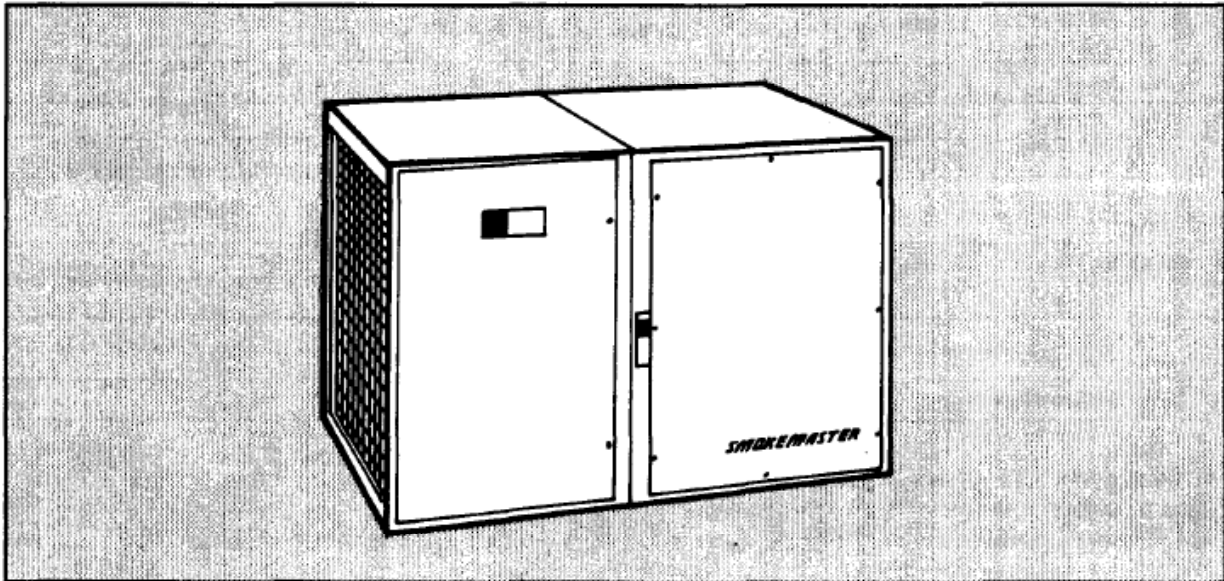


SMOKEMASTER[®]

F33R and F33L

INDUSTRIAL ELECTRONIC AIR CLEANER



THE SMOKEMASTER F33R AND F33L INDUSTRIAL ELECTRONIC AIR CLEANERS CONTROL WELDING AND METALWORKING FUMES IN WORK AREAS. THEY CLEAN THE AIR OF INDUSTRIAL SMOKE AND OIL MISTS. EITHER SOURCE CAPTURE TECHNIQUES OR AMBIENT AIR CLEANING CAN BE USED TO PROVIDE HEALTHIER WORKING CONDITIONS.

- Adjustable blower circulates up to 1,250 cfm.
- Models available with airflow from left to right or right to left.
- Single phase operating voltages include 120 Vac and 208-240 Vac.
- Interlock switches prevent operation when cell access doors are open.
- Powered from a standard grounded outlet. All models equipped with a 10 foot power cord.
- Test button diagnostics give status of collector section.
- Industrial, solid state, self-regulating, power supply output is not affected by moderate fluctuations in line voltage.
- System indicator lamp gives operational status of collection stages.
- Optional sump adapter drains collected liquids from inside the air cleaner.
- Optional plenum and hoses make source capture application easy.
- Prefilters and postfilters are interchangeable.
- Permanently lubricated, ball bearing motor requires no maintenance.
- High voltage, power supply uses voltage doubler to provide increased ionization voltage.

For further information:

BERRIMAN ASSOCIATES
1-800-480-3630
www.berriman.com

SPECIFICATIONS

IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, THIS PRODUCT IS TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

Serial No.			
Model	F33L1112 F33R1112	F33L1212 F33R1212	Model No.
No. of Electronic Cleaning Stages	1	1	
Volts - Phase	120V-1 ϕ	240V-1 ϕ	
Amps - Watts	8.1A-650W	4.1A-640W	
Hertz	60	60	
Airflow (w/o added inlet restrictions)	1200 cfm	1200 cfm	
Shipping Weight	200 lb	200 lb	
Installed Weight	180 lb	180 lb	
No of FC53A1012 Industrial Cells	1	1	
Length Dimension	41 inches	41 inches	

POWER SUPPLY: Ferroresonant iron core transformer with voltage doubler board.

CELL WEIGHT: 32 lbs. each

CELL AREA: 114 sq. ft.

MOTOR: TEFC, 1/2 Hp., Ball Bearing

AVAILABLE 60 HZ VOLTAGES AND PHASES: 120 VAC-1 ϕ , 240 VAC-1 ϕ

CROSS SECTION DIMENSIONS: (all units) 27" high x 14" wide (see length dimension above)

AMBIENT TEMPERATURE RATING - Shipping & Storage: -20°F to +150°F

Operating: 40°F to 125°F

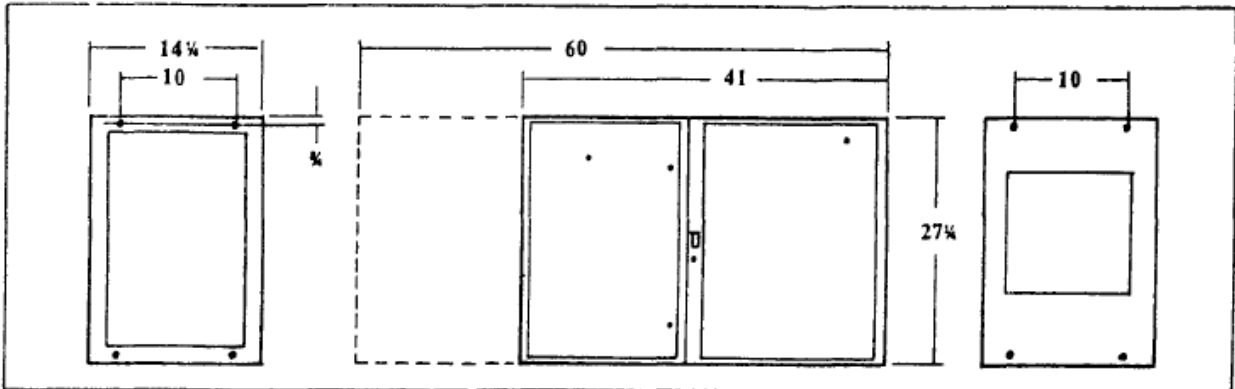


Fig. 1 Approximate Dimensions

For further information:

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1-800-480-3630

www.berriman.com

PLANNING THE INSTALLATION

WARNING

The F33 is NOT explosion proof. It must NOT be installed where there is potential for contact with explosive dusts, gases or vapors.

INTRODUCTION

Clean air is the subject of numerous laws and regulations. Typical requirements in the United States are those put out by the Occupational Safety and Health Administration (OSHA). Private groups, such as the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), have also published numerous recommendations.

Normally, clean air is defined in regulations and recommendations as air having a limited amount of contaminant in it, commonly expressed as parts per million, or milligrams per cubic meter. Approved counteractions are intended to lower or eliminate the amount of contaminants in the air. One of the more common methods of achieving this goal is through the use of electronic air cleaners.

At no time, should an electronic air cleaner be placed where there is a potential for explosion due to the presence of explosive dusts, gases or vapors. Contact the nearest Smokemaster representative for assistance in determining the correct application of an electronic air cleaner.

SIZING

Sizing is that part of the installation which determines how many air cleaning units are required to maintain a desired level of air quality. The process of sizing an application involves roughly calculating the number of air cleaners needed and then modifying the calculation according to the specific characteristics of each application.

If air contaminants are generated from fixed stations where hoods and hoses can be acceptably installed, cleaning the air by capturing the contaminant at the source is strongly recommended. For source capture air cleaning, a hood (not provided) is installed where the contaminants are generated and an attached hose feeds the contaminants to a source capture plenum. The plenum transfers the contaminants from up to 4 hoses directly into the electronic air cleaner (hose and plenum are ordered as accessories).

The actual number of contaminant sources which can be conducted into one air cleaner may vary from 1 to 4 depending on the nature of the contaminants. The composition, quantity, and rate of generation of the contaminants determines the air velocity needed to effectively capture these contaminants at the source. The required air velocity, in turn, not only affects the hood design and hood location, but it also sets limits on how much hose can be used before the air pressure drop becomes too great for effective contaminant capture.

Therefore, when sizing an application for source capture air cleaning, it is necessary to keep in mind how the specific contaminants, the hood, and the needed velocity all combine to affect the number of stations which can be attached to a single unit and the number of units which will be needed for a particular application.

When the installation of hoods and hoses is physically infeasible or unacceptable, the electronic air cleaners are strategically placed overhead or on stands to provide background air cleaning.

