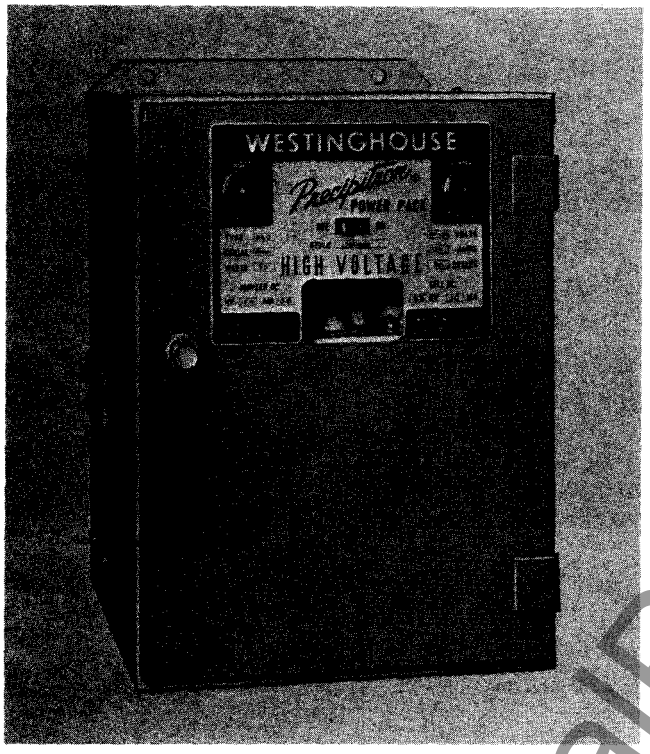

Fig. 1 Type RF-3 Power Pack

The Type RF-3 POWER PACK is a self-contained high voltage electronic rectifier specifically designed to supply the d.c. power requirements of smaller sizes of PRECIPITRON electronic air cleaners.

ELECTRICAL RATING

INPUT: 110/115/120 Volts a.c., 1 phase, 60/50 cy.
MAX. POWER CONSUMPTION: 90 Watts
P.F. AT MAX. LOAD: 85% at 60 cycles
80% at 50 cycles
MAX. D.C. OUTPUT: 3 m.a. at 13.0 KV
1 m.a. at 6.5 KV
MAX. SAFE AMBIENT TEMP.: 40°C (104°F)

COMPONENT SPECIFICATIONS

Cabinet — Welded steel, baked enamel finish. Hinged door seals for dust tight interior — window for observing tubes. Vented recess accommodates capacitor.

Controls and Indicating Lights — On-Off circuit breaker protection. Green and orange lights indicate NORMAL and SHORT CIRCUIT conditions.

Transformer — Gum filled type combining primary high voltage, filament and saturable core reactor windings in one steel case — with integral porcelain terminal block and tube sockets. Taps for 110-115-120 volt power supply, secondary delivers 6500 volts.

Capacitor — Steel cased INERTEEN filled, with porcelain terminals. Two .075 mfd, 7500 V sections, external bleeder resistor.

Rectifier Tubes — Industrial type WL-481-B Kenotrons, 5 m.a., 25,000 volt inverse peak, 2.5 volt filament.

Control Rectifier and Rheostat — Saturable core, control windings energized by .7 amp d.c. selenium rectifier. Slotted shaft, wire wound rheostat (90 ohm) provided for initial circuit adjustment.

Protective Devices — Cabinet door screw actuates switch to open primary circuit, and delays access to power pack interior until grounded bleeder resistor completely discharges capacitor and PRECIPITRON cells.

PRINCIPLE OF OPERATION

Type RF-3 power pack performs four important functions in the operation of a PRECIPITRON unit: — (1) furnishes proper operating voltages, (2) maintains stable output voltages for normal changes in load, (3) provides self protection against overload or short circuit in the PRECIPITRON unit and (4) indicates the operating status of the installation.

