I. B. 1450-2

RECEIVING • INSTALLATION • MAINTENANCE

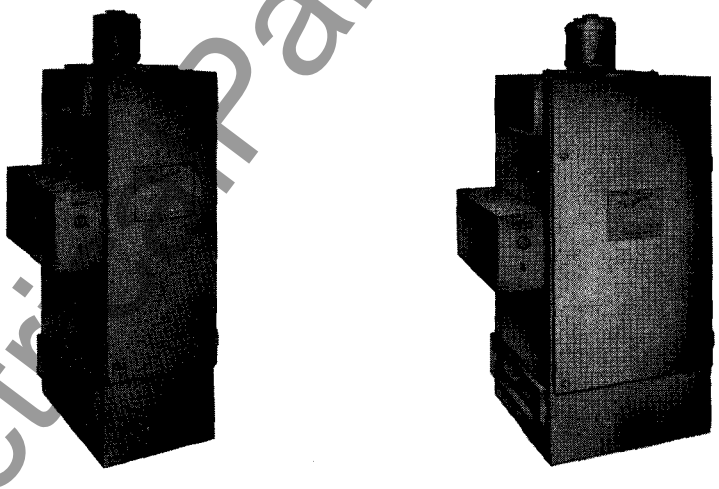
# INSTRUCTIONS

## MODEL PO-6 & PO-12

## Westinghouse Precipitron®

THE *ELECTRONIC* AIR CLEANER

## OIL MIST CONTROL UNIT

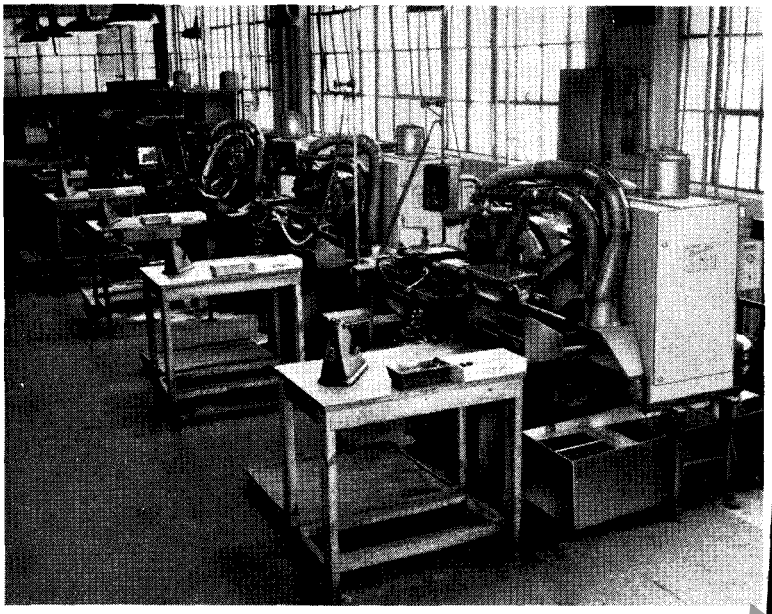


PRECIPITRON Oil Mist Control Unit is an electronic air cleaning apparatus used to remove oil mist from the machine room air. To produce the desired results, it must be properly installed and maintained. This Instruction Book gives correct steps and precautions to be taken. It should be carefully read before the unit is installed or operated.

