

Electronic and Mechanical Air Cleaner

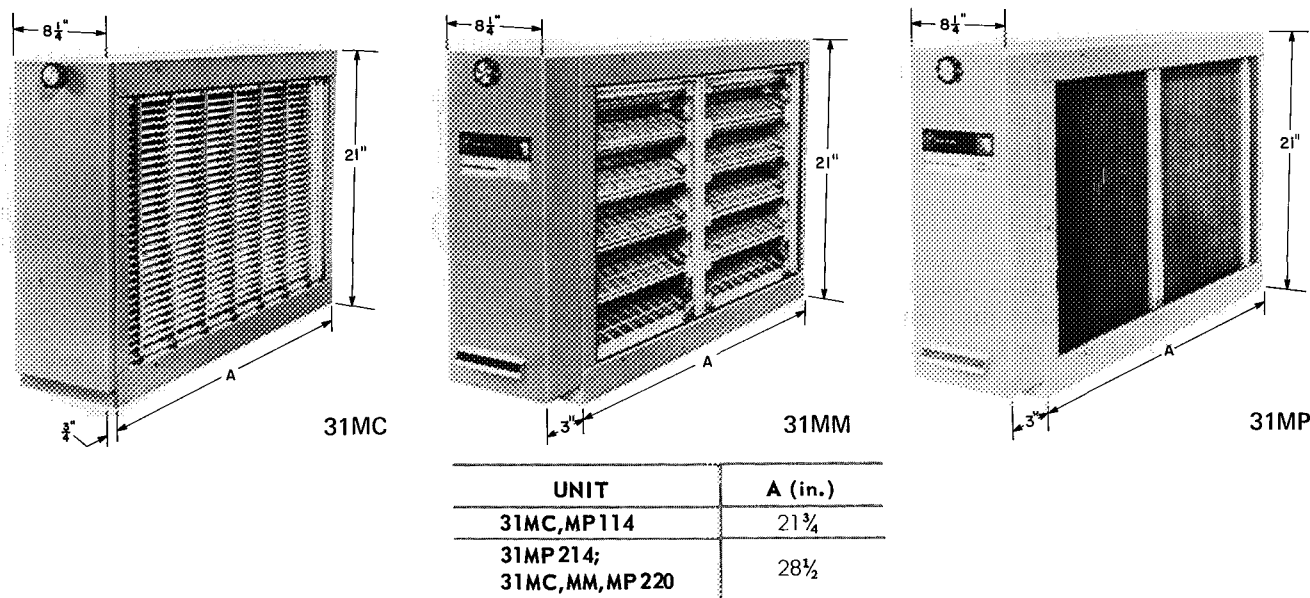


Fig. 1 — Dimensions, Electronic and Mechanical Air Cleaners

GENERAL

The Carrier 31MP plate-type and 31MM media-type electronic air cleaners and the 31MC high-efficiency mechanical air filters, all shown in Fig. 1, are designed for use with residential and light commercial forced-air heating and/or cooling systems. They can be installed vertically or horizontally in the ductwork or at the furnace. The units are easily converted in the field from right to left hand by removing the air cleaning components and reassembling them in reverse order. Cabinets will support a weight of 400 lb when installed beneath a vertical furnace or air-handling unit.

Package Contents — The 31MP and 31MM electronic air cleaner packages and the 31MC high-efficiency filter package consist of:

1. One 31MP, 31MM or 31MC unit.
2. Two base angle air baffles.
3. A template for preparing the furnace opening.
4. A bag of hardware consisting of 6 no. 8B x 1/4-in. long screws, 6 no. 8 speed nuts and a small bag containing wire nuts for making electrical connections.
5. A coil of foam tape.
6. Package of replacement media (31MM Models only).
7. An installer's packet.

When unpacking the unit, if any in-transit damage is observed, file a claim with the transportation agency. Since the air cleaner components are packed in a single carton, be sure to inspect all packing materials before discarding.

Application — Install the electronic air cleaner where all of the air circulated by the system will pass thru it. The best location is in the return air duct close to the blower compartment. This location provides the most even air flow distribution across the face of the electronic cells or mechanical filter element and also allows the air cleaner to keep the blower and motor clean. In a cooling system, the air cleaner keeps the evaporator coil clean.

When it is not possible or economically feasible to mount the air cleaner in the return air duct, consider installing the unit in the air discharge duct. However, give special consideration to the following factors when planning such an installation.

1. Even air flow distribution across the face of the electronic cells may be difficult to achieve. Use turning vanes and transitions where necessary.
2. Put the air cleaner upstream from the coil in a cooling system, if possible. The electronic air cleaner or mechanical filter will help keep the

coil clean, reducing maintenance costs. Also, air coming from the coil will frequently be near 100% relative humidity.

3. The air flow temperature thru the air cleaner must be within 40 F to 125 F.

Location — Because air-handling systems vary greatly in arrangement and style, factors such as accessibility, ambient temperature ratings, transitions, and other requirements must be carefully considered.

Units must not be installed outdoors.

In crawl space or attic installations (unconditioned space), air cleaner must be insulated the same as ductwork.

The unit must be readily accessible for periodic inspection and cleaning of the prefilter and electronic cells to maintain maximum efficiency and trouble-free operation. A minimum of 30 in. of clear area should be left in front of the air cleaner for cell and prefilter removal.

The air cleaner *must* be installed where the temperature will be within a 40 F to 125 F range.

Humidifiers — Location of the system humidifier is important to the operation of the electronic air cleaner or mechanical filter.

When an evaporative-type humidifier is used, it may be installed between the furnace warm air duct and the return air duct without affecting the electronic air cleaner.

An atomizing-type humidifier must be installed downstream from the air cleaner. If the atomizing-type humidifier is installed upstream, high humidity, salts and minerals will decrease the efficiency of the electronic cell and cause service problems or damage the high-efficiency filter element in the mechanical air filter.

Outdoor Air — When outdoor air is added to the return air duct, sufficient heat must be added to maintain the return air temperature at 40 F minimum. Lower temperatures can cause ionizer wire failure under certain conditions. Two methods are recommended:

1. Mixing baffles or vanes. When outdoor air is added, make certain that it is far enough ahead of the air cleaner to be mixed and warmed properly. If not, baffles must be installed to force mixing of the air.
2. Preheat coil. If a large amount of outdoor air is used, it must be heated. A thermostat should be used to control the heater. (A strip heater or hot water coil are typical heaters.)

INSTALLATION PROCEDURE

Remove Filter and Clean Blower Compartment Before Starting Installation.