PRECIPITRON Operating Voltages are 13,000 volts dc for ionizers, 6500 volts dc for collector cells. These voltages are obtained by stepping up low voltage ac, rectifying it and charging a two-section capacitor in what is known as a voltage doubling circuit. During one half of the ac cycle, 6500 volts from terminals A-C of transformer T-1 (see Fig. 3) is rectified by tube V-2 to charge one section of capacitor C-1. Tube V-1 is not conducting during this half cycle. During the other half of the ac cycle, 6500 volts from terminals A-C of the transformer is rectified by tube V-1, charging the second section of capacitor C-1. Tube V-2 is not conducting during this half cycle. Capacitor C-1 stores the energy alternately delivered to each of the two sections, which are connected

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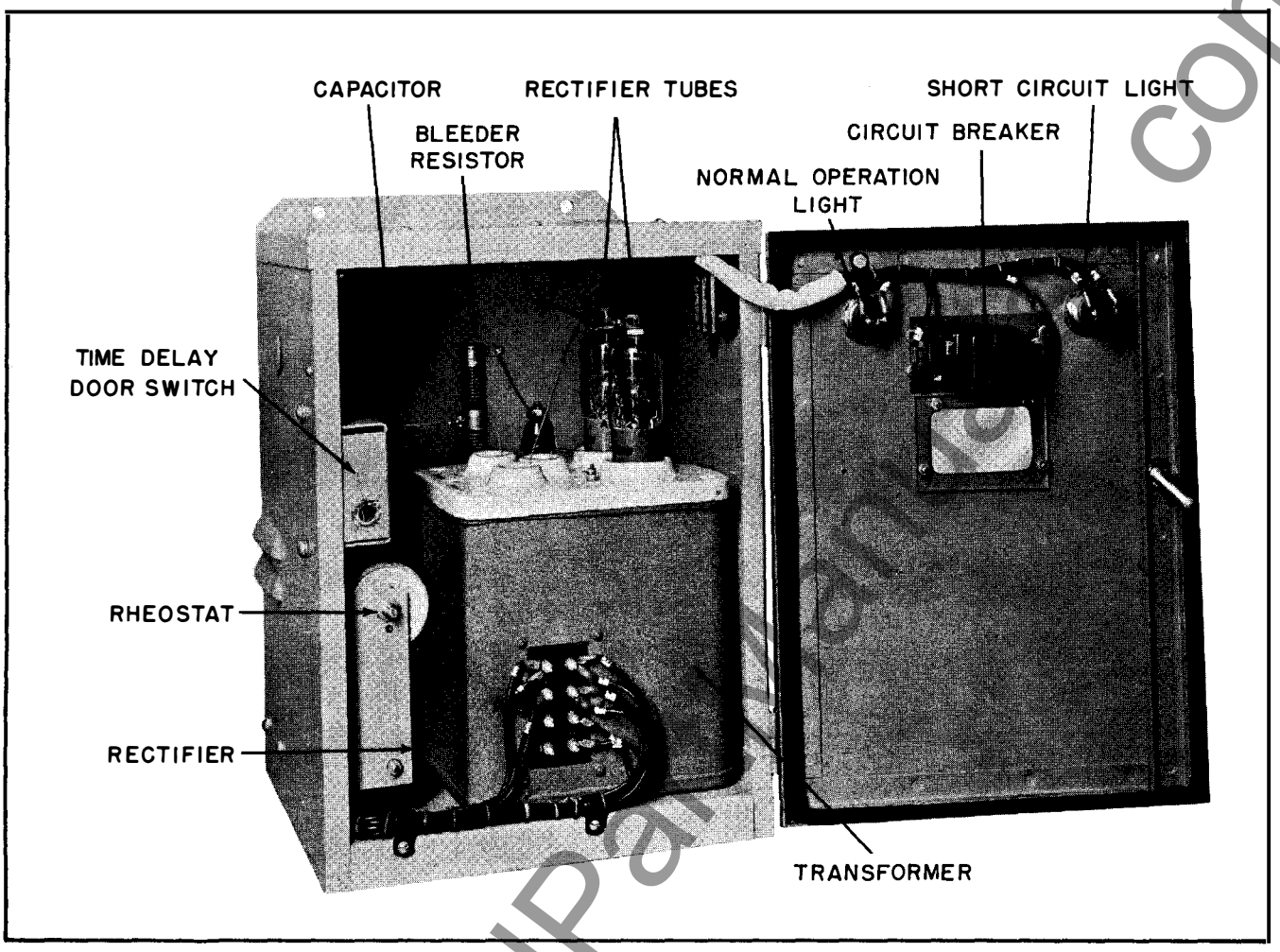


Fig. 2 Interior of Type RA-3 POWER PACK

in series. Since the charges are additive, both sections to ground gives 13,000 volts (6500 + 6500): — first section to ground gives 6500 volts.