For background air cleaning, the number of electronic air cleaners needed can be estimated by the relationship of air volume to the needed air changes per hour. In these cases the following formula is helpful:

$$\begin{aligned} \text{Electronic Air Cleaners} &= \frac{\text{Air Volume} \times \text{Air Changes/Hour}}{\text{Clean Air Rating} \times 60} \\ \text{Clean Air Rating} &= \text{Airflow} \times \text{Efficiency} \end{aligned}$$

$$\begin{aligned} 1200 \text{ cfm} \times 0.9 &= 1080 \text{ cfm} \\ [2040 \text{ M}^3/\text{hr} \times 0.9 &= 1835 \text{ M}^3/\text{hr}] \end{aligned}$$

The air volume in a space is sometimes reduced to account for high ceilings and large equipment in the space. For example, in an application where the ceiling is higher than 30 ft. [9.1 m], the air volume above 30 ft. [9.1] may be subtracted if it does not significantly affect contaminant dispersal either by how the contaminants are circulated from their sources or how the heating, cooling, or ventilating equipment affects the dispersment of the contaminants. Also, if equipment takes up a great deal of space in relation to the total air space, its volume may be deducted from the total air volume.

A method for calculating the needed air changes per hour is to measure the generation rate of the contaminants and the suggested allowable level of contamination. To use this method of calculation, consult your sales representative.

Regardless of the method used to calculate the number of units needed to produce clean air, the physical conditions of the space to be cleaned may either limit this number or demand that more units be installed. For background air cleaning it is important to establish a uniform airflow pattern throughout the entire space. Limitations to the calculated sizing may be a lack of space for mounting areas or the number of units may interrupt normal building operation; that is, a unit cannot be mounted where an overhead crane will smash into it or where stand mountings seriously interrupt building traffic patterns. The number of units required by air volume and air changes per hour might need to be increased when the shape of a structure is such that effective capturing and air distribution is not possible according to the sizing calculations.

AMBIENT CLEANING

Whether an air cleaner is ceiling hung or placed on a stand, the first important consideration is that the inlet of the unit be located as close as is reasonably possible to the greatest concentration of air contaminants. Second, since the air cleaner draws contaminated air from approximately 10 ft [3.0 m] around the inlet and exhausts the cleaned air from 50 to 75 ft [15.2 to 22.8 m] from the outlet, the inlet of the unit should be placed 25 percent of the distance along the wall of a room (Fig. 3).

DO NOT locate an air cleaner *inlet* too close to the corners of a room. Contaminated air will be able to bypass the unit and not be cleaned. DO NOT locate an air cleaner *outlet* too close to a corner or wall (Fig. 2c). The cleaned air will recirculate directly back to the air cleaner inlet.

DO NOT locate an air cleaner in an L-shaped room so that exhausted air enters directly into the small portion of the room as shown in Fig. 2d. This can produce a self-contained circular air pattern in the small part of the room which decreases the air cleaner's effectiveness. Locate an air cleaner in an L-shaped room as indicated in Fig. 2e.

The shape of a room and location restrictions may require the installation of a fan as in Fig. 2f to promote proper air circulation. Also, the size of a room may require the use of fans to bring contaminants to an air cleaner inlet.

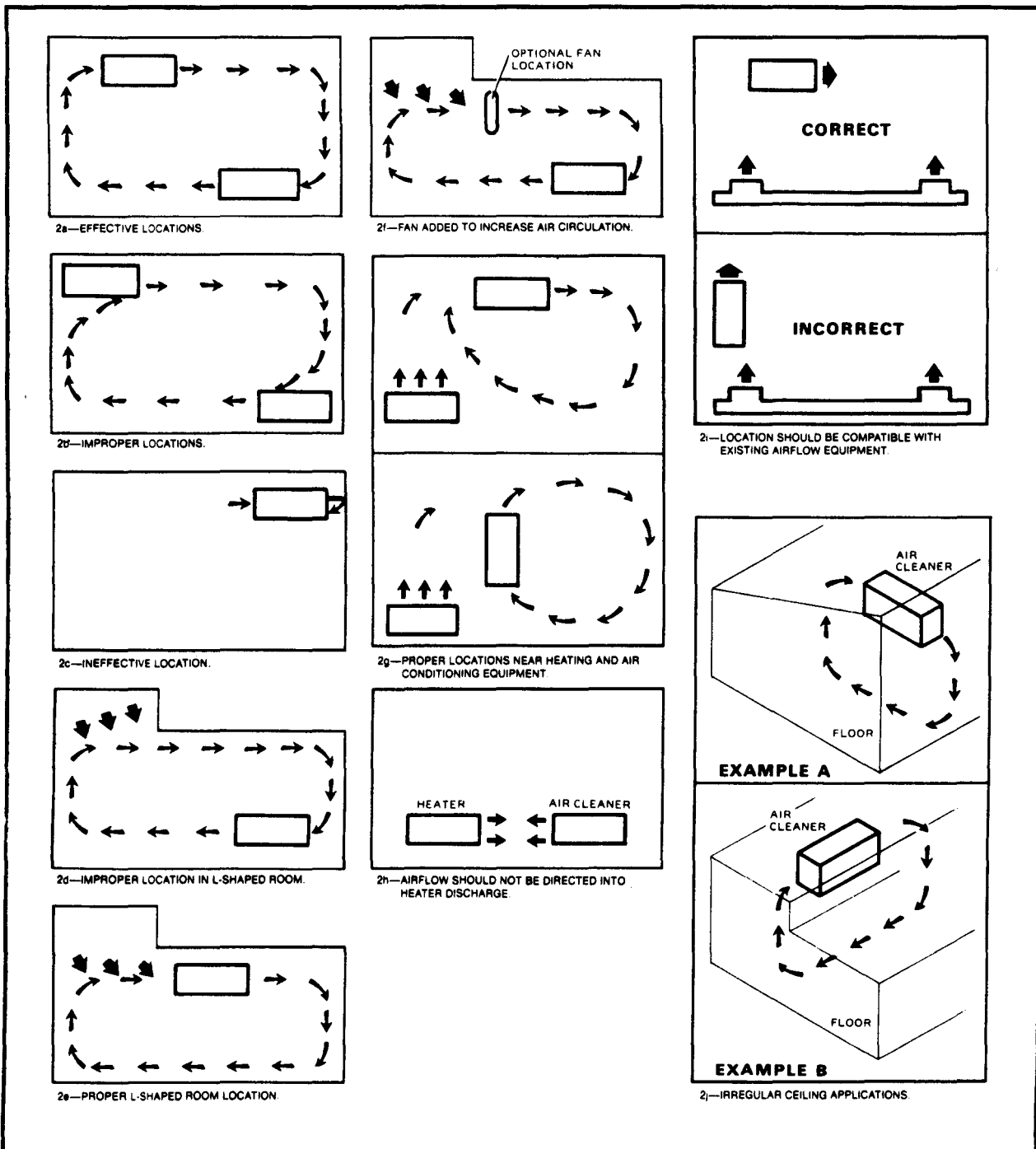


Fig. 2—Guidelines for locating the F33 when ambient cleaning.

In rooms with irregular ceilings, install the air cleaner close to the ceiling on the highest wall as example A indicates in Fig. 2). When one section of the ceiling is at least 12 in. [304.8 mm] higher than another, locate the air cleaner in the area with the higher ceiling as shown in example B of Fig. 2).

When selecting locations for numerous units, position the air cleaners to create uniform movement of air and provide maximum access to the sources of contamination. The outlets of the air cleaners should not be located so that they generate opposing air currents or that the outlet from one air cleaner is less than 30 ft [9.1 m] from the inlet of another air cleaner.

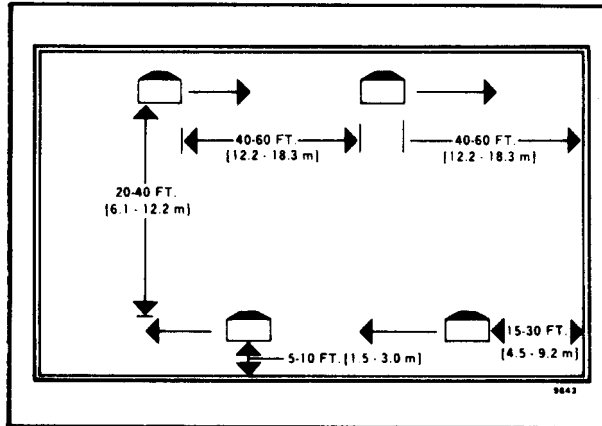


Fig. 3— F33 Location Guide for background cleaning.

SOURCE CAPTURE CLEANING

When selecting a location for an electronic air cleaner that uses a hood and hose to capture the contaminants at the source, note the available stand or ceiling mounting areas which will provide satisfactory air distribution for the air cleaner outlet. Choose the location which will keep the air pressure drop caused by the length of hose within an acceptable range. Do not mount the outlet of the air cleaner so close to a wall that it inhibits the airflow. Also, the outlet of an air cleaner should not be located such that it interferes with the source capture process of another air cleaner hood.

To effectively control atmospheric contamination at its source, proper hood design is necessary. Minimum airflow and power consumption are also important factors in designing an effective local exhaust system to control contamination.

Capturing air contaminants at their source requires the creation of sufficient airflow past the contaminant source to remove the contaminated air and draw it into an exhaust hood. Fine airborne dust particles, mists, vapors, gases, and fumes follow air currents. Airflow, alone, is sufficient to capture these contaminants.