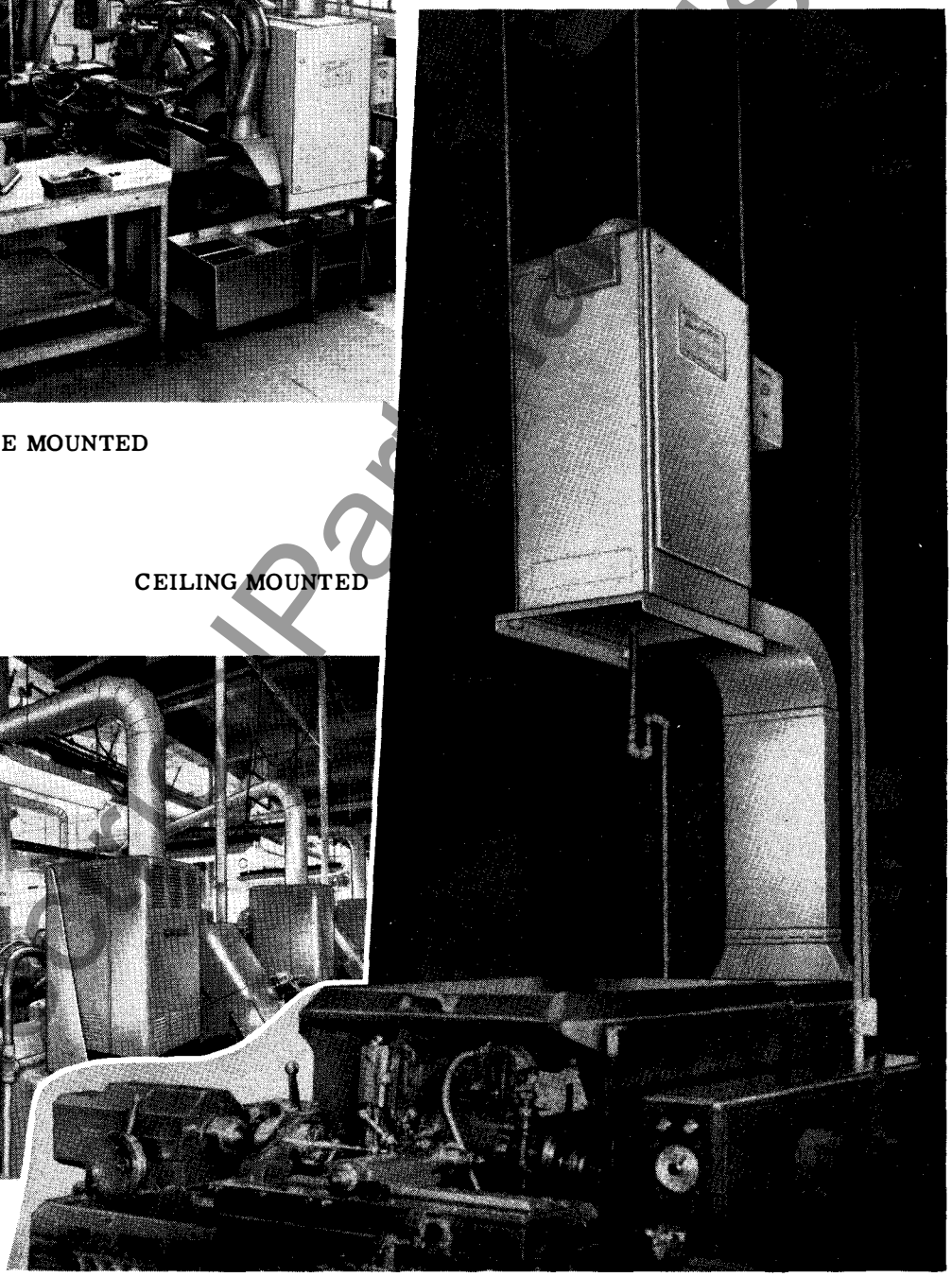
SUPERSEDES 1. B. 1450-1
EFFECTIVE SEPTEMBER, 1953

EFFECTIVE MAY, 1957

WESTINGHOUSE ELECTRIC CORPORATION
HYDE PARK • STURTEVANT DIVISION • BOSTON 36, MASS.



MACHINE MOUNTED



CEILING MOUNTED



FLOOR MOUNTED

## RECEIVING, UNPACKING AND HANDLING

PRECIPITRON Oil Mist Units are shipped completely assembled and ready to install. Model PO-12 weighs 420 lbs. and the Model PO-6 weighs 320 lbs. Dimensions for each size are shown on Dimension Sheet 1450.

As shipped from the factory, the power pack and inlet duct flange are on the left-hand side when facing the access door. Both may be relocated in the field to the right-hand side, if desired.

Upon receipt of the unit, any evidence of damage or loss should be reported immediately to the last carrier so that an inspection can be made by an agent of the transportation company. A claim should be filed against the carrier to cover any shipping damage or loss.

To uncrate, remove the top of the crate and then the four sides. Remove skid by tilting the unit and unscrewing the four bolts under the skid.

Except for initial inspection, it is recommended that the unit be stored in the crate, being sure that it is protected from the weather. Move or handle the unit by using a lift or slings under the skid. Avoid jarring or dropping the unit since the electronic equipment can be damaged by rough handling.

## INSTALLATION

**Locating the Unit.** Oil Mist Units should be located as close as possible to the machines which they serve to allow the use of short ducts and oil return lines. They may be set on the floor, mounted on the machine, set up on a simple angle iron mounting stand, or supported from overhead structures. (See "Drain Connections" for other mounting requirements.) Base of unit is provided with tapped holes at the four corners to accommodate 3/8-16 mounting bolts.