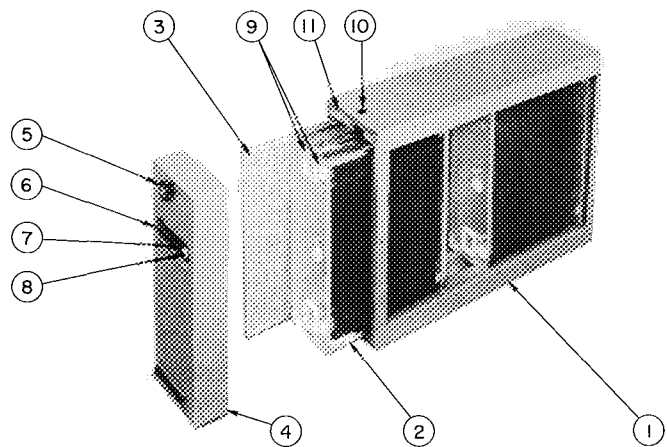
1. Remove and discard the old filter if one is used.

2. Thoroughly clean the blower compartment. The air cleaner cannot remove dirt from the blower compartment or distribution ducts.

Installation of 31MP Plate-Type or 31MM Media-Type Air Cleaner

1. Remove power door by turning fastener knob, Fig. 2, item 5, counterclockwise until power door is free. Slide out prefilter and air cleaner cells.

CAUTION: On 31MP220 twin-cell model, remove cell shipping pad; also remove cardboard shipping block from inside of power door. On 31MP214 single-cell model and 31MM220 media-type model, remove cardboard shipping block from inside the power door.



- | | |
|---------------------------|-------------------------------|
| 1 — Cabinet | 7 — Indicator Light |
| 2 — Collector Cell (31MP) | 8 — ON-OFF Switch |
| 3 — Prefilter | 9 — Ceramic Insulators |
| 4 — Power Door | 10 — Opening for Power Supply |
| 5 — Fastener Knob | 11 — Junction Box Cover |
| 6 — Test Button | |

Fig. 2 — Electronic Air Cleaner Components, Model 31MP

2. Unit can be installed with air flow thru the cabinet in either direction. No changes to the cabinet are necessary when reversing the air flow direction thru air cleaner. See Fig. 3.
3. Apply template, supplied in package, to side of furnace and prepare the opening in side of furnace according to instructions on template.
4. Prepare return air duct for installation of unit. Allow a minimum of 30-in. clearance in front of power door for servicing.
5. Return air duct should use full cabinet opening. Run duct straight into unit. Use an elbow with turning vanes if duct takes a sharp turn close to air cleaner inlet. *Do not baffle off any portion of entering air side of air cleaner* When it is necessary to change duct size close to the air cleaner, use gradual transitions to reduce turbulence. See Fig. 4.

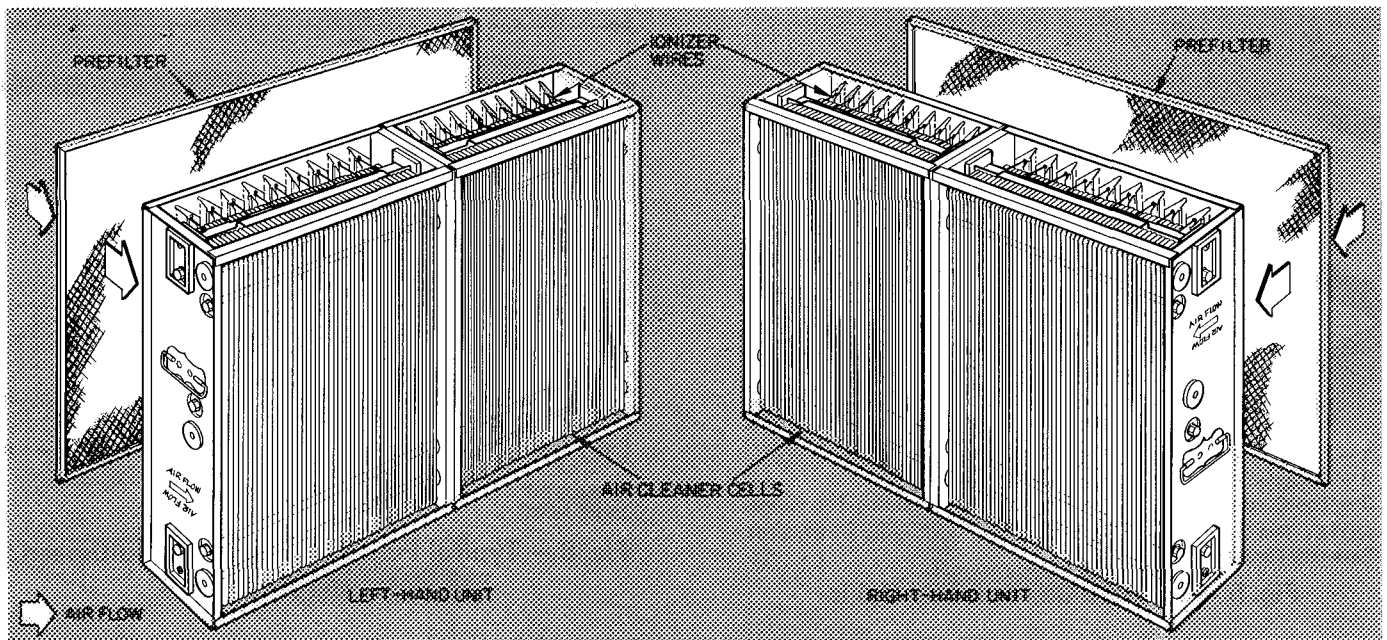


Fig. 3 – Left- and Right-Hand Assemblies

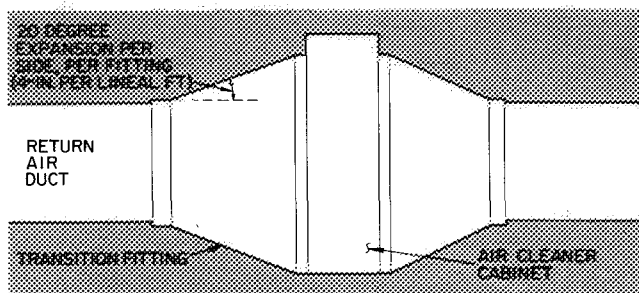


Fig. 4 – Transition from Smaller Ducts

6. When installing unit at bottom return opening of an upflow furnace:
 - a. Center furnace on air cleaner cabinet and remove components from cabinet.
 - b. Field-fabricated support not required on Carrier furnaces.
 - c. When the furnace is larger or smaller than the air cleaner, baffle off any mismatch between furnace and air cleaner with baffles, included with unit. Additional support, such as support legs, is recommended when furnace overhangs the air cleaner.