Larger dust particles tend to have a trajectory, or throw, in air. Capturing these heavier particles calls for barriers and proper hood placement to direct the particles into the hood before they fall out of the airstream. This placement should also prevent particle scattering.

Basic knowledge of the contaminated airflow to be controlled is necessary before an effective hood or enclosure can be designed. The more complete and effective the design, the more economical and efficient the installation will be.

A complete enclosure is often the best way to start. Once a source is ideally enclosed, provide access and working openings as required. This concept can be used to develop booths, side- or down-draft hoods, and side shields.

The access and working openings must be kept to a minimum. Whenever possible, they must also be kept away from the contaminated airflow. Any inspection and maintenance openings should be provided with tight doors whenever possible.

A hood that is open and does not enclose or confine the contaminant should be avoided. Open hoods can be used, but exhaust volumes must be large and cross drafts nearby can easily upset draft control.

Canopy hoods are effective in controlling operations that may suddenly release surges of gases and vapors. Hot processes are an example.

However, canopies should not be used where people may be working in the airflow between contaminant source and canopy, because exhaust airflow can actually increase the workers' exposure to the contaminant. Plating tanks and cementing tables typically have this problem with canopy type hoods.

The duct takeoff in the exhaust hood should be located in the normal line of contaminant travel. Arrange the duct openings to distribute the exhaust airflow throughout the hood. This is especially important with large shallow hoods, where air movement tends to concentrate close to the duct opening. The airflow can be spread around the hood by using multiple duct takeoffs, interior baffles, or filter banks.

Air intake from areas not needing airflow or without contaminants can be controlled with flanges. Flanges minimize airflow from areas outside the desired air collection area. Usually the flange width is equal to the hood diameter, but not exceeding 6 inches [152.4 mm]. Flanges may increase the effectiveness of the hood, allowing a reduction in hood airflow requirements by up to 25 percent.

Exhaust airflow requirements are calculated after the hood design is determined. The airflow volume is calculated using the enclosure's known open area and the airflow velocity needed to collect the contaminants. The collected airflow must be sufficient to prevent the escape of any contaminated air. Table 1 shows airflow capture velocities for various types of processes.

Where enclosing the process is impractical, the hood should be located as close to the source as possible. The airflow must be adequate to maintain the capture velocity required to carry the contaminants to the hood opening. See Fig. 3.

TABLE I—CONTAMINANT CAPTURE VELOCITIES^a

CONTAMINANT DISPERSAL CONDITION	EXAMPLES	CAPTURE VELOCITY	
		fpm	m ³ /hr.
Released with practically no velocity into quiet air.	Evaporation from tanks; degreasing, etc.	50-100	914-1829
Released at low velocity into moderately still air.	Spray booths; intermittent container filling; low speed conveyor transfers; welding; plating; pickling.	100-200	1829-3658
Active generation into zone of rapid air motion.	Spray painting in shallow booths; barrel filling; conveyor loading; crushers.	200-500	3658-9144
Released at high initial velocity into zone of very rapid air motion.	Grinding; abrasive blasting, tumbling.	500-2000	9144-36576

In each category above, a range of capture velocity is shown. The proper choice of values depends on several factors:

Lower End of Range

1. Room air currents minimal or favorable to capture.
2. Contaminants of low toxicity or of nuisance value only.
3. Intermittent, low production.
4. Large hood—large air mass in motion.

Upper End of Range

1. Disturbing room air currents.
2. Contaminants of high toxicity.
3. High production, heavy use.
4. Small hood—local control only.

^aFrom INDUSTRIAL VENTILATION MANUAL by American Conference of Governmental Industrial Hygienists.

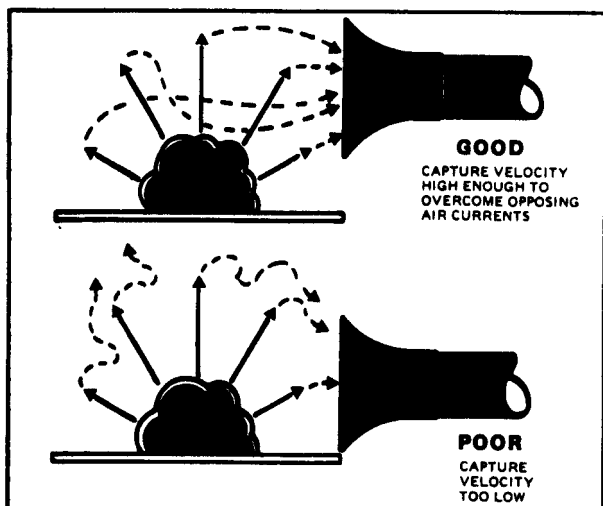


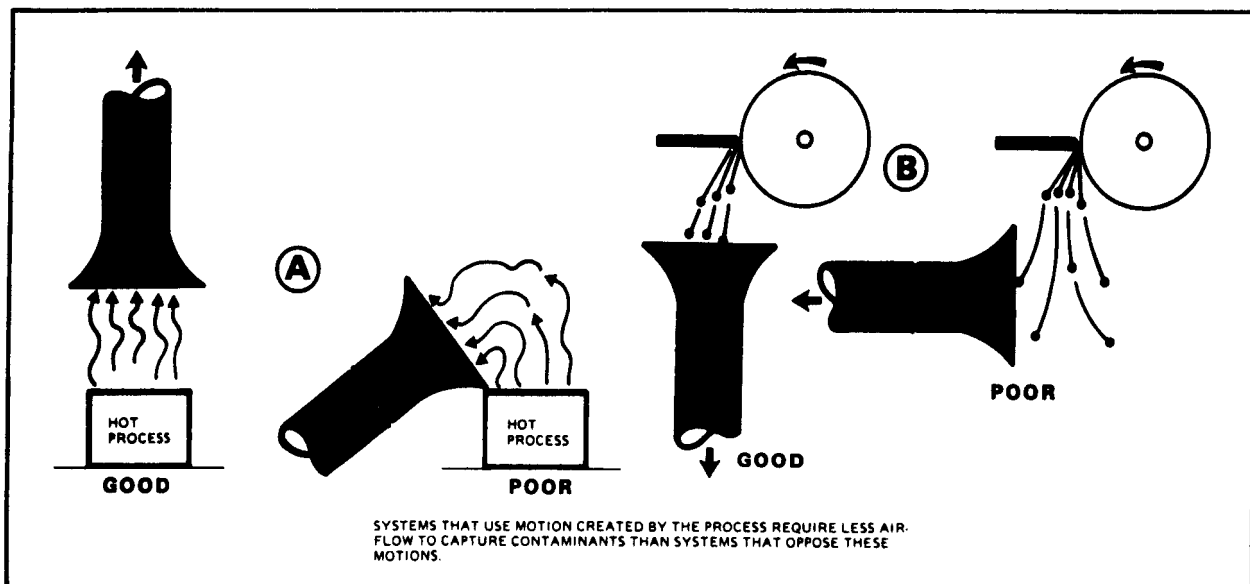
Fig. 4—Capture velocity.

Collecting contaminants is accomplished by eliminating or minimizing natural air currents at the contaminant site, and by pulling the air into the exhaust hood. The airflow velocity must be high enough to overcome any opposing air currents and maintain the capture velocity (see Fig. 4).

Sources of air motion to either minimize or use to advantage in hood design—

- Thermal air currents from hot or heat generating operations.
- Machinery motion (conveyor belts, grinders, etc.).
- Material motion (dumping or container filling).
- Operator movements.
- Room air currents (generally 50 fpm [85 m³/hr] minimum; could be much higher).
- Spot heating, cooling or ventilation equipment near area.

See Fig. 5.



SYSTEMS THAT USE MOTION CREATED BY THE PROCESS REQUIRE LESS AIR FLOW TO CAPTURE CONTAMINANTS THAN SYSTEMS THAT OPPOSE THESE MOTIONS.

Fig. 5—Utilizing process motion.

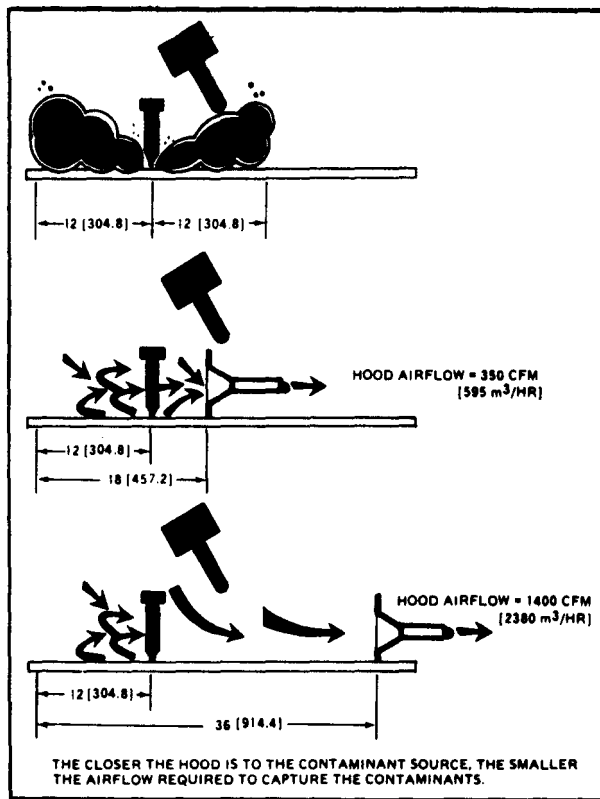


Fig. 6—Hood location; airflow needed increases with distance from work.