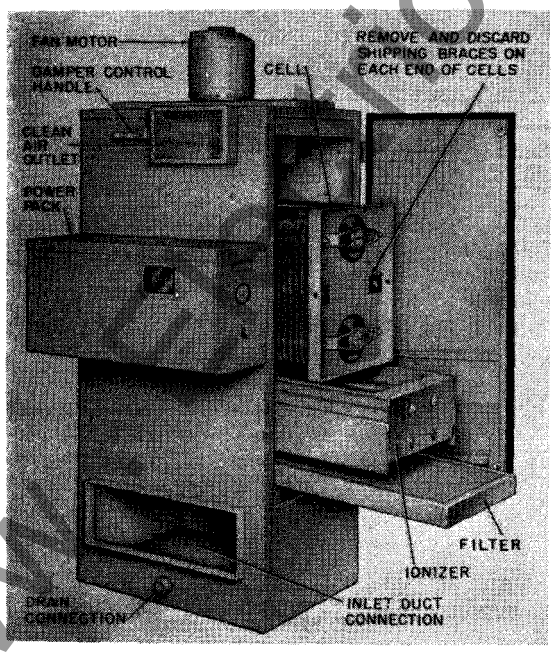



FIG. 1 PO-6 UNIT

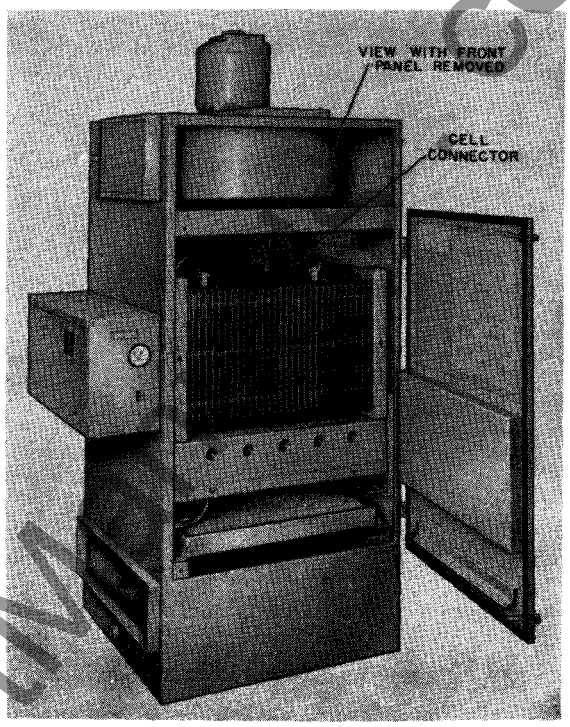



FIG. 2 PO-12 UNIT

A minimum of 30" of clearance space in front of the cabinet door, 10" on the window side of the power pack, and 10" above the overall height of the unit is required for service access.

**Internal Packing.** When unit is located, open the cabinet door and remove cardboard packing between the ionizer and door. Remove shipping braces and extra nuts at the ends of each cell. (see Fig. 1 & 2.)

**Air Flow Requirements.** Nominal ratings are 600 cfm for Model PO-6 and 1200 cfm for Model PO-12, when the static pressure loss in the external duct system is 1" w.g.

Best overall results are obtained when rated cfm capacity is used. This requires that the external duct and hood be designed for no more than 1" w.g. static pressure loss. Should the loss be less, air flow will be increased but with a corresponding reduction in air cleaning efficiency. An outlet damper is provided to adjust air flow for best results. However, should the loss in the external duct system exceed 1" w.g. reduced air flow can only be corrected by redesigning the duct elements.

**Hoods and Ducts.** Control of oil mist requires the removal of air immediately surrounding the point of dispersal. Around this point, there will be a zone where air is highly contaminated and mist will be spreading rapidly into the surrounding atmosphere. Air within this zone must be made to flow toward and into the duct pick-up opening at sufficient speed to overcome the forces causing the mist to spread. A minimum air velocity of 100 f.p.m. at the outer limits of the zone is recommended. Wherever possible, the mist zone should be confined with some sort of an enclosure or hood.

The efficiency of mist collection decreases rapidly as the duct opening or throat of the hood is moved from the source of mist generation. For typical ducts, this distance should not be much beyond 1 to 1-1/2 duct opening diameters to create the required minimum 100 f.p.m. inrush velocity. The shape of the duct pick-up opening also affects its area of influence, but more important, it definitely limits the efficiency with which the whole duct system will operate. A large percentage of system pressure loss can be due to poor design of the opening. A streamlined opening is best. Flared hood with 40 degree included angle between the sides is good. A flanged opening is fair, but a straight pipe opening is poor.

Ducts should be sized liberally, with a minimum number of elbows or sharp turns. Ducts sized for velocities from 2000 to 3000 f.p.m. are satisfactory. Round ducts are preferred cost-wise but equivalent rectangular ducts are equally satisfactory. Duct work should be smooth, with tightly fitted joints and seams and should be pitched to prevent oil pockets in the duct.