Stable Output Voltage is characteristic of the normally low reactance transformer T-1. Small 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, is obtained by employing auxiliary saturable cores in the magnetic circuit of the transformer. The magnetic flux supplied to the high voltage secondary winding is controlled and limited when necessary by these saturable cores.

Initial adjustment to a given size PRECIPITRON is obtained by setting rheostat R-1 for the proper output voltages. This rheostat controls the dc bias to the saturable cores. When an overload or short circuit develops, the saturable cores automatically react to reduce the magnetic flux available to the high voltage secondary winding. This lowers the output voltage of the power pack to a safe value — until the fault is cleared. With a 60 cycle supply, 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 may trip.

Indicating Lights on the power pack door show the operating status of the PRECIPITRON unit. With normal conditions the green NORMAL OPERATION LIGHT glows and the orange SHORT CIRCUIT LIGHT does not glow. On overload the green light dims and the orange light starts to glow visibly. 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 orange 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 delays access to the interior high voltage parts until the capacitor charge is drained off through the discharge resistor. This switch should not be tampered with even though the time consumed in turning the screw may seem unnecessary. 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. An instruction book is packed inside the cabinet.

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-3 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 12 sq. ft. Larger face areas require a larger capacity 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 (66 lbs. net), using four 3/8″ mounting bolts.

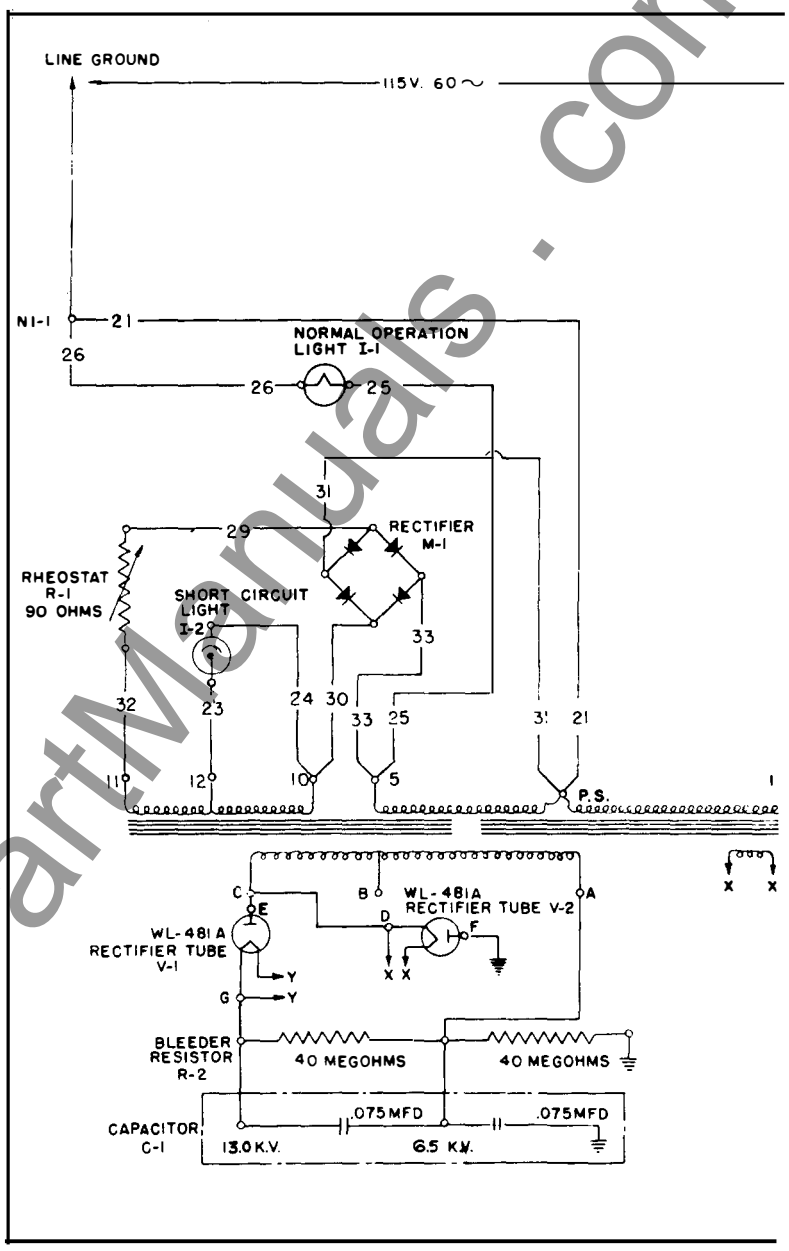
Electrical Connections. Wiring to and from the power pack should be in 1/2″ conduit. Three conduit holes are provided in the cabinet. *Important* to assure proper electrical clearance between cables and wires, conduits must terminate as follows: 13.0 KV conduit to right top hole (facing door), 6.5 KV 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 capacitor terminals. Solder the lugs to the cables. The terminal marked 13.0 KV is for the PRECIPITRON ionizer cable, the 6.5 KV terminal for the cell cable. (See Fig. 3.)