Airflow needed in a hood design is affected by hood shape, size and location. The hood should be as close as possible, and enclose the operation as much as possible.

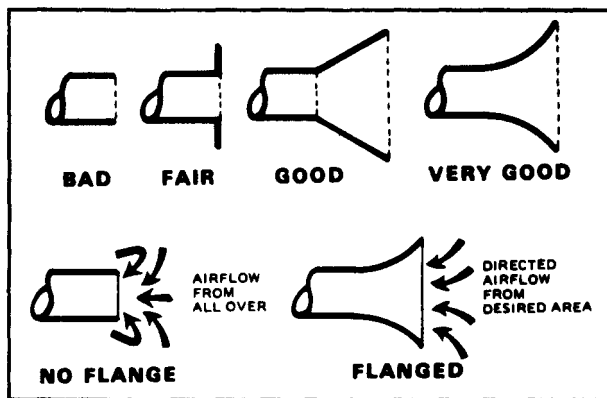


Fig. 7—Hood flanges.

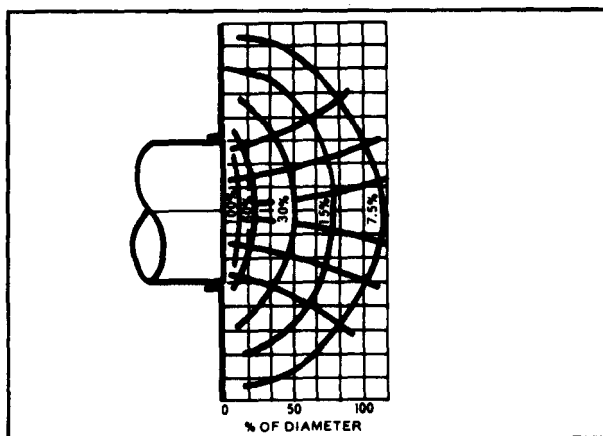


Fig. 8—Velocity contour (in percentage of opening velocity) for flanged circular opening.

Suction in a duct opening will draw air in equally from all directions. As distance from the inlet opening increases, the decrease in airflow velocity occurs quicker. The velocity in feet per minute (fpm) equals the cubic feet per minute (cfm) from Fig. 10 divided by inlet area in feet (0.35 for 8 inch hose).

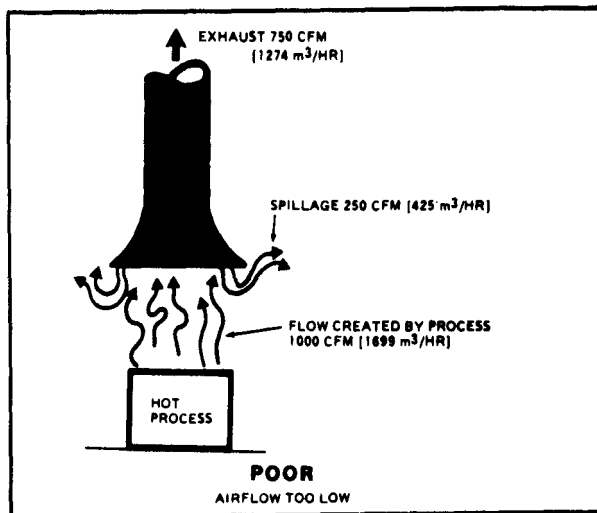


Fig. 9—Maintain adequate airflow.

Fig. 10—

When utilizing thermal airflow occurring in a process, exhaust airflow should be greater than the process airflow. This will minimize air spillage at the rim of the hood.

For further information on ventilation and hood design, refer to a more complete source, such as:

INDUSTRIAL VENTILATION, by American Conference of Governmental Industrial Hygienists, published by Committee on Industrial Ventilation, Lansing, Michigan, 48901.

HANDBOOK OF VENTILATION FOR CONTAMINANT CONTROL, by Henry J. McDermott, published by Ann Arbor Science, Box 1425, Ann Arbor, Michigan, 48106.

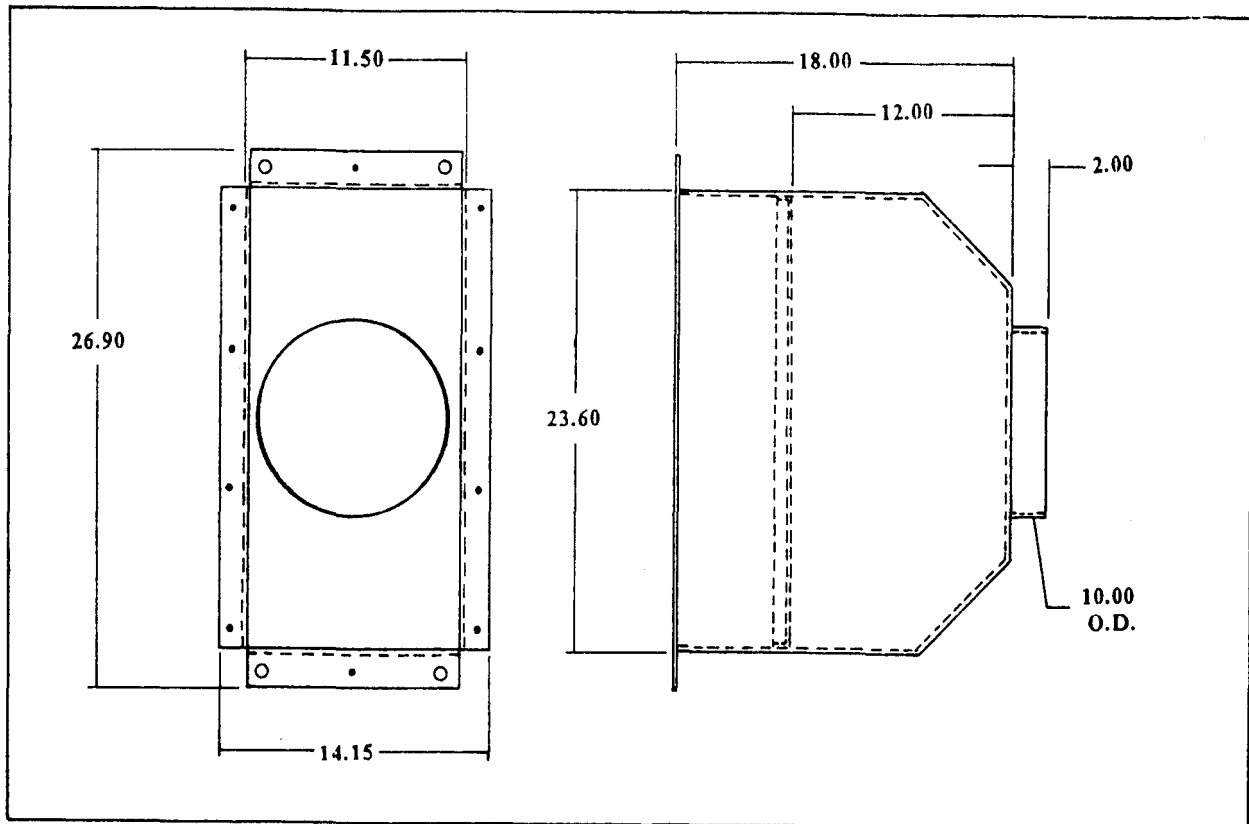


Fig. 11—Source Capture Plenum dimensions in inches [millimetres in brackets].

INSTALLATION

WHEN INSTALLING THIS PRODUCT . . .

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

1. Disconnect power supply before installation, and connect power after mounting air cleaner to prevent electrical shock and equipment damage.
2. Motor is equipped with automatic thermal overload. Should motor become overloaded, it will de-energize. However, it automatically energizes after sufficient cooling time (several minutes to an hour). Therefore, be sure to turn off air cleaner before servicing.
3. If air cleaner must be energized for electrical check, be extremely careful near moving parts.

UNPACKING

All components of the F33 are assembled and packed in one box. Check all air cleaner components carefully when unpacking. Remove all shipping cardboard. Be sure to inspect all packing materials before discarding them.

OVERHEAD MOUNTING

When installing the F33 in an overhead location, position the air cleaner as close to the contaminant source as possible. This increases the air cleaner's effectiveness. It is important to select an overhead mounting location for the air cleaner which provides easy access for cell cleaning and maintenance. Do not place a ladder against the air cleaner when it is mounted overhead in order to gain access to the air cleaner interior.

Be certain that the mounting apparatus from the air cleaner to the ceiling (not included) provides adequate strength and stability, and that it is securely attached to the overhead structure. Do not fasten the air cleaner to a false ceiling or to plaster or plasterboard. In some cases it may be necessary to construct supports which will bear the weight of the F33 when it is hung in an overhead location.