CAUTION: When setting furnace on cabinet, do not drop it into place. Also, position furnace correctly on cabinet to prevent a corner from slipping down and damaging cabinet.

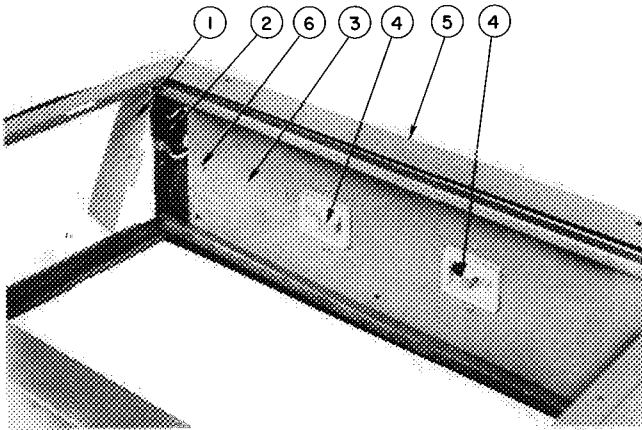
7. If a filter flag is used to indicate a clogged filter, install it downstream of cleaner, following instructions furnished with the filter flag.
8. Seal all joints on downstream side of air cleaner.

9. Slide prefilter and air cleaner cells into cabinet. Units are shipped for right-hand installation. To convert from a right- to a left-hand unit, reverse the position of the prefilter and the air cleaner cells in the cabinet as indicated in Fig. 3. Be sure the air flow arrows are pointing to the direction of air flow thru unit, and the ionizer wires in the cell are adjacent to the prefilter. The 31MC220 high-efficiency mechanical filter does not have a prefilter or electronic cell. Simply reverse position of filter element to change from right- to left-hand. An air flow direction arrow is stamped on the filter element.

10. Remove junction box cover on 31MM and MP units only, Fig. 5, item 1, located below receptacle, item 2, on top inside of cabinet. Install strain relief in opening for 120-volt input supply, Fig. 2, item 10, in top of cabinet. Connect 120-volt supply pigtails in junction box with wire nuts provided, and connect ground wire to green pigtail provided. Wire supply voltage from fan circuit of system to have air cleaner operating only when unit fan is running. See Fig. 6, 7, 8 and 9 for typical furnace wiring diagrams. All wiring must comply with applicable local and national codes.

11. Replace power door. Turn fastener knob clockwise until power door is securely fastened, thus ensuring good electrical contact between power door and unit components. Diverse installations are shown in Fig. 12.

12. Check over the installation for correct sheet metal and electrical work.



- 1 - Junction Box Cover
 - 2 - Receptacle
 - 3 - Top Guide
 - 4 - Contact Spring (Contactor)
 - 5 - Cabinet
 - 6 - Screw for Holding Top Guide
- NOTE: The 2-cell unit (-220) shown; the 1-cell units (-114, 214) have one contactor in the door

