

# INSTRUCTIONS



TYPE RC-5  
TYPE RC-22

*Precipitron*  
THE ELECTRONIC AIR CLEANER

POWER PACK

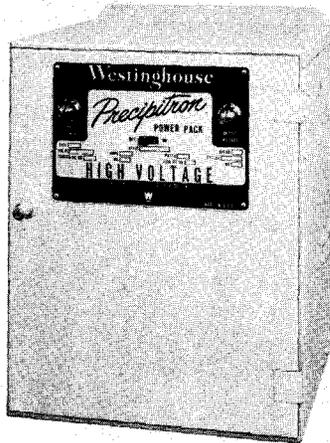


Figure 1. Type RC-5 & RC-22 Power Pack

The Type RC Power Packs are self-contained high voltage electronic rectifiers, specifically designed to supply the dc power requirements of PRECIPITRON electronic air cleaners.

Type RC-5 and Type RC-22 Power Packs are physically the same, except for the size of overload heater in the circuit breaker and a factory-made connection to the secondary winding of the high voltage transformer. These differences adapt the RC-5 arrangement to small PRECIPITRON units, and the RC-22 arrangement to large PRECIPITRON units.

## COMPONENT SPECIFICATIONS

**Cabinet** - Welded steel, mottled gray finish. Hinged door seals for dust tight interior. Vented recess accommodates capacitor.

**Controls and Indicating Lights** - On-Off circuit breaker protection. Neon glow lamps indicate input power and output voltage conditions.

**High Voltage Transformer** - low reactance, steel cased, gum filled with porcelain terminal block. Operates in series with reactor, with taps for 115-120-125 volt power supply, secondary terminals deliver 5000 volts after rectification.

**Filament Transformer** - steel cased, vacuum impregnated, gum filled with porcelain top providing integral mounting sockets for rectifier tubes.

**Capacitor** - Steel cased, INERTEEN filled, with porcelain terminals. Two 0.4 mfd, 7500 v sections, External bleeder resistors.

**Rectifier Tubes** - Industrial type WL-481B Kenotrons, 30 m.a., 25,000 volt inverse peak, 2.5 volt filament.

**Reactor, Rectifier and Potentiometer** - Saturable core reactor of varnish impregnated, open core and coil construction for primary circuit control. Direct current saturating coil energized by 350 m.a. selenium rectifier. Slotted shaft, wire wound potentiometer (2500 ohm, 0.17 amps. max.) 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 resistors completely discharge capacitor and cells.

## PRINCIPLE OF OPERATION

Type RC 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 10,000 volts dc for ionizers, 5000 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. The operation is as follows: - During one half of the ac cycle, 5000 volts from the high voltage transformer T-1 (see Fig. 4) 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, the 5000 volts from the high voltage 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 in series. Since the charges are additive, both sections to ground gives 10,000 volt (5000-5000): - first section to ground gives 5000 volts. Surge limiting resistors R-4 and R-3 normally have no effect on these voltages but when arc-over occurs in the PRECIPITRON these resistors protect the capacitor.

## ELECTRICAL RATING

	Type RC-5		Type RC-22	
	60 Cycle	50 Cycle	60 Cycle	50 Cycle
Input	115/120/125 V-AC, 1 PH		115/120/125 V-AC, 1 PH	
Rated Input Amps.	1.5	2.2	3.5	3.6
Rated Input Watts	125		330	250
Power Factor at Rated Load	71%	46%	79%	69%
Rated DC Load	5 MA at 10 KV-DC		22 MA at 10 KV-DC	
	1.7 MA at 5 KV-DC		7.3 MA at 5 KV-DC	
Max. Safe Ambient Temp.	40°C(104°F)		40°C(104°F)	
Circuit Breaker Heater Amps.	3		4.6	