For convenience, Model PO-6/12 cabinets have an inlet opening on both sides. The duct flange may be exchanged for the blanking cover, using the screws provided. Where one unit is to serve two or more machines, both inlet openings should be used. Ducts from each machine should be equipped with dampers to balance the air flow. A typical duct inlet transition is shown in Fig. 3.

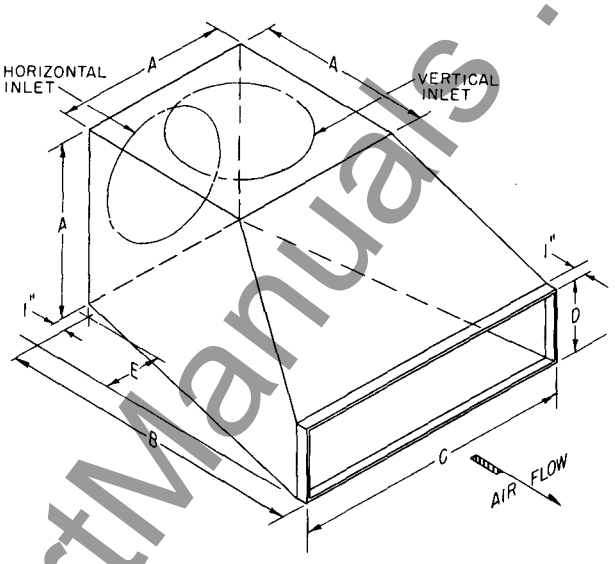
Clean air from the unit is normally returned to the machine room area. If it is desirable to exhaust air to a remote point, the screened cover may be removed from the air outlet to provide a flange for duct connection. (Remote exhaust may be necessary if objectionable gases are combined with oil mist being collected, since PRECIPITRON can only remove liquid or solid particles from the air.) Outlet flange cannot be relocated since it is a part of the fan. If vertical discharge is desired, an elbow connection as shown in Fig. 3 is recommended. Note: If an exhaust duct is used, be sure to include its pressure loss when designing the overall duct system.

**Drain Connections.** A 3/4" i.p.s. female drain connection is located at the left lower side of the cabinet. Suitable plumbing is required to drain collected oil to the machine coolant sump or other disposal facility. Piping should be pitched to assure gravity flow from the unit. A "U" trap should be installed in the drain pipe to prevent blocking, reverse oil flow, or leakage of air due to the fan suction. Instead of a trap, the end of the drain pipe may be submerged into the oil at the machine sump. Trap or submerged pipe should overcome a minimum of 3" w.g. suction. For gravity draining, a platform or mounting stand may be required to elevate the unit above the machine sump.

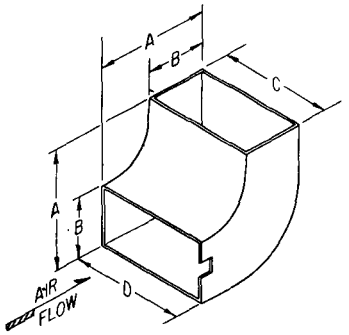
**Power Supply.** 115 ±5 volts, 1 ph., 60 cy., power is required for the power pack and 220 or 440 volts, 3 ph., 60 cy. for the fan motor. If the power pack voltage varies more than the ±5 volts, the local power company or a competent engineer should be consulted and the voltage corrected. 50 cy. power can be used, but the cfm rating will be 1/6 less.

**Wiring Connections.** Units are supplied completely wired, requiring only connections to the external power supply. Rigid steel conduit or flexible armored cable with approved hardware should be used as required by electrical codes having jurisdiction.

**Power Pack Wiring.** Connect the 1 ph. supply as shown in Fig. 4, using 7/8" wiring hole in the top of the power pack. For late design units, remove the side cover plate for access to the terminal block. For early design units, remove the four screws on the front control panel and carefully pull out the chassis and panel assembly far enough for access to the terminal block.




| INLET FOR UNIT | A | B | C | D | E |
|---|---|---|---|---|---|
| PO6 | 12 | 20 | 17 7/8 | 5 3/4 | 3 |
| PO12 | 14 | 25 | 22 7/8 | 5 3/4 | 4 1/2 |




| OUTLET FOR UNIT | A | B | C | D |
|---|---|---|---|---|
| PO6 | 9 1/8 | 5 1/4 | 8 3/4 | 8 15/16 |
| PO12 | 15 3/8 | 8 | 13 3/4 | 13 15/16 |

FIG. 3 TYPICAL DUCT CONNECTIONS

Measure the supply voltage with a voltmeter and change the transformer primary tap, if necessary, as specified in Fig. 4. Transformer taps are accessible through the side plate opening on late design units. For early design units, the panel and chassis assembly must be pulled nearly all the way out for this access, and it is necessary to disconnect the external leads.