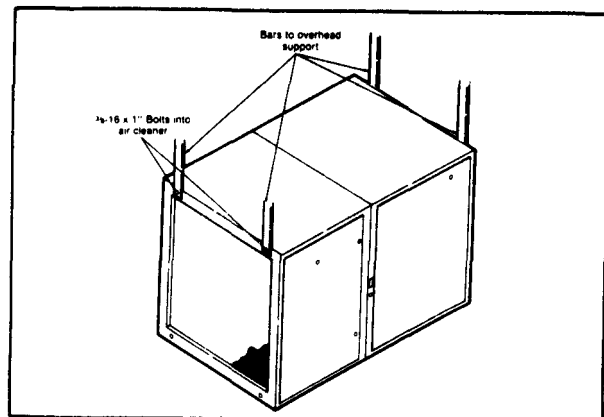


Fig. 12—Mounting the F33 overhead.

STAND MOUNTING

Securely place the F33 on an appropriate stand or cart and locate as close to the contaminant source as possible. The position should also allow satisfactory distribution of air from the outlet of the air cleaner. If a source capture hood, plenum, and hose are used, observe the instructions in PLANNING THE INSTALLATION for selecting a suitable location for the unit.

SOURCE CAPTURE PLENUM AND DUCTWORK

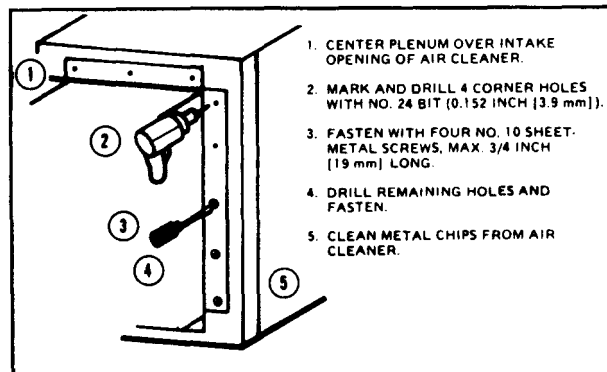


Fig. 13—Installing source capture plenum.

1. Center the plenum over the intake opening of the air cleaner, then use the plenum as a template to mark 4 corner holes.

2. Use a No. 24 bit (0.152 inch (3.9 mm)) to drill the 4 holes.

3. Fasten the plenum to the air cleaner using No. 10 sheetmetal screws $\frac{1}{2}$ to $\frac{3}{4}$ inch (12.7 mm to 19 mm) long (not furnished).

4. Drill holes at remaining screw locations around the plenum. Fasten with sheetmetal screws. 2-cell air cleaner plenum uses 18 screws.

5. Remove any metal chips and shavings from the interior of the air cleaner.

Replace the prefilter and cells. Connect hose length to desired plenum flange using hose clamps (not furnished). Block off unused plenum openings with tee caps available separately.

Route the hose(s) to the source capture hood. Support the hose(s) as necessary using hangers and support bands. Support bands on the hose should be at least 2-1/4 inches (57.2 mm) wide and placed at 5 foot (1.52 m) intervals. Do not pinch or flatten the hose.

Hood size and location should be determined by an accepted authority or reference, such as the "Industrial Ventilation Manual," to meet applicable codes and ordinances for a particular application.

ELECTRICAL INSTALLATION

CAUTION

This procedure should be attempted only by persons qualified to install electrical wiring. All wiring must comply with applicable codes and ordinances.

1. Locate an unswitched single phase power circuit with a junction box near the air cleaner location. Be certain the circuit voltage matches the voltage of the air cleaner.
2. Check the circuit breaker or fuse for that circuit and determine whether the amperage rating of the circuit and the existing circuit loads are such that the air cleaner can be added to the circuit. If not, a new circuit must be wired from a circuit breaker or fuse to the air cleaner.
3. **CAUTION:** Turn off the building circuit at the fuse or circuit breaker before proceeding.
4. Connect the black wires from the pigtails in the air cleaner junction box to the supply circuit.
5. Connect a green wire from the grounding terminal in the air cleaner junction box to the grounded conduit of the building wiring system. If the building does not have conduit it will have a green or bare grounding conductor for connection to the air cleaner green wire. DO NOT connect the grounding wire from the air cleaner to the white wire of the building. The air cleaner frame must be electrically connected to the frame of the building or the electrical conduit system.

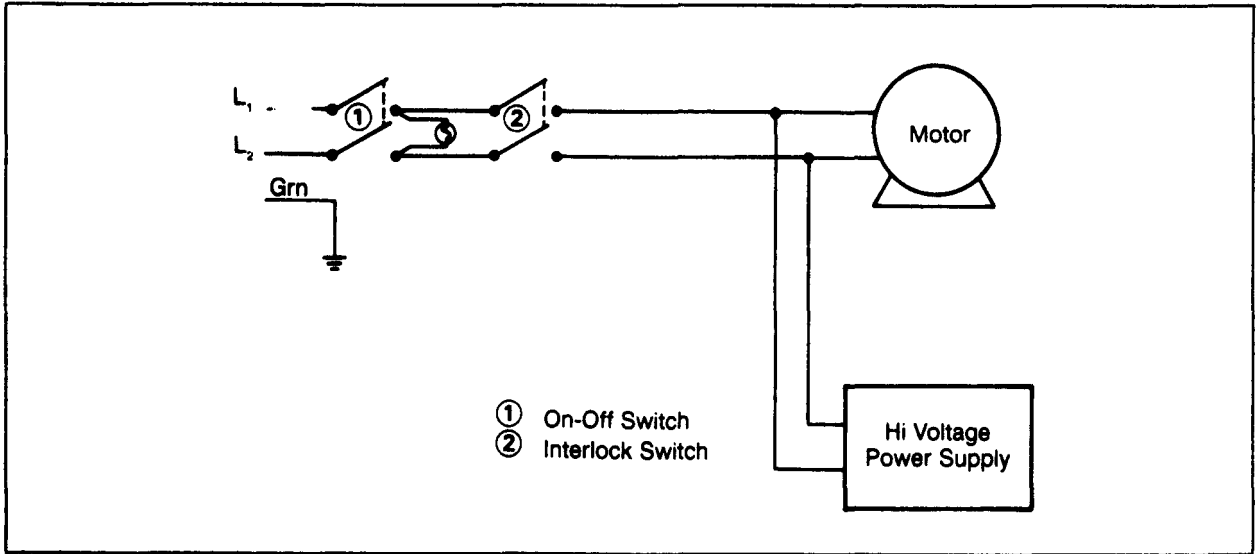


Fig. 14—Schematic for Single Phase, Single Pass Air Cleaner.

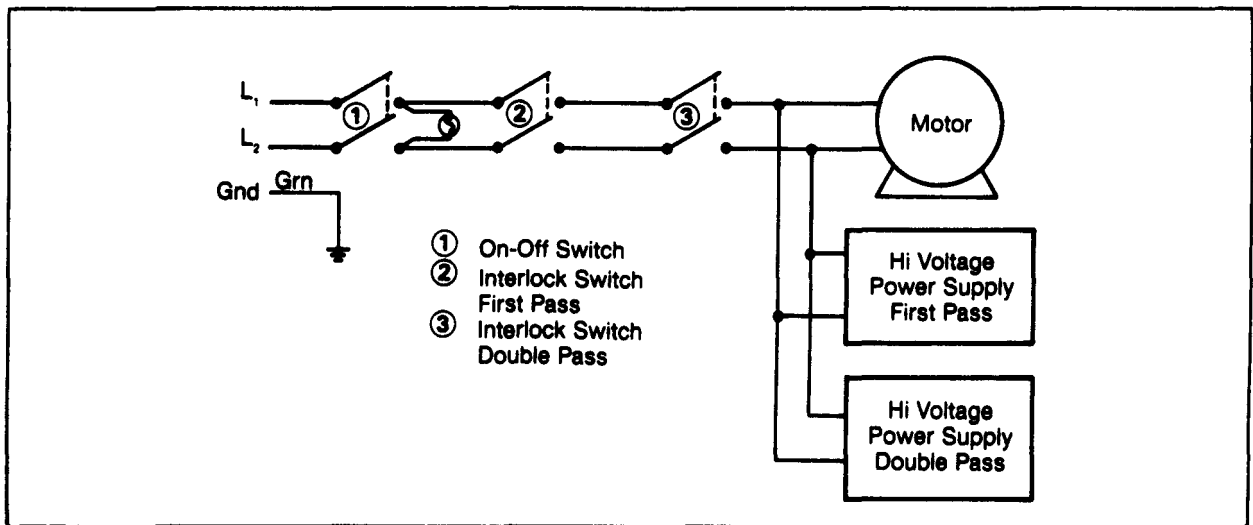


Fig. 15—Schematic for Single Phase, Double Pass Air Cleaner.

OPERATION AND CHECKOUT

CHECKOUT

Before operating the F33, check out the installation using the following procedure:

1. Observe that the air cleaner is oriented for good air circulation where it will not interfere with personnel and material traffic. Keep out of fire lanes and away from overhead cranes.
2. Note that the access doors can be easily opened.
3. Check that the F33 is securely mounted overhead or in a stable position on the accessory stand.
4. Check that the electronic cell(s) are correctly oriented; the airflow arrows are pointing toward the blower and the handles are near the access door hinges.
5. Observe that the prefilter and postfilter screens are properly in place.
6. Check and adjust belt tension if necessary.
7. Make sure the junction box cover has been reinstalled.
8. Clean up the inside of the cabinet, the outside of the cabinet, and the installation area.