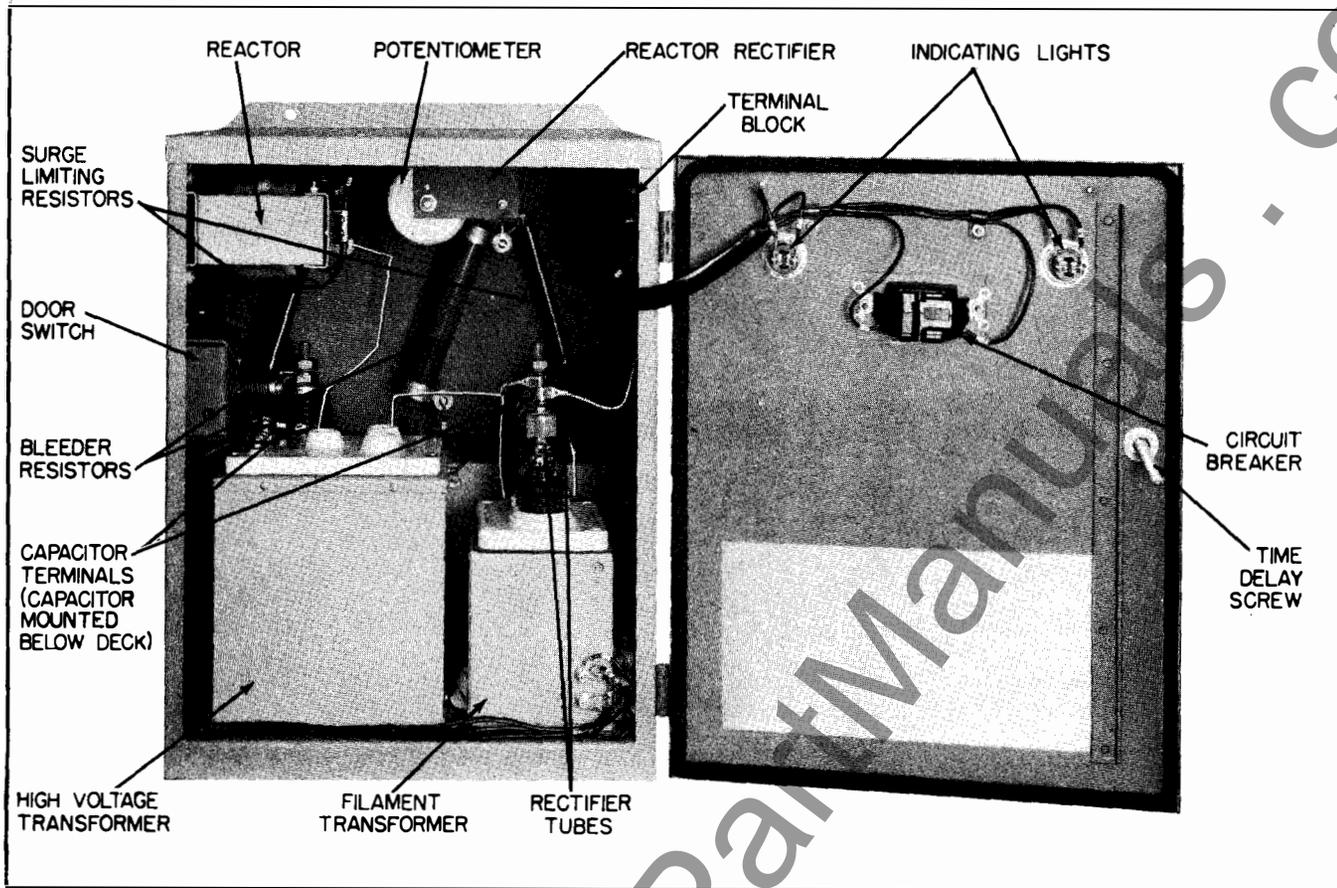


Figure 2 Interior of Type RC-5 and RC-22 Power Pack

**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 adjustment to a given size PRECIPITRON, potentiometer 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 door show both the operating status of the PRECIPITRON Unit and the power pack itself.