## CHECK CHART

| Trouble | Verification | Correction |
|---|---|---|
| 1. Mist in machine room | a. All mist not drawn into duct pick-up | See 2 & 3 below |
| | b. Mist exhausting from the unit | See 2, 4, 5 & 6 below |
| | c. Mist originating from another source | Install another PRECIPITRON Oil Mist Control Unit or otherwise eliminate. |
| 2. Low air velocity | a. Undersized duct or poor hood design | See "Air Flow Requirements" & "Hoods and Ducts" |
| | b. Low motor current | See "Adjustment of Outlet Damper" |
| | c. Low electrical frequency | See "Power Supply" |
| 3. Fan not running | a. Power supply open | Check incoming power supply |
| | b. Motor starting switch "off" or "tripped" | Turn on switch - check heater rating - also see 3c, d or e below |
| | c. Wrong or faulty wiring | Correct wiring |
| | d. Defective motor | Repair or replace motor |
| | e. Fan wheel restrained | Correct fan wheel clearance |
| 4. Ammeter reads zero | a. Power pack circuit breaker "off" or "tripped" | Turn on breaker. Also see 6 below |
| | b. Time delay switch at cabinet or power pack open | Tighten or adjust time delay screw |
| | c. Open circuit in low voltage system or faulty ammeter | Check continuity of low voltage wiring and parts. Repair or replace as required |
| 5. Ammeter reads low (Green range below 0.4 amps) | a. Low power supply voltage | See "Power Supply" & "Power Pack Wiring" |
| | b. Dirty Ionizer | Clean wires and tubes. See "Cleaning" |
| | c. Ionizer and cell cables not connected | Connect cables |
| | d. Rectifier tube does not glow | Check tube socket contact - try replacing tube - check transformer wiring and winding. See "Normal Operation" |
| | e. Faulty ammeter | Replace meter |
| 6. Ammeter reads high (Red range above 0.6 amps) | a. High supply voltage | See "Power Supply" & "Power Pack Wiring" |
| | b. Broken ionizer wire | Replace wire being sure to remove broken pieces |
| | c. Dirty cells or ionizer | See "Cleaning". Also too much moisture in mist |
| | d. Short circuit in cells, ionizer or wiring | See notes 1 & 2 below |
| | e. Short circuit in power pack | See notes 1 & 2 below |

Note #1: Short circuits can usually be located in the cells or ionizer by inspection. (See "CAUTION"). Check for broken ionizer wires, bent cell plates, dirt between plates or dirty components. If the fault cannot be located by inspection, localize the trouble by alternately disconnecting the high voltage cables at the cells, ionizer and capacitor terminals. Repair or replace the defective part. For power pack short circuits, first check the rectifier tubes. Next inspect the wiring for grounds and then test the transformer and capacitor or try replacing them until the fault is corrected.

Note #2: If a d.c. high voltage meter is available, measurement of the ionizer & cell voltages is helpful in locating troubles. See "CAUTION". Ionizer voltage should be 12.5 ± 0.5 KV and cell voltage 6 ± 0.5 KV. Usually these voltages will be low when there is a high voltage short circuit.

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the ionizer, become thickly coated. In addition to collecting oil mist, the unit will also collect other particles, such as dirt and smoke. Small quantities of these impurities will usually be flushed away as the oil drains, but large quantities may adhere to the internal components requiring occasional cleaning. The type of oil being collected also affects cleaning requirements. If the oil does not flow freely or forms gummy deposits, periodic cleaning will be required.

There are many types of oil mixtures, some better adapted than others for mist collection. It is not always possible to predetermine the degree of self-cleaning, but for satisfactory results, the oil to be collected should meet the following qualifications:

| | |
|---|---|
| Flash Point | - Not below 275 deg. F. |
| Viscosity | - Free flowing at room temperature. |
| Quality | - Mineral oil base, stable properties. |
| Condition | - Preferably mist with minimum of smoke or carbonized oil. |

Experience has proven that some materials must be avoided. Inflammable or explosive mists present too great a fire hazard. Highly volatile materials, while not necessarily hazardous, may leave insoluble residues or corrosive compounds, Animal, and some vegetable oils, air drying oils, paints, inks, and others that dry out, oxidize readily forming gums which coat the elements too effectively for practical operation.

With due respect to these limitations, units will operate three to six months or longer without the need for cleaning. Even though a particular application requires more frequent cleaning, the benefits obtained by elimination of oil mist nuisance will usually outweigh the cleaning costs. Need for frequent cleaning can be reduced by eliminating some of the dirt or smoke entering the unit or by selecting a more suitable oil.