OPERATION

When the electronic air cleaner is energized, the blower produces an airflow velocity which conveys contaminated air into the air cleaner inlet. Particles that are too small to be caught by the prefilter screen are given an intense electrical charge in the ionizing section of the electronic cell. As the air carries these charged particles into the collecting section of the electronic cell, they are hurled against metal plates by the force of a powerful electrical field. These particles cling to the metal plates and the air passes through a postfilter screen, the blower compartment, and re-enters the building space as cleaned air.

Start up the air cleaner with the access doors properly closed. Put the rocker switch in the ON position. Check for the following:

1. The blower should be providing a strong discharge airflow.
2. The performance indicator light should be on when the blower is running.
3. Opening the access doors should stop the blower and turn off the performance indicator light. Do not place a ladder against the air cleaner when it is mounted overhead in order to gain access to the air cleaner interior. NOTE: If the F33 does not appear to operate correctly, refer to TROUBLESHOOTING section.

ADJUSTMENTS

Adjust the bidirectional louvers of the air cleaner discharge so that the airflow discharge does not produce discomfort or a possible hazard to personnel and equipment.

The blower capacity of the F33 is factory-set. This capacity may be adjusted (see SPECIFICATIONS for adjustment range). Before adjusting the blower capacity make sure that the ON-OFF switch is in the OFF position. To adjust the blower capacity:

1. Turn the air cleaner off and open the access door to the blower and motor section of the air cleaner.
2. Loosen the two bolts locking the end of the motor rail in position. Remove the belt.
3. Loosen the Allen setscrew on the face of the motor sheave.
4. Rotate the sheave into a position which gives the desired blower capacity.

NOTE: When the sheave is rotated all the way into the shaft, the blower capacity is at its maximum. When the sheave is rotated 5 turns out on the shaft, the blower capacity is at its minimum. **DO NOT ROTATE THE ADJUSTABLE SHEAVE MORE THAN 5 TURNS OUT ON THE SHAFT.** The sheave may already be adjusted one or more turns out on the shaft.

5. Make sure that the sheaves are in line. If not, loosen the motor and blower sheaves and align them properly. Tighten sheaves securely.

6. Replace the belt and retighten bolts in motor rail. The belt should be tightened enough to prevent slippage but not so tight that vibration occurs. The correct tension results in a $\frac{3}{4}$ to 1 in. (19.1 to 25.4 mm) deflection when a 10 lb. (4.5 kg) force is applied to the center of the belt span.

7. Close the access door and energize the air cleaner.

NOTE: For some blower adjustments, it may be necessary to use a smaller belt instead of the existing belt to achieve proper tension. Generally, a 1 in. [25.4 mm] shorter belt will be required.

SERVICE

CLEANING THE ELECTRONIC AIR CLEANER

The F33 is used to remove a variety of contaminants from the air. In the process of cleaning the air, however, parts of the air cleaner will become dirty, and the cleaning efficiency will be lowered.

In order to maintain a high standard of reliability and efficiency, it is necessary for the F33 to receive periodic maintenance. Periodic maintenance means cleaning the collector cells and inspecting the electronic air cleaner, both visibly and with instruments. Service will be required if the air cleaner seems damaged, or appears to be performing at substandard efficiency.

Smokemaster recommends regular cleaning and the use of an alkaline detergent solution. The exact scheduling is a matter of experience, since each air cleaning situation varies. Actual experience may dictate a greater or lesser period between cleanings.

If, because of excessive buildup of captured contaminants, the alkaline detergent solution proves inadequate, the use of physical force (such as high pressure air, water, or steam) or an acid detergent solution may be required.

CAUTION

1. Be extremely careful when working with F33 cells and filters. The edges of the cells and filters, and the collection plates and ionizing wires of the cell may be sharp.
2. When cleaning the cells and filters, be sure to wear appropriate protective gear, especially goggles and gloves. Skin contact with either alkaline or acid detergent solution should be avoided.

REMOVING THE ELECTRONIC CELLS AND PREFILTERS

Before the electronic cells and prefilters can be cleaned, they must be removed from the F33. Be careful NOT to place a ladder or other heavy item against the F33 unit, cells or prefilters. Electronic air cleaners and their components are susceptible to damage.

CLEANING THE PREFILTERS

The prefilters on an F33 do require cleaning. The procedure is simple. Remove the prefilter and shake the accumulated contaminants from it. If this does not seem adequate, a vacuum can be used, or the prefilter can be soaked in the alkaline detergent solution. Do NOT soak the prefilter in an acid detergent solution. Physical force methods could also harm the prefilters.

THE ALKALINE DETERGENT SOLUTION CLEANING METHOD

1. Provide a container large enough to hold the electronic cells and prefilters to be cleaned.
2. Fill the container with detergent and hot water sufficient to cover the electronic cell.

NOTE: Be careful to avoid prolonged skin contact with the solution. Do NOT splash solution in the eyes.

3. Soak the cells and prefilters in the solution for about 15 minutes. The solution should be agitated in some way, such as sloshing the cells or prefilters, or stirring the solution.

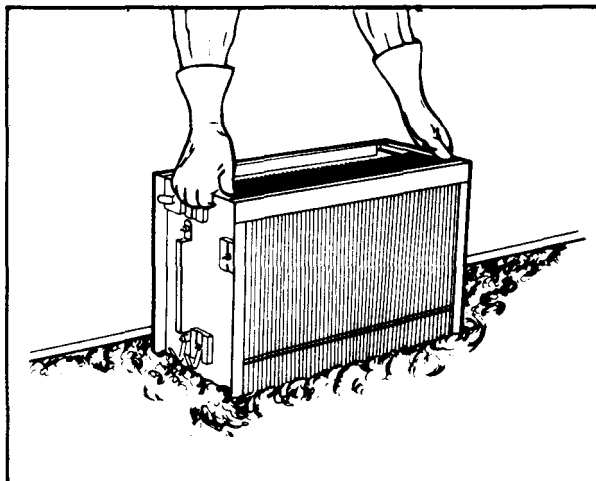


Fig. 16—When soaking the cell, agitate the water.

4. Remove the cells and prefilters from the alkaline cleaning solution and place them in another container of hot water (150 F to 170 F [66 C to 77 C]) for rinsing. The cells and prefilters should be rinsed for 5 to 10 minutes.

5. Remove the cells and prefilters from the rinse water. Allow the cells and prefilters to drain and dry before energizing them.

The collection plates of the electronic cells **MUST** be checked for any detergent residue. If there is any residue remaining, rinse it off, since it may affect the efficiency of the electronic air cleaner.

THE ACID DETERGENT METHOD

Smokemaster does sell an acid detergent. However, acid cleaners should be used only after alkaline detergents have proven inadequate. Acid cleaners have been tested and proven to be corrosive. They *will* decrease the life of cells. If an acid detergent solution is used, be sure to use a weak mixture. Do NOT place prefilters in an acid detergent solution.

IMPORTANT

Acid cleaners *must* be properly handled. Refer to the label on the acid detergent used. This means wearing protective clothing, rubber gloves, and goggles and reading all precautions on the label of the detergent used. If contact is made in the eyes, flush with large amounts of water and consult a physician.

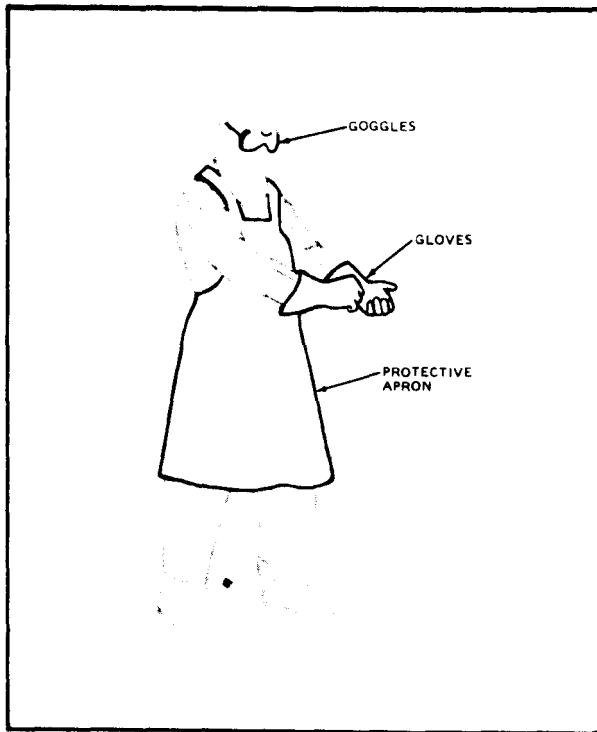


Fig. 17—Be sure to wear the proper equipment for working with detergent solutions.

NOTE: Be sure to provide adequate ventilation when using acid detergents.

After the cleaning process is completed, the soak water must be neutralized according to the U.S. Environmental Protection Agency, and state and local pollution control guidelines and requirements. Soda ash is one neutralizer.

1. Use a polyethylene or type 316 stainless steel container large enough to hold the electronic cell. Other types of containers should be avoided since the acid detergent may react with the container material.