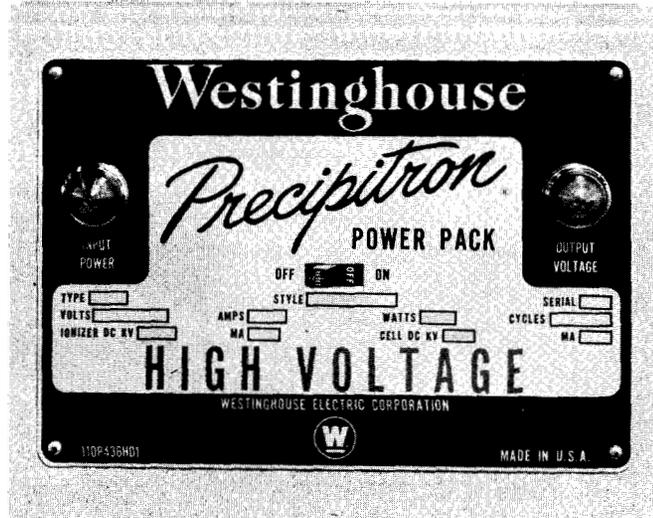


Figure 3 Location of Indicating Lights

The **INPUT POWER** light indicates whether the power pack is or is not energized by line power (120 volts). Under normal conditions this light is on at all times. Any interruption in the 120 volt input circuit, such as a power failure, an open access door, interlock switch or a tripped circuit breaker will extinguish this light.

**TYPE RC POWER PACKS**

The **OUTPUT VOLTAGE** light indicates whether or not the power pack is delivering high voltage at the output terminals of the surge resistors. This light is "on" under all normal conditions. It is extinguished when any of the following faults occur:

- (a) **SHORT CIRCUIT** in either the cells or ionizers of the PRECIPITRON Unit.
- (b) Failure of either rectifier tube.
- (c) Failure of either surge limiting resistor.
- (d) Failure of the 10 KV bleeder resistor.
- (e) Failure of some internal component that will cause complete absence or drastic reduction of output voltage.

The most significant indication provided by the **OUTPUT POWER** light is that of short circuit or excessive arcing in the PRECIPITRON Unit. Short circuits occur most frequently from excessive dirt loadings due to inadequate washing. Frequent arcing in the unit is a signal that the unit should be inspected and possibly washed. This will be indicated by flashing of the **OUTPUT POWER** light.

**Door Switch.** For safety of the operator, the cabinet door is equipped with a screw operated interlock switch. This opens the 120 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.

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.

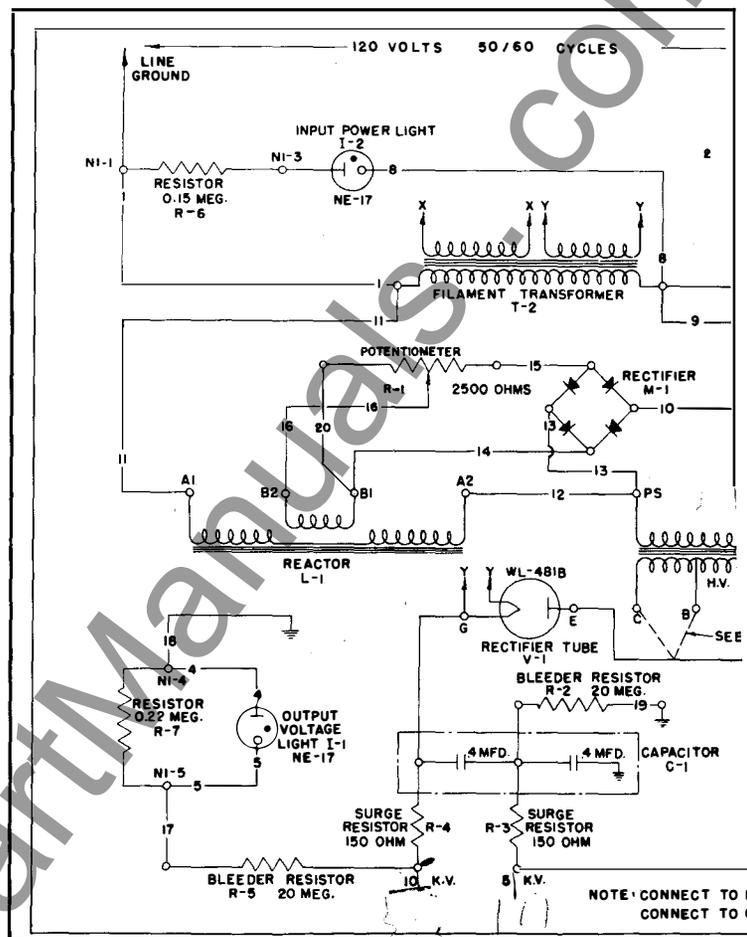
**INSTALLATION**

**Application.** The Type RC-5 or Type RC-22 Power Pack is used with various combinations of Type CB PRECIPITRON cells or other collector assemblies where 10 KV dc is required for the ionizers and 5 KV for the plates. Choice between RC-5 and RC-22 depends on the face area of the collector. The RC-5 is usable for 2 to 20 sq. ft. total face area. The RC-22 is usable for 10 to 60 sq. ft. Larger face areas require two or more packs.