Fig. 5 - Junction Box and Top Guide

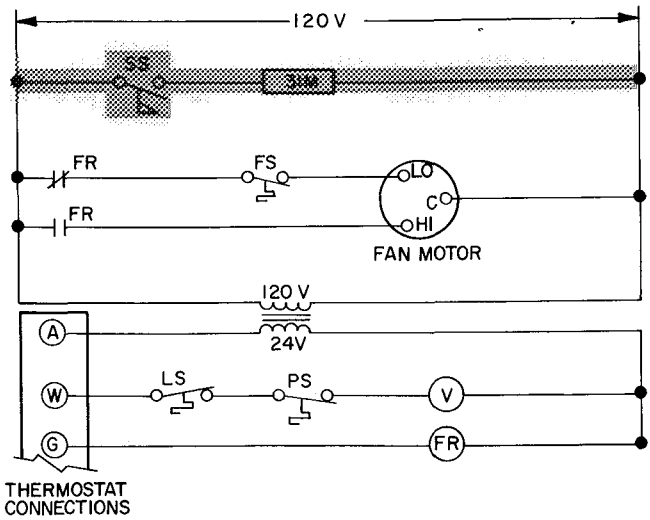


Fig. 8 - Typical Furnace Wiring with Multispeed Fan Motor and Sail Switch

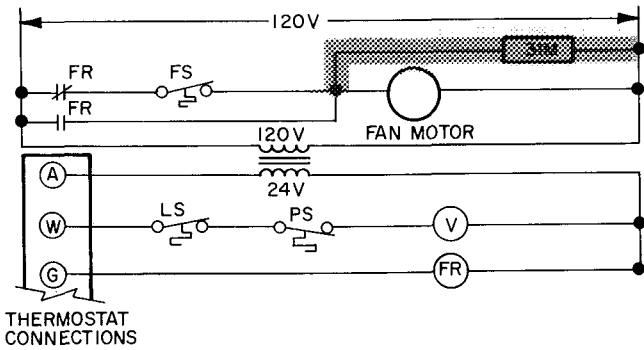


Fig. 6 - Typical Furnace Wiring with Single-Speed Fan Motor

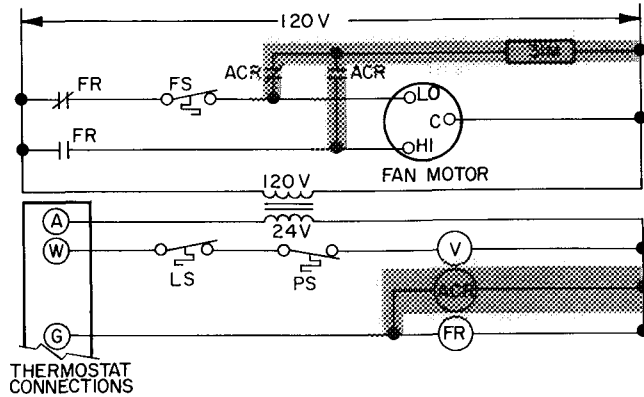


Fig. 7 - Typical Furnace Wiring with Multispeed Fan Motor and Air Cleaner Relay

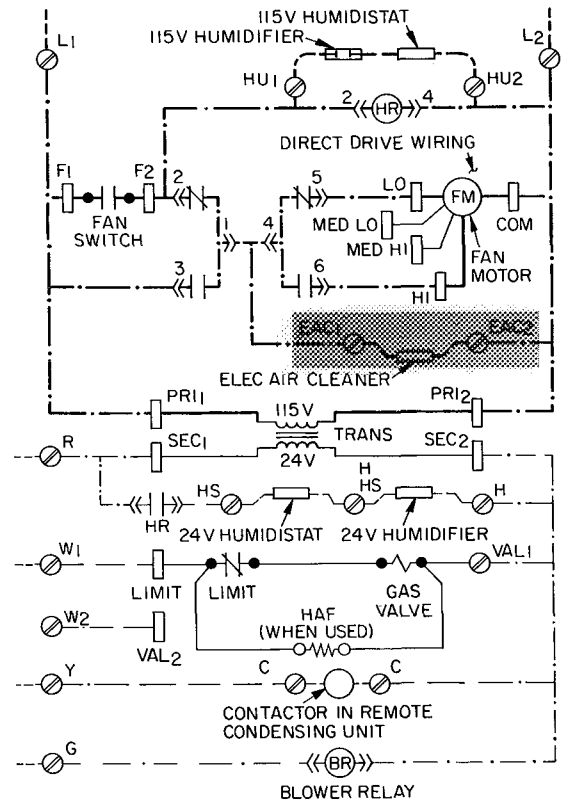


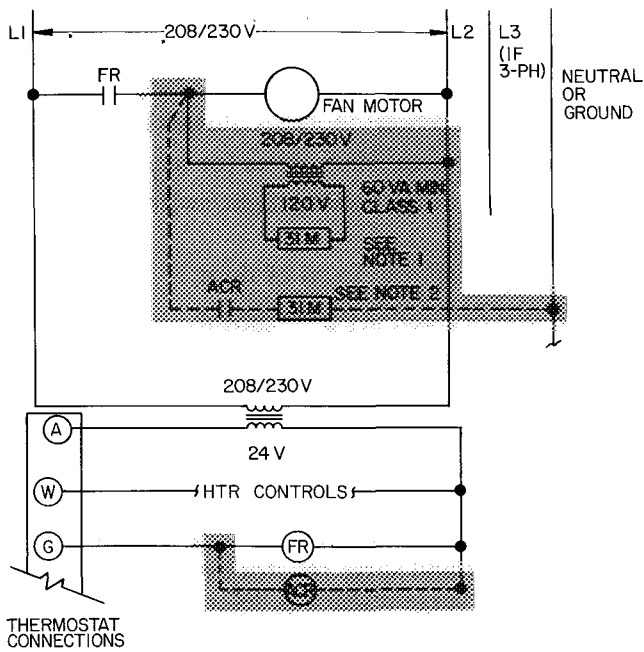
Fig. 9 - Electronic Air Cleaner Wired into 58ES or 58GA Furnace Wiring

LEGEND for Fig. 6, 7, 8, 9, 10 and 11

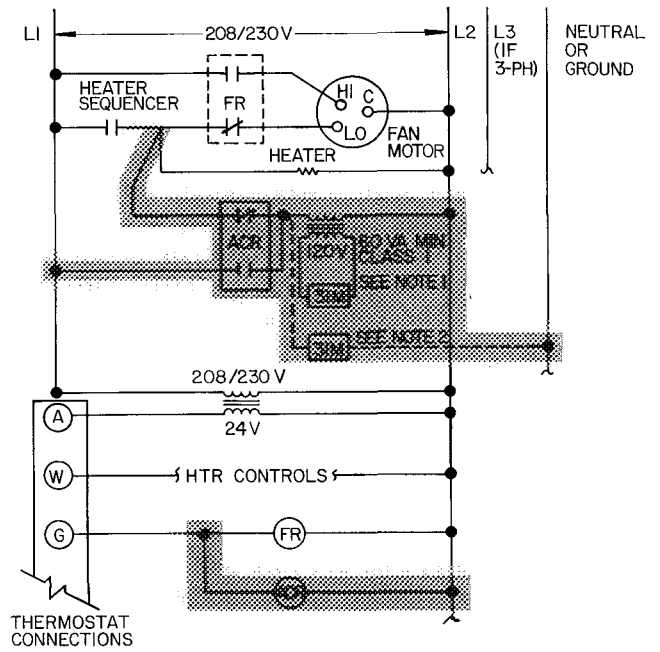
- 31MM or MP wiring
- ACR** - Air Cleaner Relay (Location of ACR is optional)
- FR** - Fan Relay (FR may be installed in furnace)
- FS** - Fan Switch
- HAF** - Heat Assist Fan Switch
- HR** - Humidifier Relay
- LS** - Limit Switch
- PS** - Pilot Switch
- SS** - Sail Switch
- Trans** - Transformer
- V** - Gas Valve

NOTES for Fig. 10 and 11

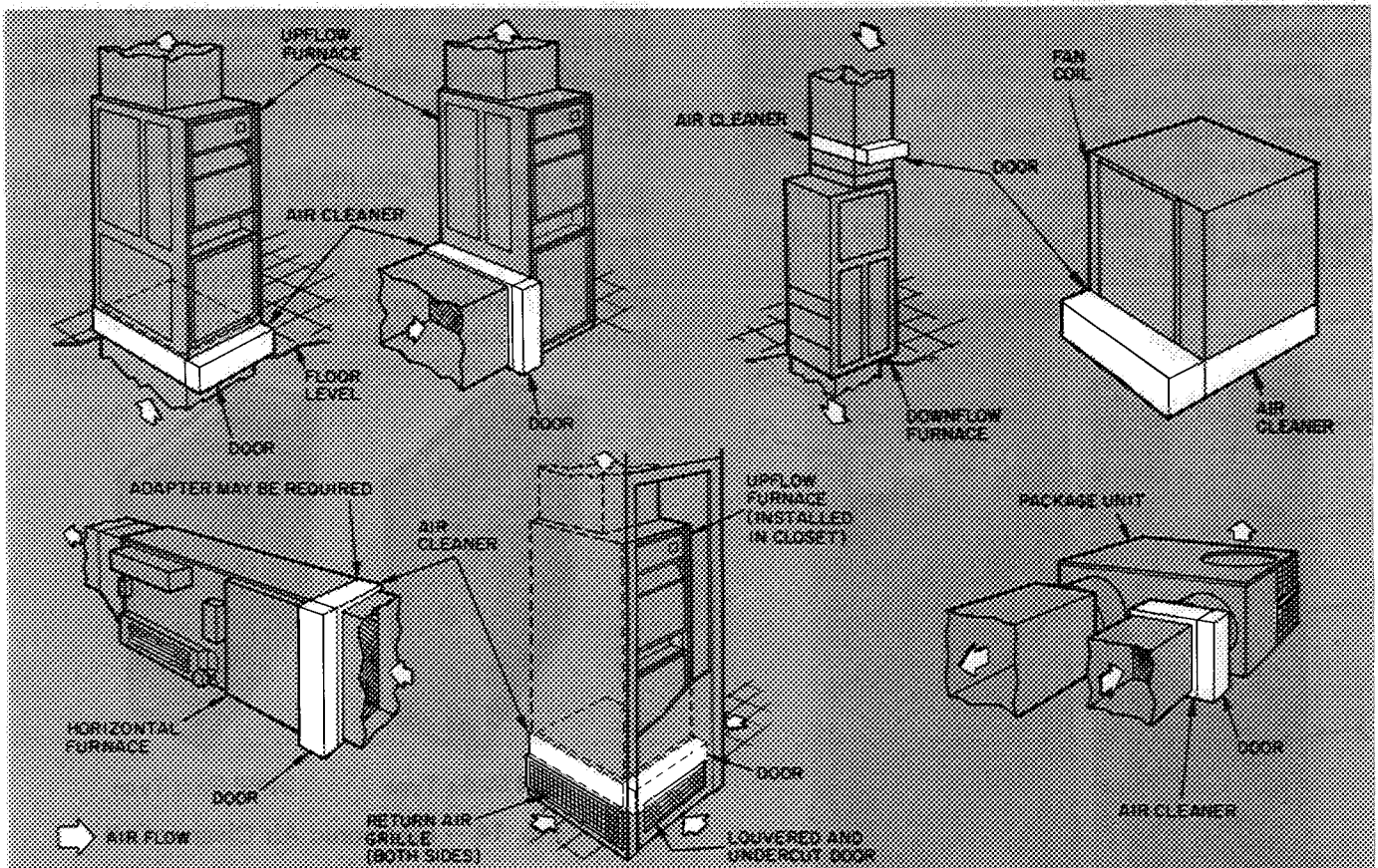
- 1 Transformer must be used on 208-230 v supply Exceptions:
 - a) 208-3 Phase wye
 - b) 208/230-1 Phase with reliable ground
- 2 Dashed lines indicate wiring for:
 - a) 208-3 Phase wye
 - b) 208/230-1 Phase with reliable ground