Extreme operating conditions (requiring cleaning more frequently than once a week) where too much dirt or smoke is collected, may be improved by deliberately injecting an oil spray into the inlet air. The source of this oil can be from the coolant in the machine sump. By saturating the air with oil mist, self cleaning action is greatly improved. Oil injection equipment (motor pump, spray nozzle with suitable control parts and piping) can be supplied when required.

## MAINTENANCE

**Inspection.** Regular inspection of the unit will assure optimum performance. Inspect daily to see that the fan and power pack are operating properly and that clean air is being discharged as outlined under "Normal Operation".

**Cleaning the Unit.** For new units, cells, ionizers, and filters should be inspected weekly for cleanliness. Experience after a few inspections will determine the need for regular cleanings. In any event, it is good practice to inspect the internal components at least monthly. If a layer of dirt or hardened oil is observed on cell plates, ionizer tubes, ionizer wires, insulators, or filters, the dirty components should be removed and thoroughly cleaned. This is not necessary if a slight oil film is noted, but its presence should be carefully observed during subsequent inspections to be sure that buildup is not taking place. Thick layers are difficult to clean off, particularly if allowed to remain for long periods.

When removing components, be careful not to break ionizer wires or bend cell plates. Also, be sure to disconnect and reconnect high voltage cables properly.

Ordinary degreasing equipment is usually quite effective in removing oily dirt, and should be used if available. If a degreaser is not available or if it is not effective, a dip tank (at least 24" x 18" x 15" for the P0-12 or 12" x 18" x 15" for the P0-6) is recommended. Mix a solution of one pound of mild detergent in each gallon of 130-150°F. water. (Detergent "ALL" is recommended because it is available and will not adversely affect the aluminum.) Dip dirty components in the detergent solution and allow to soak ten minutes. Immediately after removing components from the dip tank, thoroughly rinse or hose with clean hot water. Inspect components for cleanliness and repeat detergent dip and rinse if necessary. Components should be metal clean.

## LOCATION AND CORRECTION OF FAULTS

After the unit is properly installed and adjusted, all mist should be drawn into the duct pick-up and no appreciable mist should be exhausted from the unit. Any deviation from this condition indicates the unit is under-size and a larger or additional unit is required. Before actually changing the unit, a thorough check of the installation is recommended to be sure that the duct elements are properly designed and installed and that the unit is operating properly. The "Check Chart" should be used as a guide for this check as well as for locating and correcting troubles.

**CAUTION:** During servicing, be careful not to come in contact with electrical parts inside the power pack or cabinet when the power pack is energized. Allow at least 30 seconds after the power pack has been turned off. This will permit the HIGH VOLTAGE to leak off to a safe value through the resistors in the capacitor. In addition, before touching any high voltage part it is recommended that the part be grounded with a ground prod equipped with a suitably insulated handle.

nounced. With the fan and power pack operating properly, all mist should be drawn from the work space and clean air should exhaust from the unit.

**Starting of the Unit.** After unit and duct system have been properly installed and adjusted, arrangements should be made for the Westinghouse service representative to give the unit a start-up inspection.

## OPERATION

**Principle of Operation.** PRECIPITRON operates on the electronic principle that oil mist may be removed from the air by first giving the mist an electrostatic charge (ionizer) and then deflecting the charged mist particles by electrostatic forces to the collecting surfaces (cell plates). When connected to a suitable duct system, electric power and drain facilities, the unit will effectively clean and salvage ventilating air with a minimum of service. As the oil is collected, it drains from the cell plates onto the ionizer, and then through the filter to the drain pan. This flushing action plays an important part in eliminating or reducing the need for cleaning the internal components of the unit.

**Cabinet** is designed for maximum serviceability. Cells, ionizer, and filters are supported by tracks permitting easy removal. Cells are held with angle clips bolted to the cabinet sides. Hinged door is fastened with two hand operated screws and is gasketed to prevent air leakage. Fan and motor assembly forms the top of the unit and the drain pan forms the bottom. Direction of air flow is upward.

**Fan and Motor Assembly** is sized to draw rated air volume through the unit when connected to a properly designed duct system. (See Fig. 5) Fan wheel is attached to the motor shaft with two set screws.

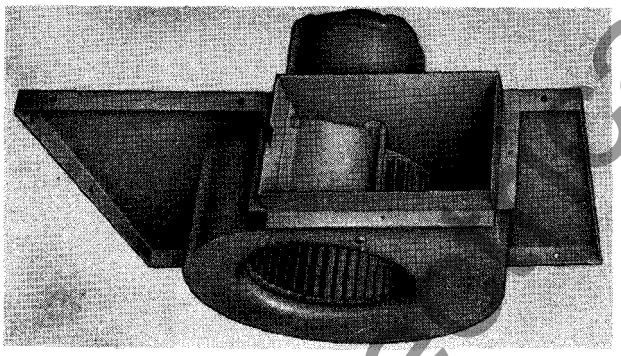

FIG. 5 FAN AND MOTOR ASSEMBLY

**Cleanable Filter** prevents chips and large particles from entering the high voltage components.

**Ionizer** (Fig. 6) charges the airborne particles. Consists of a series of horizontal tubes, between which small wires are suspended from a framework set off with insulators. Horizontal tubes, being attached to the casing, are at ground potential. Application of high d.c. voltage (12 KV) between wires and tubes creates an ionizing zone where airborne particles receive electrostatic charges.