Type RC-5 Power Pack may be field converted into Type RC-22 by changing the high voltage tap connection, (see Fig. 4) and changing the circuit breaker heater (see Maintenance, Step 10).

The primary supply voltage must be steady (+3 volts max. fluctuation) and within the limits provided by the primary transformer taps, i.e. 115, 120 or 125 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 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.

**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: 10 KV conduit to right top hole (facing door), 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 of the surge limiting resistors. Solder lugs to cables. The terminal marked 10 KV is for the PRECIPITRON ionizer cable, the 5 KV terminal for the cell cable. (See Fig. 4.)

**Low Voltage Connections.** After checking all high voltage and grounding connections, connect the incoming low voltage supply to terminals 1 & 2. (See Fig. 4.) Note: Refer to PRECIPITRON unit wiring diagram for overall installation connections.

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

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. INPUT POWER light out.	<ul style="list-style-type: none"> <li>a. Door switch on duct doors or power pack not closed.</li> <li>b. Burned out lamp.</li> <li>c. Loose connections to input power light socket, defective resistor R-6 or defective socket.</li> </ul>	<p>Check door switches.</p> <p>Replace lamp with known good one.</p> <p>Check leads 3 and 8 and connections at both ends. Check resistor R-6. Test socket.</p>	<p>Tighten time delay screws.</p> <p>Install new lamp.</p> <p>Repair, replace resistor, if necessary.</p>
2. OUTPUT VOLTAGE light flashing.	<ul style="list-style-type: none"> <li>a. PRECIPITRON Unit needs washing.</li> <li>b. Defective lamp.</li> </ul>	<p>Wash unit and re-check.</p> <p>Replace lamp with known good one.</p>	<p>Locate and remove dirt lodged between cell plates.</p> <p>Install new lamp.</p>
3. OUTPUT VOLTAGE light out.	<ul style="list-style-type: none"> <li>a. Short circuit in PRECIPITRON cells or H.V. cable.</li> <li>b. Short circuit in PRECIPITRON ionizers or H.V. cable.</li> <li>c. Defective rectifier tube.</li> <li>d. Faulty surge limiting resistors.</li> <li>e. Power pack component failure.</li> </ul>	<p>Disconnect H.V. cable to cells from 5.0 KV terminal in power pack. Energize power pack.</p> <p>If light now glows, cells or H.V. cable are short circuited.</p> <p>Disconnect H.V. cable to ionizers from 10.0 KV terminal in power pack. Energize power pack. If light now glows, ionizers or H.V. cables are short circuited.</p> <p><b>OBSERVE CAUTION:</b> Energize power pack with door open and examine tubes for fluorescent glow or burned out filament.</p> <p>Bridge resistors R-3 and R-4 individually, energize power pack and check output voltage indication.</p> <p>Check components and wiring as described in text.</p>	<p>Locate and correct fault in PRECIPITRON cells or H.V. cables.</p> <p>Locate and correct fault in PRECIPITRON ionizers or H.V. cables.</p> <p>Replace defective tubes.</p> <p>Replace defective resistor.</p> <p>Replace defective part.</p>
4. Circuit breaker trips.	Short circuit in power pack component or faulty circuit breaker heater.	First measure input voltage and current, then check wiring and parts.	Repair wiring or replace defective part.
5. INPUT POWER light on, but one or both rectifier tubes do not glow.	<ul style="list-style-type: none"> <li>a. Defective rectifier tubes.</li> <li>b. Faulty filament transformer (both tubes "out").</li> </ul>	<p>Install known good tubes.</p> <p>Check filament transformer. (See text)</p>	<p>Install new tube.</p> <p>Replace filament transformer.</p>
6. INPUT POWER light on, OUTPUT VOLTAGE low or non-existent.	<ul style="list-style-type: none"> <li>a. Defective rectifier tube.</li> <li>b. Primary reactor control circuit not functioning.</li> <li>c. Defective high voltage transformer.</li> <li>d. Defective capacitor.</li> </ul>	<p>Check operation with known good tubes.</p> <p>Measure voltage drop across primary of high voltage transformer. (normal is 95-120)</p> <p>Check H.V. transformer for open windings.</p> <p>Check capacitor for open circuit.</p>	<p>Replace defective tube(s).</p> <p>Replace potentiometer, rectifier, reactor, if defective. Recheck potentiometer setting. (See "Adjustment")</p> <p>Replace defective transformer.</p> <p>Replace defective capacitor.</p>