→ Fig. 10 – Typical Fan-Coil Wiring with 208/230-v Supply and Single-Speed Fan Motor



→ Fig. 11 – Typical Fan-Coil Wiring with 208/230-v Supply and Multispeed Fan Motor



→ Fig. 12 – Installation of 31MC Mechanical or 31MM or MP Electronic Air Cleaner

Installation of 31MC Mechanical Air Filter

1. Remove the access door and slide out mechanical filter.
2. Follow steps 2, 3, 4, 5, 6, 7 and 8 of Installation Procedure in this booklet.

3. Slide mechanical filter into cabinet. Be sure arrow on filter is pointing in the direction of air flow. Secure access door to cabinet with fastener knob.

OZONE

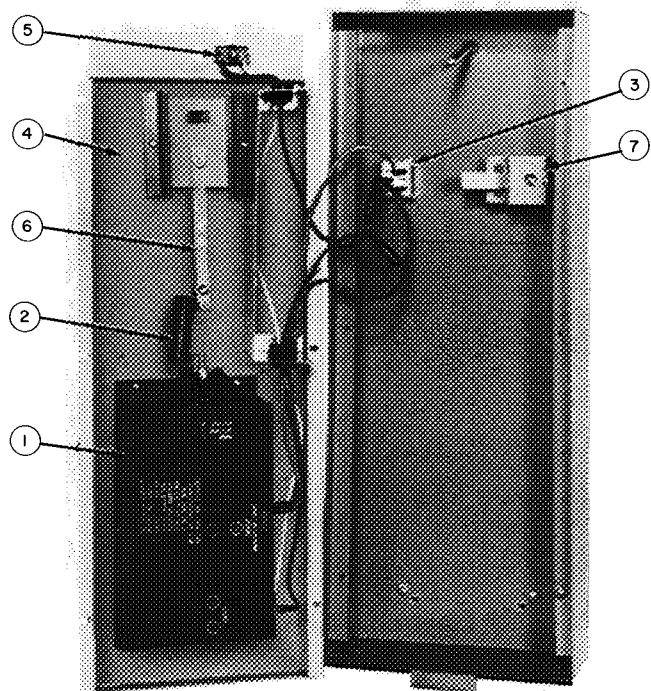
The odor of ozone may be noticeable during operation of an electronic air cleaner. A somewhat higher ozone generation rate during the first week or 2 of operation may be caused by sharp edges on some of the new high-voltage parts. Normal use dulls these sharp edges in a short time.

The odor of ozone is detectable by an average person at levels as low as 0.003 to 0.010 parts per million (ppm). The concentration of ozone produced in a home by an electronic air cleaner ranges from 0.006 to 0.015 ppm. Average concentrations of ozone in the air of major cities range from 0.020 to 0.040 ppm and even higher. This is well above the level produced by an electronic air cleaner.

SERVICE

Cabinet Assembly, Fig. 2, consists of a power door item 4, which is attached to the cabinet, item 1, by means of a fastener knob, item 5. Inside the cabinet are the prefilter, item 3, and the cell, item 2, both of which can be easily slid out of cabinet for cleaning and service.

Power Door, Fig. 13, retains all the air cleaning components inside the cabinet and also contains the power supply, item 1, which produces high voltage for the cells. The power door also contains the surge resistor, item 2, test button, item 7, and the indicator light and ON-OFF switch, item 3. To service these components, remove 6 screws from the ground plate, item 4, on the door and separate ground plate from door.



- | | |
|---------------------------------------|------------------|
| 1 — Power Supply | 4 — Ground Plate |
| 2 — Surge Resistor | 5 — Receptacle |
| 3 — Indicator Light and ON-OFF Switch | 6 — Bus Bar |
| | 7 — Test Button |

Fig. 13 — Power Door

INDICATOR LIGHT AND ON-OFF SWITCH are both in one unit. Replace complete assembly when necessary.

1. Disassemble power door. See Power Door.
2. Disconnect wires. Mark wires for reassembly.
3. Compress springs holding light/switch assembly in door.
4. Pull assembly from front of door.

POWER SUPPLY

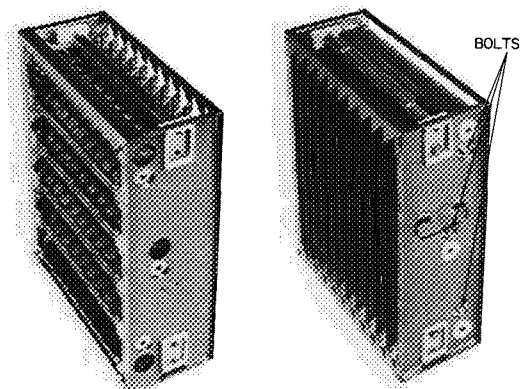
1. Disassemble power door. See Power Door.
2. Remove surge resistor connection at the power supply.
3. Remove 4 sheet metal screws holding the power supply to the plate.