Low Voltage Connections. Connect the incoming low voltage supply to terminals 1 and 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 requires 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.



Preparation For Use. After wiring is complete, remove the cardboard shipping brace on the rectifier tubes. Examine the rectifier tubes and other internal parts of the power pack for mechanical damage or loose wiring. The power pack is now ready for adjustment by a service engineer.

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.

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.	Replace lamp with known good one.	Install new lamp.
	b. Loose connections to NORMAL OPERATION light socket or defective socket.	Check leads 25 and 26 and connections at both ends. Test lamp socket.	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.	Disconnect HV cable to cells from 6.5 KV terminal in power pack. If power pack then indicates normal operation, check cells or HV cable for short circuits.	Locate and correct fault in PRECIPITRON cells or HV cable.
	b. Short circuit in PRECIPITRON ionizers or HV cable.	Disconnect HV cable to ionizers from 13.0 KV terminal in power pack. If power pack then indicates normal operation, check ionizers or H.V. cable for short circuits.	Locate and correct fault in PRECIPITRON ionizer or HV cable.
	c. Faulty rectifier tube.	Check tubes for fluorescent glow between plate and filament. Substitute known good tube if necessary.	Replace defective tube.
	d. Faulty wiring, faulty selenium rectifier, or defective control (PS-5) or bias (10, 11, 12) windings in transformer. Short circuited normal operation light or socket.	Check wiring and components.	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.	Replace defective tube or interchange tubes in sockets.	Install new tube.
	b. Defective tube socket connections.	Remove and replace tube in socket to check socket contacts.	Correct contacts or replace transformer if necessary.
	c. Defective transformer filament winding.	Check filament windings for open circuits.	Replace transformer.
5. Power pack indicates normal operation but there is no high voltage output. Both rectifier tubes lighted.	a. Faulty wiring or loose connections.	Check wiring and connections.	Repair wiring or connections.
	b. Faulty rectfiier tube(s).	Check operation with known good tubes.	Replace defective tube(s).

1c. Disconnect H.V. bus leads from bleeder resistors R-2. NORMAL light 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 transformer T-1 and check operation. NORMAL light indication shows that capacitor C-1 or transformer T-1 is defective. Check capacitor C-1 for short circuits or ground using a megger and replace if defective. 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.