Replacement Rectifier Tubes. Westinghouse Type WL-481B are recommended. In an emergency, tubes

Type 3-B-24, RK-72 or CE-220 will work as a substitute.

PE RC POWER PACKS

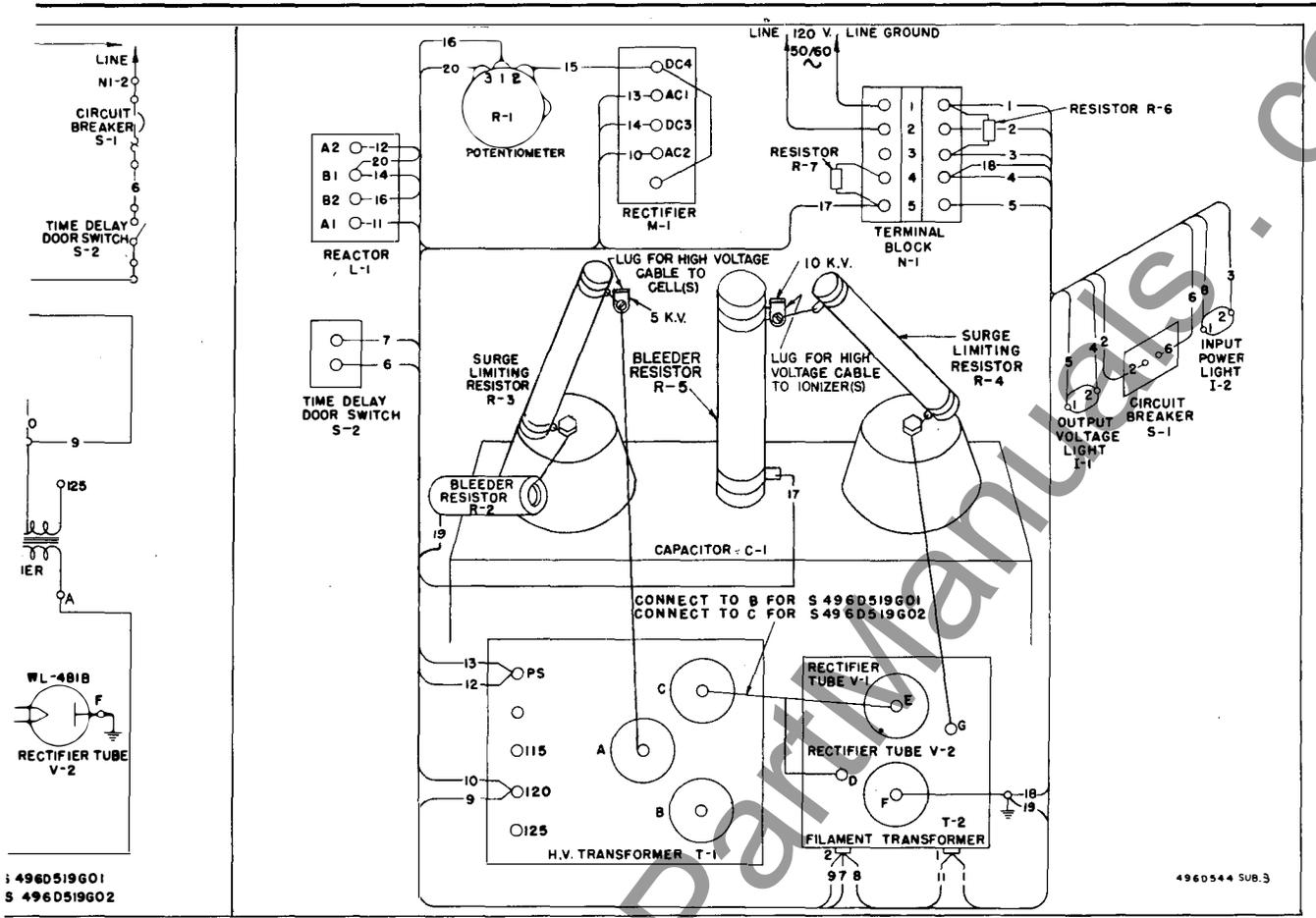


Figure 4 Schematic and Detailed Wiring Diagrams

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.

**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 9 & 10 to transformer tap closest to the average supply voltage.
2. Switch "off" circuit breaker. Connect ammeter to read supply current (terminal 1 or 2).
3. Connect high voltage meter to 5 KV terminal (R-3) and ground. Remove locking cap and turn potentiometer to full counterclockwise position (min. output voltage). Switch "on" door time delay switch S-2 by inserting a 3/8-16 bolt or screw driver.

4. Observe the "CAUTION" (Page 4), and switch on the circuit breaker. Both rectifier tubes and the INPUT POWER indicator should glow. (The OUTPUT VOLTAGE indicator may not glow until the potentiometer is readjusted in the following step.) If these conditions do not exist, use check chart to locate trouble and correct fault before proceeding.

5. Being sure not to touch any other part, turn the Potentiometer shaft clockwise (with an insulating handle) until high voltage meter reads 5.0 KV. At this point the OUTPUT VOLTAGE light should glow at about the same brilliance as the INPUT POWER light. If 5.0 KV cannot be obtained by Potentiometer adjustment, use check chart to locate trouble and correct fault before proceeding.

6. Record ammeter reading and compare with load curves in Fig. 5. 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.

7. Switch "off" circuit breaker, observe the above "CAUTION" and connect high voltage meter to 10 KV terminal. Switch "on" circuit breaker and note voltmeter reading. Should be 9.7-10.1 KV.

8. Switch "off" circuit breaker. Observing "CAUTION" remove bolt or screw driver from door time delay switch and remove meters. Make a scribe mark, in line with slot in potentiometer 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.