**Ionizer Wires.** Attached near the center of each wire is a dampener (ball) which prevents the wire from vibrating during operation. These wires are supplied complete with dampeners and pre-looped ends from the factory, and must be completely replaced if the wire breaks or the dampener becomes damaged or loose. To check the effectiveness of

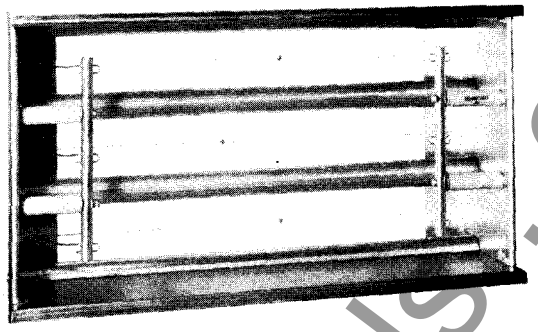

FIG. 6 IONIZER

the dampener, pluck the wire to see that the vibration dampens in one or two seconds. Wires should be taut and centered between the tubes.

**Cells.** Charged mist passes to the cells where it is collected. Cells comprise an assembly of many flat plates equally spaced and supported on tie rods. These plates are arranged in two sets, one grounded, and the other supported on insulators. High d.c. voltage (6 KW) applied between the sets creates a strong electrostatic field which forces the charged particles out of the air stream onto the plates.

**Drain Pan.** collects oil as it drains from the cell plates.

**Power Pack** provides energizing d.c. voltages for the ionizer and cells from a 115 volt, 1 ph., power source. (See Fig. 7.) On the front panel is an ammeter to warn the operator when the unit is not functioning properly and an "on-off" circuit breaker providing overload protection for the power pack. The transformer raises the incoming voltage where it is converted to pulsating d.c. by the rectifier tubes. The two stage capacitor smooths out the pulsating output voltages and doubles the voltage for the ionizer circuit.

**Protective Devices.** For safety of the operator, the cabinet door and power pack access panel are equipped with screw operated switches. These open the 115 volt circuit and delay access to the interior high voltage parts until the capacitor charge has drained off to a safe value through discharge resistors built into the capacitor. These switches should not be tampered with even though the time consumed in turning the screw may seem unnecessary. The screw at the cabinet door may be pushed into place without turning, but must be fully unscrewed to open the door.

**Operating Requirements.** Cleanliness of internal components is important because the efficiency of the unit will decrease as the cells, and particularly