2. Following the instructions for temperature of the water and amount of acid detergent used, prepare the cleaning solution. The amount of detergent and the soaking time will be determined by the amount of contaminants captured by the cells and the difficulty encountered in removing the buildup. The usual mix for acid solution is 2 oz of acid detergent to 1 gal of water [59.2 mL to 3.8 L].

NOTE: It is recommended that acid cleaning of any electronic air cleaner cells containing metal oxide contaminants be performed with room temperature or cold water. NEVER add acid detergent to hot water.

3. Be sure to observe the cleaning operation when the cells are placed in the acid detergent solution. The amount of acid detergent should be reduced if less than 30 seconds pass before large amounts of bubbles are released. The cells should NOT remain in the acid detergent solution more than 30 seconds after vigorous reaction begins. It is a good idea to remove the cells and inspect the cleaning action of the acid detergent solution. If contaminant deposits remain, the cells can be returned to the solution.

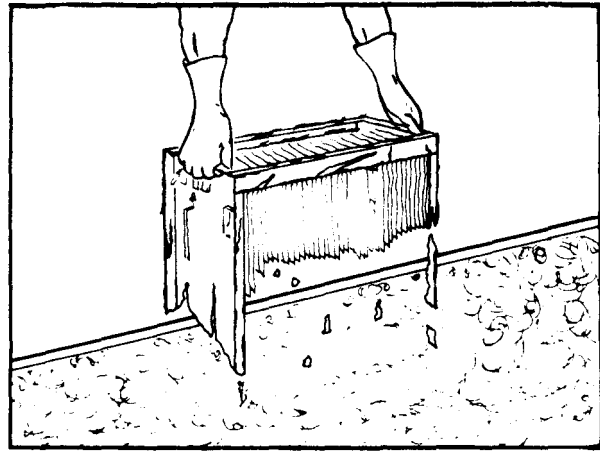


Fig. 18—Too much time in that acid solution may harm the electronic cell.

IMPORTANT

After the contaminants are removed by the acid detergent solution, any further time the cells remain in the solution serves only to decrease their life.

4. After removing the cells from the acid detergent solution, rinse them thoroughly for at least 5 minutes.

5. Allow the cells to drain and dry before energizing them.

STAINING

Occasionally, after the soaking process, the cell or prefilter may seem stained. If the stain is black or very dark, it is probably detergent residue and should be rinsed off at once. Detergent residue may affect the electronic air cleaner's efficiency.

If yellowing appears, it is probably staining. The acid detergent solution will remove the yellowing. However, it should be noted that the yellowing does not affect air cleaner efficiency.

PHYSICAL FORCE METHODS

The following physical force methods may be needed to clean some contaminants from the F66 cells. Do NOT use physical force methods on the filter screens.

1. High Pressure Air or Water. Either of these methods should prove to be adequate. However, care should be taken to avoid damage to the electronic cells.

NOTE: Using any caustic detergent with high pressure is dangerous.

If a detergent is required with the high pressure water, an alkaline detergent should be used, if allowed by the high pressure equipment manufacturer. Do NOT use an acid detergent, except when allowed by the equipment manufacturer.

2. Steam. Extreme care must be exercised when steam cleaning to avoid warping or bending the collector plates of the electronic cells or any other damage to the cells. Remember that the cells will be hot after steam cleaning, and that care must be taken to avoid burns.

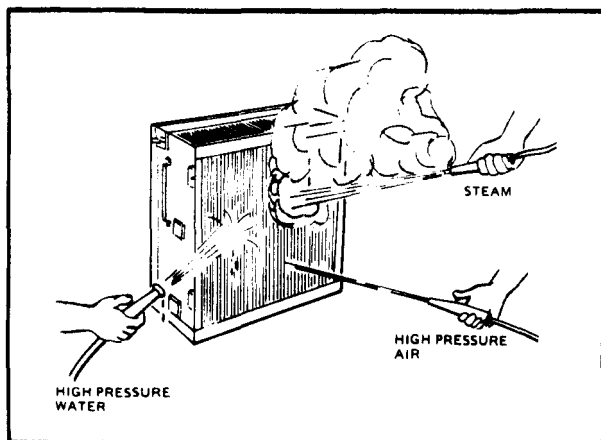


Fig. 19—It may be necessary to use physical force methods to remove collected contamination.

CONTAMINANTS AND CLEANING PROCEDURES

The following is a selective listing of contaminants captured by electronic air cleaners. This listing gives the appropriate cleaning procedure for various types of contamination found on electronic air cleaner collector plates and prefilters.

CONTAMINANT	CLEANING PROCEDURE ^a
Animal Hair	Alkaline Solution
Cabosil	Alkaline Solution High Pressure Air
Carbon (carbon black, soot, lamp black, graphite, charcoal dust, etc.)	Alkaline Solution High Pressure Air High Pressure Water
Cooking Oils: Vegetable (soybean, peanut, etc.) Animal (lard, butter, etc.)	Alkaline Solution Steam
Cotton Fibers	Alkaline Solution
Dust (silicon dioxide and calcium carbonate and mineral type compounds)	Alkaline Solution
Flour Dust	Alkaline Solution
Linseed Oil	Alkaline Solution
Lubricants	Alkaline Solution High Pressure Water
Metal Oxides	Acid Solution
Metals	Acid Solution
Mineral Oil (petroleum base, diesters, and silicone)	Alkaline Solution High Pressure Water
Paper Products	Alkaline Solution
Paint: Oil Base Water Base	Alkaline Solution Alkaline Solution
Pine Tar Resins	Alkaline Solution Steam

(continued next column)

CONTAMINANT	CLEANING PROCEDURE ^a
Polyethylene	Alkaline Solution
Polyphenyleneoxide	Alkaline Solution
Polypropylene	Alkaline Solution
Rubber Molding Accelerators	Alkaline Solution
Soaps	Alkaline Solution
Sodium Chloride	Alkaline Solution
Sugars (includes molasses)	Alkaline Solution Steam
Talc	High Pressure Air Alkaline Solution
Tobacco Tars and Smoke	Alkaline Solution
Varnishes	Alkaline Solution
Waxes (all types)	Alkaline Solution Steam
Welding Fumes	Acid Solution
Wood Products	Alkaline Solution

^aCleaning procedures are listed in order of preference.

REPLACING THE CELLS AND PREFILTERS

Before replacing the electronic cells, be sure to visually check the electronic cell for bent or damaged collector plates or broken ionizing wires.

Bent or warped collector plates may be bent back into shape.

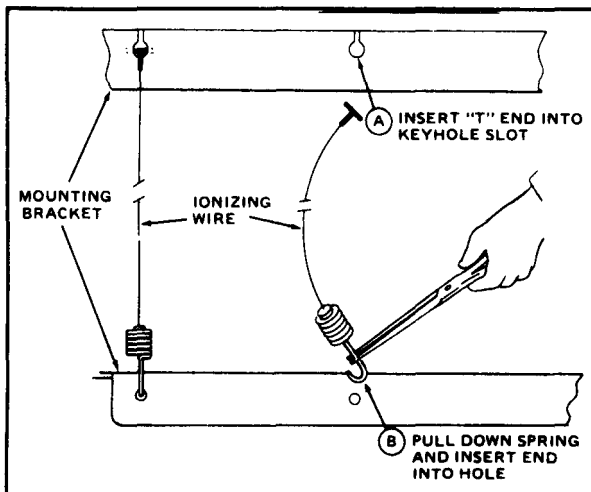


Fig. 20—Replacing ionizing wires.

Broken or damaged ionizing wires must be replaced for top efficiency. Remove all parts of the broken or damaged wire. Replacement wires come cut to length and ready for installation. Remember, when replacing the ionizing wires, to:

1. Use care to avoid damage to the spring connector or other parts of the cell during installation.
2. Hook "T" end of the ionizing wire in keyhole slot at one end of the cell.
3. Pull down spring with a needle-nose pliers and insert hook into hole.

Before replacing the cell, it might be a good idea to check it for a short circuit. This is done by using an ohmmeter to check the resistance between the frame of the cell and both the ionizer and collector contacts. In each case, the resistance should be infinite.

Note that the electronic air cleaner has a cell key, preventing the electronic cell from being replaced the wrong way. If the cell seems to be stuck when it is replaced, or resists, check to be sure that the cell is being replaced the right way. If excessive force is used, the cell or unit could be damaged.

If cells are placed into the air cleaner unit while wet, the indicator light will not come on until the cells are dry.

SUMP PAN CLEANING

If a sump pan is used with the F33, make sure that the pan is periodically inspected and cleaned. Inspect both the drain and the trap in the sump to make sure that it is not plugged. If the drain in the sump plugs, the cabinet will start to fill with liquid and may short out the air cleaner.

TROUBLESHOOTING

CAUTION

1. During troubleshooting, dangerous line voltage circuits are exposed. Use extreme care to avoid electrical shock or equipment damage.
2. Although not normally lethal, the high voltage output of the electronic air cleaner power supply can produce a painful shock. Use caution.
3. To prevent injuries from the motor and fan, always turn the electronic air cleaner off using the control switch before opening the access doors.
4. Do NOT place any heavy object, such as a ladder, against the F33.

Troubleshooting can be done with only a few tools. These are:

- Test Meter—Simpson 248 Hi Voltage meter or equiv.
- Neon test lamp for line voltage.
- A spare silicon diode
- Screwdrivers—long shank with plastic or rubber handles.
- Needlenose or longnose pliers—for replacing ionizing wires.
- Soldering iron.