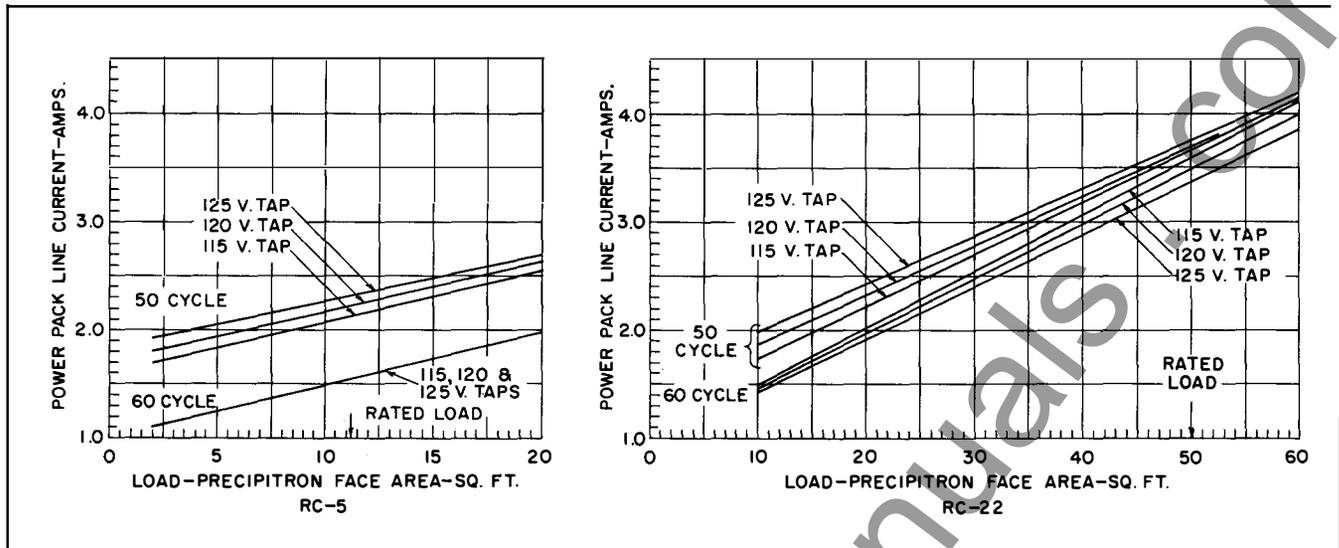


Fig. 5 Power Pack Input Current VS Precipitron Load

### 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. **INPUT POWER** indicating light should glow at normal brilliance.
2. **OUTPUT VOLTAGE** indicating light should glow at normal brilliance with little or no flashing. (A faint glow indicates trouble to be corrected.)

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

**Servicing** . Ordinarily, except for failure of the neon lamp, flashing, dimming or extinction of the OUTPUT VOLTAGE indicating light will signal an overload or short circuit in the PRECIPITRON Unit. This may be caused by excessive dirt in the unit, dirt bridges between plates of a collector cell, or broken ionizer wires or foreign objects lodged between high voltage and grounded parts.

Therefore, the first corrective step is to thoroughly wash the unit, then inspect for these possible causes of trouble. If necessary to proceed further, use the check chart, Table 1, as a guide in locating and correcting the trouble. Follow this through first, before going to the more complicated procedures.

**Isolating The Power Pack** is helpful in localizing the fault to the PRECIPITRON Unit or the power pack itself. Complete isolation should follow the verification check for external short circuits in the cells, ionizers or high voltage wiring. When the high voltage cables are disconnected from the surge limiting resistors, be sure to reconnect the rigid bus wire connections and bend the cables completely free and clear of all contact with high voltage parts. For safety, it is recommended that the power pack door be closed and the time delay screw used to close the power pack interlock switch.

**No - Load Check** . If the OUTPUT VOLTAGE light does not glow at normal brilliance when the power pack is disconnected from the PRECIPITRON Unit, the fault within the power pack must be located by inspection or suitable meters.

**Isolating Defective Parts** . Observe "CAUTION", Page 4, throughout all checks where the power pack door must be open while the power pack is energized.

1. **Voltage Output**. Make this check first. Connect line voltmeter and suitable high voltage meter, repeating steps 1, 2 and 3 under "Adjustment" as a check for mis-adjustment or malfunction in the reactor control circuit.