SURGE RESISTOR is riveted to the bus bar, item 6. The bus bar and surge resistor assembly must be replaced if the surge resistor is defective.

1. Disassemble power door. See Power Door.
2. Disconnect surge resistor at power supply.
3. Remove screws holding the bus bar.

Cell — Plate-type and media-type, Fig. 14. The cell contains the ionizer wires, the ionizer ground plate, Fig. 15, item 1, and the charged and grounded collector plate assembly, item 3, of the plate-type cell.

The plate-type and media-type cleaners are the same electrically. Physically, however, while the media-type cell has the same type of ionizer as the plate-type, a fiber glass pad between a charged grid and a grounded grid replaces the charged and grounded collector plate assembly.



31MM Media Type

31MP Plate Type

Fig. 14 — Electronic Air Cleaner Cell

DISASSEMBLING THE PLATE-TYPE CELL — Refer to Fig. 15.

1. Remove 4 sheet metal screws, item 8, holding the ionizer ground plate, item 1, to the cell structure, item 2.
2. Lift off the ionizer ground plate.
3. Remove 3 bolts from each end panel. See Fig. 14.

- Remove the cell structure which consists of a riveted assembly of 2 end panels and 2 angles. ROUND INSULATORS, Fig. 15, item 4, may be lifted from the rod ends when the cell structure is removed.

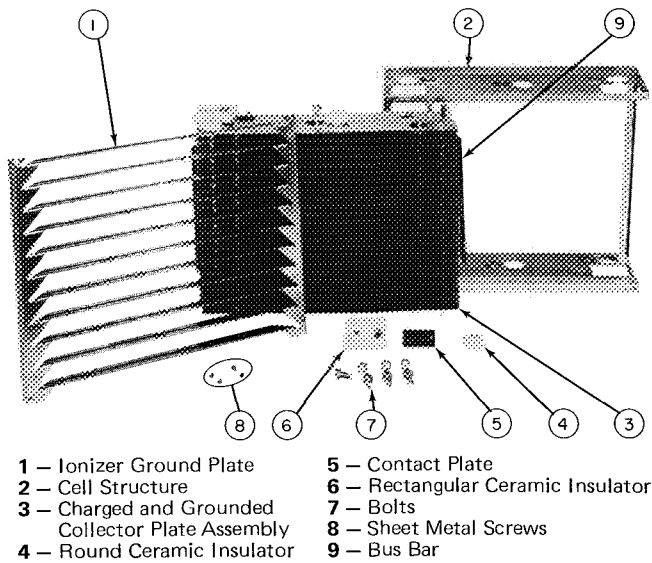


Fig. 15 — Disassembled Cell, Model 31MP

RECTANGULAR INSULATORS, Fig. 15, item 6.

- Remove the cell structure. See Disassembling the Plate-Type Cell.
- Remove the large bolt that holds the insulator to the end of the plate assembly.
- Remove the sheet metal screw holding the insulator and contact plate, item 5, to the end of the bus bar, item 9.
- Lift off insulator and contact plate.

Replacing Ionizer Wires, Fig. 16 — The following procedure is recommended for replacing broken ionizer wires:

- Remove ionizer ground plate. See Disassembling the Plate-Type Cell.
- Remove the broken ionizer wire. Be sure no pieces of the broken wire remain in the cell to cause shorting.
- Secure end of new ionizer wire in loop of bottom ionizer wire spring.
- Depress top ionizer wire spring with finger as in Fig. 16.
- Secure top end of ionizer wire in loop of ionizer wire spring while it is depressed.
- Inspect wire installation and relieve finger pressure from ionizer wire spring.
- Replace ionizer ground plate.