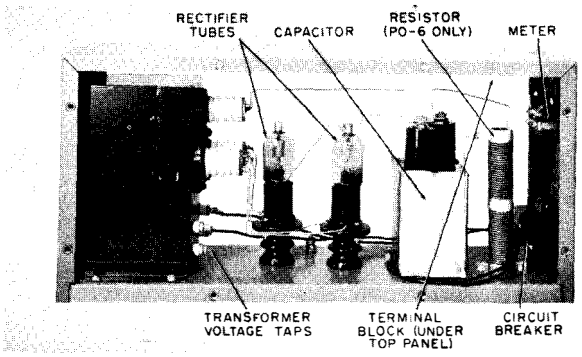


FIG. 7 POWER PACK

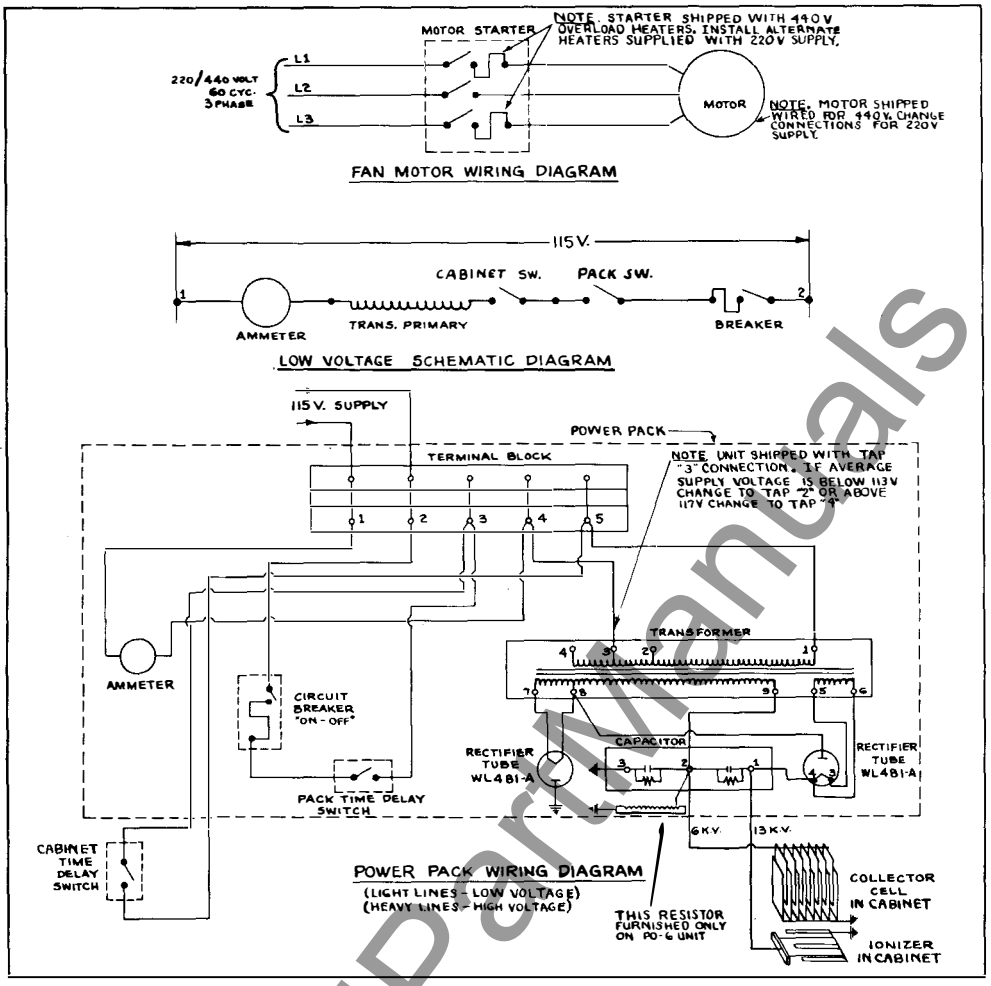


FIG. 4 WIRING DIAGRAM

**Fan Motor Wiring.** Fan motors on standard units are 3 phase, 60 cycle, 220/440 volt. They may be used on 50 cycles with the corresponding reduction in speed. Single phase and 550 volt motors will be furnished on order.

A switch or circuit breaker providing thermal overload protection should be mounted convenient to the operator and connected to the motor as shown.

Turn the fan wheel by hand to be sure that it turns free. Then turn on power and check fan rotation with the direction arrow on the motor housing. To reverse rotation, interchange two line leads.

**Grounding the Unit.** Connect the cabinet to a permanent low resistance ground using solid or flexible copper cable. Use a dummy screw in the side opposite the power pack for this connection.

**Relocating the Power Pack.** Power pack may be relocated to opposite side of the cabinet for convenience of the duct layout. Duplicate mounting holes are provided on the opposite side of the cabinet. Relocation involves disconnecting all external lead connections to the power pack, removing power pack mounting screws, relocating high voltage cables and wiring hardware, and reconnecting power pack to the other side of cabinet. Cover unused wiring and mounting holes with the plug buttons and dummy mounting screws to prevent air leakage. On early design units, unscrew the inspection window and move to the opposite side. Note: Mark each lead when it is disconnected to assure proper reconnection.

**Adjustment of the Outlet Damper.** After completing installation, the outlet damper should be adjusted to assure proper air volume through the unit. This is done simply by setting the damper so that full load current is drawn by the fan motor. With full load current, units deliver very nearly rated cfm. This adjustment eliminates need for direct air measurements which are considered unreliable for oil mist units when made at the installation site.

An a.c. ammeter (0-5 amp scale or smaller) is needed to accurately measure the motor current. It should be connected in fan motor circuit so that it may be short circuited or otherwise protected while motor is started. With fan running, release set screw and position damper so that full load (nameplate) current is drawn. Tighten set screw to hold damper in this position. Note: If less than full load motor current is drawn with damper wide open, the external duct system is probably undersized as explained in "Air Flow Requirements".

**Normal Operation.** After the unit is properly adjusted, normal operation consists of keeping the power pack and fan operating when oil mist is being generated. With the power pack circuit breaker "on", the ammeter should be in the white range (0.4-0.6) for the P0-12 unit and for the P0-6. Rectifier tubes are visible through the window and should glow at an "incandescent lamp" color. A blue glow around the filament is serious only when it is pro-