2. **Tubes**. If both tubes light, install known good tubes as a check for possible tube defects.

3. **Resistors**. Inspect for burning and check with an ohmmeter against values shown in the wiring diagram.

4. **Capacitor C-1**. Remove surge limiting resistors and disconnect all bus wires to the terminals. Check each section to ground with a megger. A good capacitor will initially show low resistance but after it is charged a few seconds by the megger it will show open circuit. CAUTION, be sure to "ground" both capacitor terminals after each test, before touching.

5. **Filament Transformer T-2**. Check continuity of windings with an ohmmeter. Resistance will be too low for resistance readings. Check insulation with a megger.

6. **High Voltage Transformer T-1**. Check windings with an ohmmeter. Approximate resistances should be 0.6 ohms between terminals PS-125; 1400 ohms between A-B; 270 ohms between B-C.

7. **Reactor L-1**. Check with an ohmmeter. Approximate resistances should be 0.5 ohms between terminals A1-A2; 330 ohms between B1-B2.

8. **Potentiometer R-1**. Check with an ohmmeter. Full resistance is approximately 2500 ohms. Rotate shaft to check contact arm, resetting finally to original scribe mark position.

9. **Rectifier M-1**. Examine for signs of overheating or damage.

10. **Circuit Breaker S-1**. INPUT POWER light should show continuity. Temporarily ground load terminal to check overload trip. Correct overload heater is 3 amps. for RC-5 and 4.6 amps. for RC-22.

**Parts Replacement** . In all cases where defective parts are replaced, be sure to reconnect all internal wiring before making further tests. Check power pack with high voltage cables disconnected (See NO-LOAD CHECK above), then reconnect cables and check voltage at 5.0 KV terminal as described in Step 3 under "Adjustment".