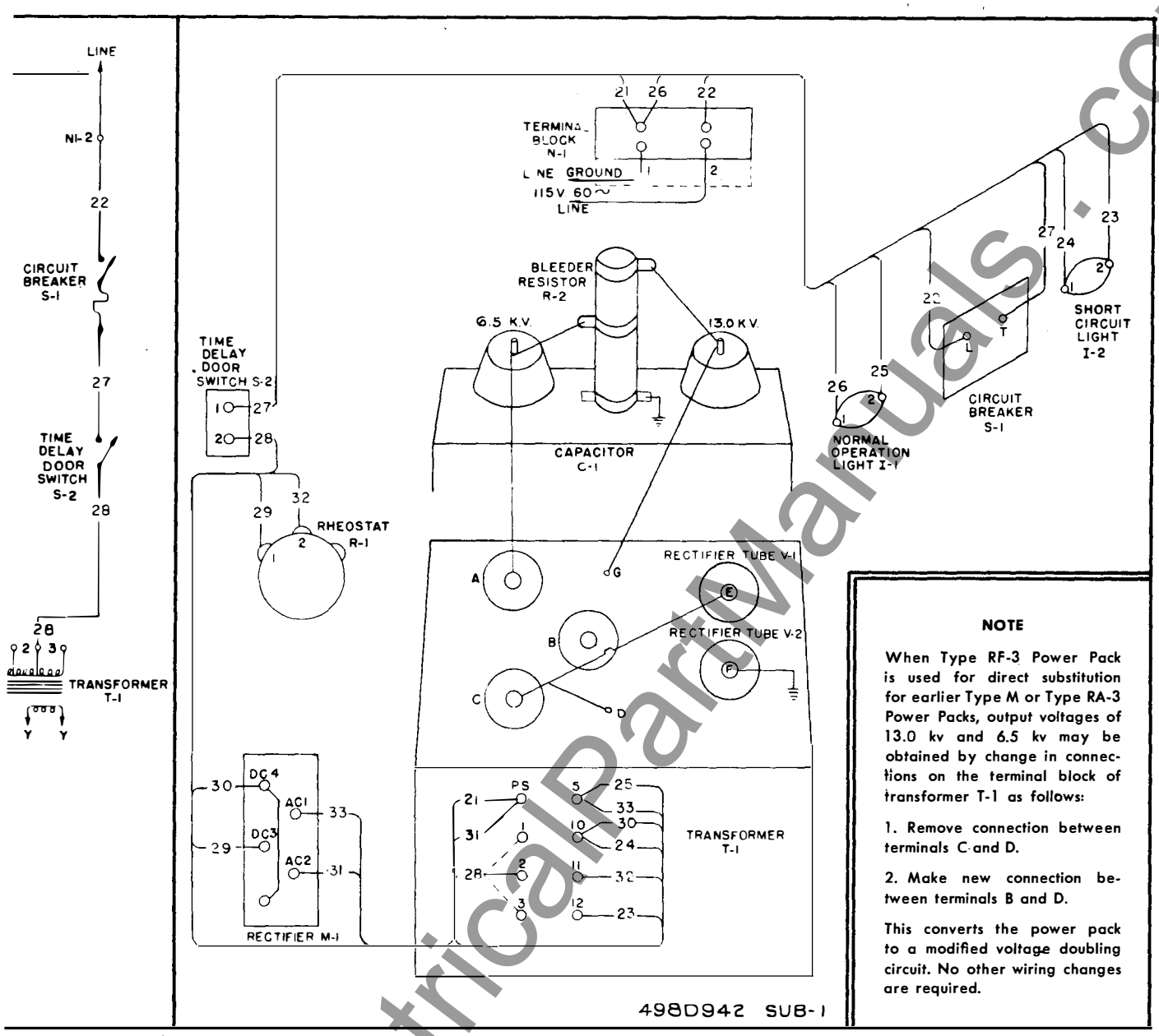
2a. If a short circuit indication persists after the above checks, there may be a short circuit or ground in transformer T-1, open circuit in rheostat R-1 or rectifier M-1 may be defective.

2b. Check transformer T-1 insulation with a megger. Check windings with ohmmeter. Approximate resistances should be 7.5 ohms PS-3: 1.0 ohms PS-5; 11 ohms 10-11; 7800 ohms A-C. Replace transformer if found defective.

2c. Check rheostat R-1 with an ohmmeter. Approximate resistances should be 90 ohms when set to extreme counterclockwise rotation. Replace rheostat if found defective.

2d. Examine rectifier M-1 for signs of damage or overheating and replace if found 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-481 rectifier tubes are recommended. In an emergency, Type 3B24 tubes will work as a substitute.



NOTE

When Type RF-3 Power Pack is used for direct substitution for earlier Type M or Type RA-3 Power Packs, output voltages of 13.0 kv and 6.5 kv may be obtained by change in connections on the terminal block of transformer T-1 as follows:

1. Remove connection between terminals C and D.

2. Make new connection between terminals B and D.

This converts the power pack to a modified voltage doubling circuit. No other wiring changes are required.

Fig. 3 Schematic and Detailed Wiring Diagrams

Adjustment. Before the PRECIPITRON unit is placed in operation, each power pack must be initially adjusted for proper operating voltages. This requires an approved high voltage d.c. meter, a 0-150 V ac voltmeter and a 0-1 amp ac ammeter. Note: Observe the "caution" (Page 4) throughout the adjustment.

1. Measure supply line voltage.

2. Using Fig. 4 select proper transformer tap to compensate for line voltage and face area of PRECIPITRON being supplied by the power pack.

3. Disconnect lead #28 from transformer. Connect ammeter between lead #28 and transformer tap selected in step 2 above.

4. Connect high voltage meter between 13.0 KV terminal and ground.

5. Close power pack door time delay switch using 3/8-16 bolt or screw driver to operate switch.

6. Energize power pack by turning on circuit breaker and adjust rheostat to give 13.0 KV reading on high voltage meter. If output voltage is low or power pack indicates short circuit, check PRECIPITRON cells and ionizers for short circuit or excessive leakage.