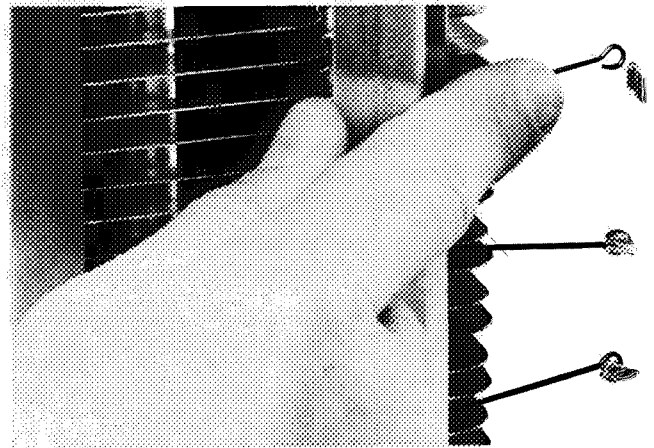


Fig. 16 — Replacing Ionizer Wire

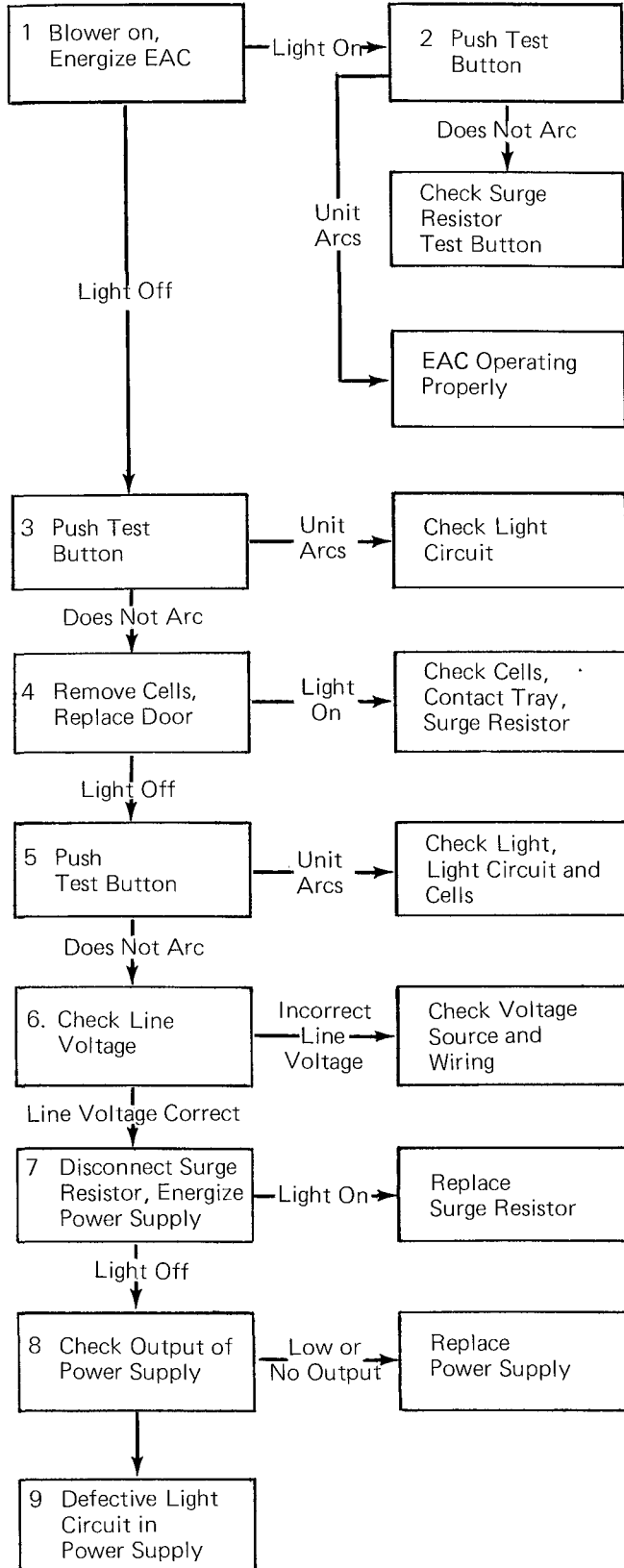
SERVICE PROBLEM ANALYSIS

COMPLAINT	POSSIBLE CAUSES	SOLUTION
Indicator Light Off	Shorted cells Shorted top guide Defective light Defective power supply Defective push button Blower not operating Cells wet either due to high humidity or from being washed	See Troubleshooting Procedure. Energize blower. Cells will dry.
Arc Test Button Produces No Snapping Noise	Shorted cells Shorted top guide Defective push button Defective surge resistor Defective power supply System blower not operational Humidifier upstream Cells loaded	See Troubleshooting Procedure. Energize blower.
Unit Snaps or Arcs Continuously	Line voltage too high Cells need cleaning Broken ionizer wire Broken contact spring in top guide of power door Broken insulator in cell Broken insulator in power door or contact tray Foreign material lodged between plates or in ionizer Bent plates or media grille for media EAC Broken or deformed arc test button assembly	Adjust line voltage. Clean cells. Replace wire. Replace spring. Replace insulator. Replace insulator. Remove object. Straighten. Replace or repair.
Humming Noise	Improper wiring connections Loose ionizer wires Excessively dirty ionizer or collector	Check wiring. Replace or repair. Clean as per Maintenance Instructions, Owner's Manual
Air Cleaner Doesn't Clean Dirt	Lack of power to cells due to improper alignment of contact spring on power door to cells in top guide Defective interlock plug or receptacle Air volume too great Leaks in ductwork on downstream side of air cleaner Dirty air not being delivered to air cleaner Damaged or improperly placed dirt collecting pad (media-type only) Uneven air distribution across face of unit which may be indicated by uneven loading pattern of dirt in collector section of air cleaning cells The entering air side of collector stage should be evenly covered with dirt. In the case of the 020 sized units, each cell should have an even loading pattern.	Adjust alignment or replace spring. Replace. Reduce air volume to design cfm. Seal. Insufficient air — check return air grilles for obstruction by furniture, drapes, etc., and remove, check blower for proper air flow. Replace or reposition as per Maintenance Instructions, Owner's Manual. Install turning vanes or air baffles CAUTION: Do not block off any of the entering air side openings to the unit.
Radio or T.V. Interference	Accumulation of foreign particles lodged in ionizer section Unit improperly grounded Ground line of power supply not properly grounded Loose ionizer wires Loosely connected components, or loose connections Defective power pack Dents in collector section of ionizer section Damaged dirt collecting pad (media-type only) Improperly installed dirt collecting pad (media-type only)	Remove. Provide good ground to unit. Correct same. Replace. Tighten. Replace. Straighten. Clean or replace. Reposition.
White Dust on Furnishings	Occasionally a "white dust" might be noticed in bedrooms or newly furnished rooms. This is mainly composed of lint which because of its weight, settles before it reaches your unit. This is not mixed with airborne dirt. It has no staining or soiling properties and will lessen as the excess lint works out of fabrics.	Only air taken thru return grilles is cleaned.

TROUBLESHOOTING PROCEDURE

The following troubleshooting procedure has been designed to speed the serviceman's work and ensure that any malfunction in the electronic air cleaner is quickly detected and properly repaired.

Troubleshooting Sequence Chart



CAUTION:

1. During the troubleshooting procedure, dangerous line voltage circuits are exposed. Use care to avoid the hazard of electrical shock or damage to equipment.
2. Although not lethal, the high-voltage output of the power supply can produce a painful shock. Use caution here too.

Troubleshooting the electronic air cleaner can be accomplished with only a few tools.

- Screwdrivers – long shank, plastic or rubber handles; 2 required for some arc checks.
- Jumper cord.
- Voltmeter with 25 kv DC probe.
- Grounding wire.

Most of the steps can be performed by observing the indicator light in the ON-OFF switch. This light is powered from the high-voltage circuit on the high-voltage transformer and is on whenever the high-voltage transformer is working properly.

This procedure is outlined in the Troubleshooting Sequence Chart. A complete description is provided on the following pages.

This troubleshooting procedure description is divided into 2 sections:

1. Diagnostic Tests – The numbered steps correspond to the numbered steps on the Troubleshooting Sequence Chart. Follow this sequence of tests to locate the cause of a failure within the air cleaner.
2. Component checks explain how to locate a faulty component within an assembly, or how to prove a component good or bad.

Diagnostic Tests

STEP 1 – ENERGIZE ELECTRONIC AIR CLEANER

- a. Be sure electronic cells and prefilter screens are clean, dry and properly installed in cabinet.
- b. Energize electronic air cleaner.
 - Put switch at “On” position.
 - Energize blower.
- c. Check on indicator light operation.
 - If light is off, failure is in the electronic air cleaner – go to Step 3.
 - If light is on – go to Step 2.

STEP 2 – PUSH TEST BUTTON – INDICATOR LIGHT ON

Test Button Fig. 2, item 6, on the cleaner access door, provides a simple easy-to-use method of checking for correct high voltage in electronic cell. When pushed, it shorts from insulated high-voltage components to ground. From the sound of the resulting arc, serviceman may determine whether or not high voltage is supplied to electronic cell.

- a. Turn electronic air cleaner on and energize system fan to power the electronic air cleaner.
- b. Push test button. Snapping sounds (arcing noise) indicate that air cleaner is working properly.
- c. If no arcing noise is heard, check for continuity thru resistor, and then check push button assembly.

STEP 3 – PUSH TEST BUTTON – INDICATOR LIGHT OFF

- a. Turn on electronic air cleaner and energize system fan to power the electronic air cleaner.
- b. Push test button. Snapping sound indicates that electronic air cleaner is working properly. Failure is in the indicating light circuit. See Step 9 – Defective Light Circuit.
- c. If no snapping sound is heard, go to Step 4.