7. When power pack has been adjusted to deliver exactly 13.0 KV to the PRECIPITRON under average line voltage conditions, check ammeter reading and compare with Fig. 4. If line current is more than 5% higher or lower than curves indicate, check PRECIPITRON for faults, correct and repeat adjustment.

8. Shut off power pack and connect high voltage meter to 6.5 KV terminal and check voltage. Should be 6.2-6.6 KV.

TAP SELECTION TABLE			
LINE VOLTAGE	SQ. FT. FACE AREA		
	4-6	7-9	10-12
110	TAP 2	TAP 1	TAP 1
115	TAP 3	TAP 2	TAP 2
120	TAP 3	TAP 3	TAP 3

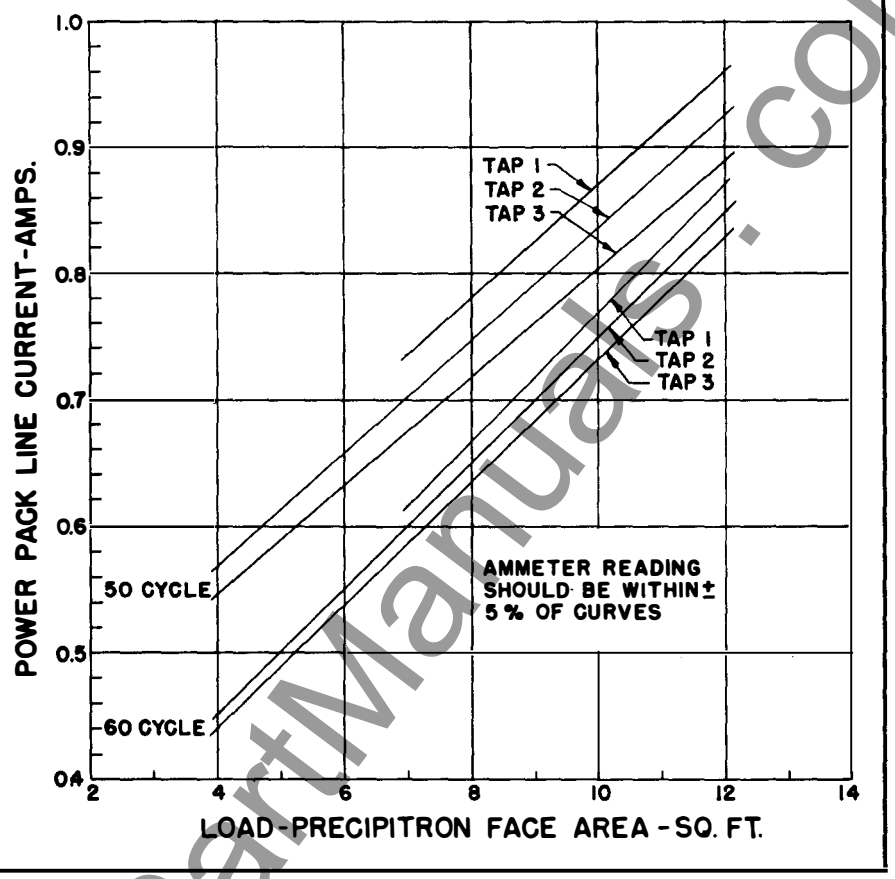


Fig. 4 Input Current vs. Precipitron Load and Transformer Tap Settings

9. Make scribe mark, in line with slot in rheostat shaft, on bracket to indicate proper setting. Replace locking cap nut on rheostat.

10. Remove bolt or screw driver from power pack time delay switch. Disconnect high voltage meter and ammeter. Reconnect lead #28 to proper tap on transformer and close power pack door.

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" (orange) 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 also helpful in locating internal faults. First check the line voltage and tap setting (steps 1 and 2 of "Adjustment"). Set rheostat to extreme counterclockwise position and remove both high voltage cables from the capacitor terminals. Connect H.V. meter between 13.0 KV terminal and ground. When a trouble free pack is energized, the green light should glow (after initial flash of orange light) and the H.V. meter should read approximately 14.3-14.9 KV. Significantly low voltage indicates a short circuit. Reconnect H.V. cables and adjust rheostat 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.