STEP 4 – REMOVE CELLS

- a. Turn off blower circuit and remove electronic cells.
- b. Replace power door and reenergize power supply. Put switch in “On” position and energize blower.
- c. If light comes on now, check cells and top guide assembly for proper contact. Check surge resistor. Refer to Step 7.
- d. If indicator light does not light, go to Step 5.

STEP 5 – PUSH TEST BUTTON

- a. Energize power supply as in Step 1, a and b.
- b. Push button. Snapping sound indicates proper high-voltage output from power supply and surge resistor. Failure is probably in cells or top guide assembly or in the light circuit within the power door. Check cells, light and light circuit. If light is faulty, replace switch and light assembly.
- c. If there is no arcing or snapping, go to Step 6.

STEP 6 – CHECK LINE VOLTAGE

- a. Remove access door and energize blower. Line voltage to the air cleaner can be determined using a neon test lamp and inserting prongs into receptacle on cabinet. If voltage checks low on the voltmeter, trace wiring back to determine cause of problem. (Refer to wiring application diagram.)
- b. If voltage checks correctly, open power supply door by removing the 6 screws from the door base. Use ohmmeter to check continuity of low-voltage wiring, taking care to check switch in both the “Open” and “Closed” position. If circuitry checks correctly, go to Step 7.

STEP 7 – DISCONNECT SURGE RESISTOR. ENERGIZE POWER SUPPLY

- a. Refer to internal components of the power door, Fig. 13.

- b. De-energize system blower. Remove lug at output end of power supply and remove surge resistor from high-voltage circuit.

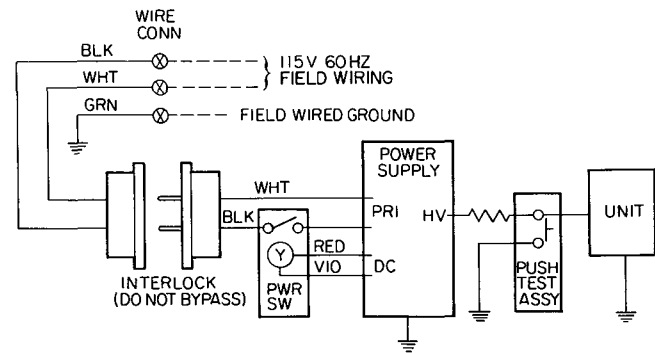


Fig. 17 – Internal Schematic for 31MP and 31MM Electronic Air Cleaners

- c. Using jumper cord and grounding cord, provide circuitry between plug on power door and receptacle on cabinet. Attach grounding wire between power door base and cabinet. See Fig. 18.

CAUTION: High voltage is present at the output terminal of power supply. Use care to avoid painful shock.

- d. Energize system blower and turn switch to “On” position. Glowing light indicates faulty surge resistor; replace same. If light still is not glowing, go to Step 8.

STEP 8 – CHECK OUTPUT OF POWER SUPPLY

- a. With blower and electronic cleaner on, measure output of power supply using voltmeter with mating high-voltage probe. If output reads between 6500 to 7500 volts DC, problem is defective light circuit. Go to Step 9. If output is low, replace power supply.

STEP 9 – DEFECTIVE LIGHT CIRCUIT

- a. With power on, measure voltage at light circuit terminals on power supply. Output should read between 90 – 2000 volts. If output is correct, replace switch and light assembly. If there is no output, replace power supply.

Component Checks

CHECK ELECTRONIC CELLS

Visual Inspection – Carefully examine the electronic cells. Look especially for:

1. heavy dirt accumulation
2. bent collector plates (plate cleaner)
3. broken ionizing wires
4. dirt accumulation on insulators
5. contact springs – broken or dirty – ionizer and collector damage
6. deformed pleat grids (media cleaner)

Check for Short Circuits – Use an ohmmeter to check resistance between the outside frame of the cell and the high-voltage contact. In each case, the resistance should be infinite (open circuit).

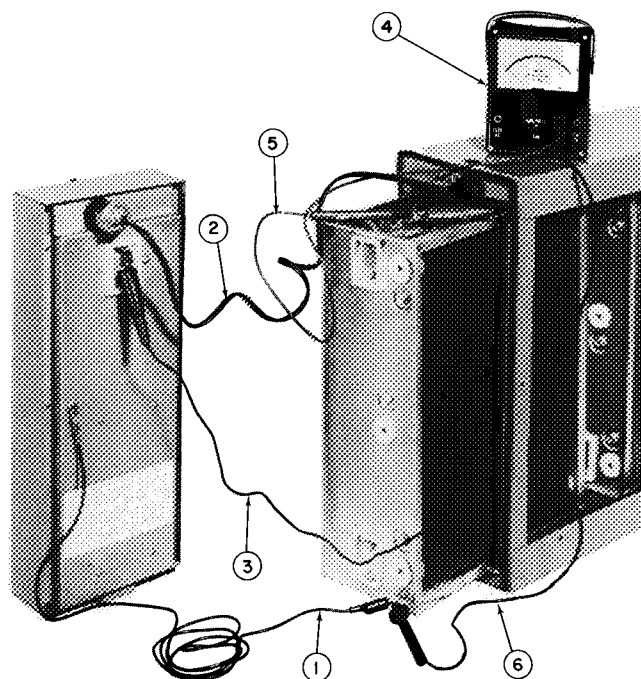
CHECK TOP GUIDE – (2000 Cfm Models)

1. Remove top guide assembly from cabinet by removing the single screw below junction box. See Fig. 5.
2. Using ohmmeter, check for shorts between contact spring and ground. Resistance should be infinite.
3. Examine insulators for cracks or heavy dirt buildup. Clean if dirty; replace if cracked.

CHECK SURGE RESISTOR – See Step 7 under Diagnostic Tests.

The function of the surge resistor is to protect the power supply from instantaneous “spikes” of high-voltage power that occur when the unit arcs. This important component must be operating satisfactorily to adequately protect the power supply. *Do not bypass.*

CHECK LIGHT AND LIGHT CIRCUIT – See Step 9 under Diagnostic Tests.



- | | |
|---|--------------------------------------|
| 1 – Ground Wire | 4 – Voltmeter with 25-Kv DC Probe |
| 2 – Patch Cord for 115-v Supply Voltage | 5 – High Voltage Lead from Meter |
| 3 – High Voltage Wire (7500-v DC) | 6 – Common or Ground Lead from Meter |

Fig. 18 – Test Circuit Between Power Door and Cabinet

For replacement items use Carrier Specified Parts.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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