Before troubleshooting the F33, study the flow chart in Fig. 28. The boxes in the chart describe actions to take when troubleshooting the F33. In between the boxes are possible responses of the F33 to these specific actions. Note that the flow chart branches into three problem areas:

1. Fan motor.
2. Ionizer circuitry.
3. Collector output voltage.

To complete the troubleshooting procedure, read the following information which describes how to perform the actions called for in the boxes of the flow chart.

NOTE: If the F33 is a double-pass configuration, all electronic cleaning cell and high voltage power supply troubleshooting procedures must be repeated on each of the two stages.

TROUBLESHOOTING PROCEDURE

Before beginning the troubleshooting procedure, be sure the F33 is correctly assembled (see ASSEMBLY).

The following procedure has been designed to speed troubleshooting and insure the quick detection and proper repair of any malfunction in the electronic air cleaner.

Most of the troubleshooting steps can be performed by observing the performance indicator light.

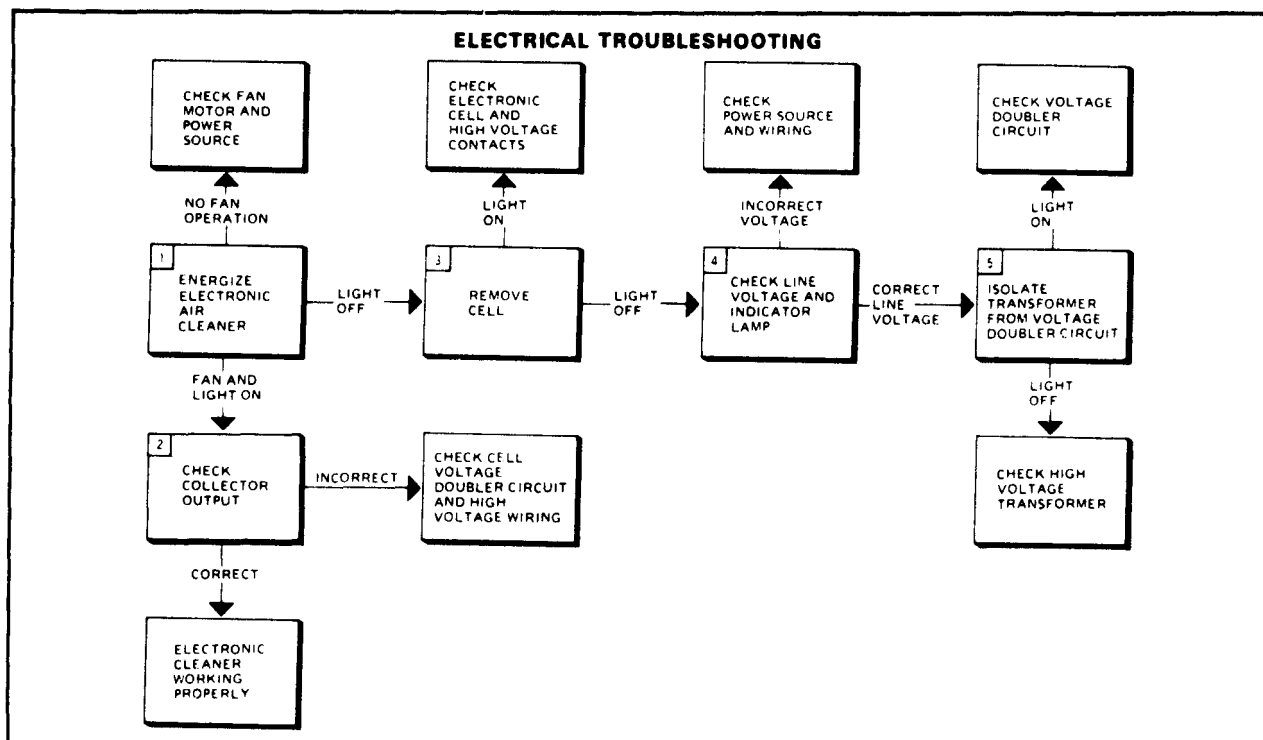


Fig. 21—F33 troubleshooting flow chart.

DIAGNOSTIC CHECKS

1. ENERGIZE THE ELECTRONIC AIR CLEANER

- Be sure the electronic cleaning cells are properly installed, with the airflow arrow pointing towards the fan. The cells should be clean and dry. (Though wet cells may be placed in the air cleaner, it will not operate until the cells are dry.)
- Be sure the filters are installed correctly.
- Close the access door properly, and turn the air cleaner control switch on.
- If there is airflow, and the light is ON, go to step 2.
- If there is NO airflow, go to step 5.
- If the light is OFF, go to step 6.

2. CHECK COLLECTOR OUTPUT VOLTAGE

- Turn the air cleaner OFF, and open the access door to the electronic cleaning cells.
- Actuate the interlock safety switch with the power switch on. The belt may be removed from the motor to stop airflow.
- Using a voltmeter, measure the voltage from the collector contact to ground. See Fig. 30.
- Actual collector output voltage should be about 4600 Vdc. A voltage measurement taken with a meter could range from 3950 Vdc to 4800 Vdc.
- Using a voltmeter, measure the voltage from the ionizer contact to ground. See Fig. 30.
- Actual ionizer output voltage should be about 9200 Vdc. A voltage measurement taken with a meter could range from 8400 Vdc to 9600 Vdc.

3. CHECK CELLS, VOLTAGE DOUBLER CIRCUIT, AND HIGH VOLTAGE TRANSFORMER

- Turn the electronic air cleaner OFF, and release the interlock safety switch. Bleed the cleaning cells by placing a screwdriver across the ionizer contact to ground and the collector contact to ground. See Fig. 30.
- Remove the cleaning cells and actuate the interlock safety switch with the power switch on. Removing the belt from the motor will stop airflow.
- Using a voltmeter, measure the voltage from the collector contact to ground. See Fig.
- Actual collector output voltage should be about 4700 Vdc. A voltage measurement taken with a meter could range from 4250 Vdc to 4900 Vdc.
- Using a voltmeter, measure the voltage from the ionizer contact to ground. See Fig.
- Actual ionizer output voltage should be about 9400 Vdc. A voltage measurement taken with a meter could range from 8600 Vdc to 9600 Vdc.
- If the voltage measurements are correct, check the electronic cells as described in step 7.
- If the voltage measurements are incorrect, check the high voltage wiring to the power supply as detailed in steps 9, 10, 11, and 12.

4. ELECTRONIC AIR CLEANER IS WORKING PROPERLY

- Release the actuated interlock safety switch.
- Read the SERVICE section to find out how to clean the cells, if necessary.

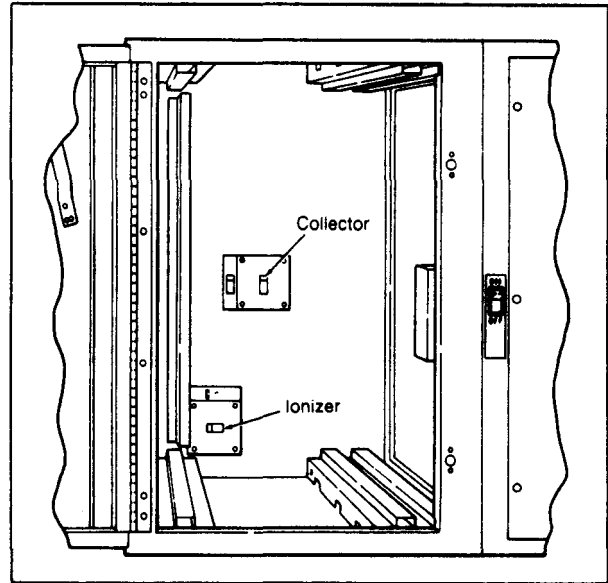


Fig. 22—Measuring points for cell input-voltages.

5. CHECK FAN, MOTOR, AND POWER SOURCE

- Turn the electronic air cleaner OFF and open the access door to the fan and motor.
- Examine the motor for physical damage. Make sure the motor can rotate freely. Replace or repair worn out or damaged parts as necessary.
- Actuate the interlock safety switch and measure the motor voltages
- If the voltage measured complies with the model requirements check the motor capacitor, motor wiring, and fan motor.

6. REMOVE CELLS, ENERGIZE ELECTRONIC AIR CLEANER

- Turn OFF the electronic air cleaner and open the access door to the cleaning cells.
- Bleed the electronic cell as in step 3A. Remove the electronic cells.
- Close the access door and turn the electronic air cleaner ON.

7. CHECK ELECTRONIC CELLS

- Turn OFF the electronic air cleaner.
- Visually inspect the cleaning cells for bent collector plates. Bent collector plates may be straightened with a needlenose pliers. If the cell is damaged too badly, replace it.
- Remove dirt accumulated on the insulators and on the ionizer and collector contact tabs. See Fig. 30.
- Make sure the cell contact tabs are making a good contact with the air cleaner contacts.
- Replace any broken or damaged ionizing wires (see SERVICE section).
- Use an ohmmeter to check resistance between the outside frame of the cleaning cell and both the ionizer and collector contacts. In both cases, the resistance should be infinite, because it is an open circuit.

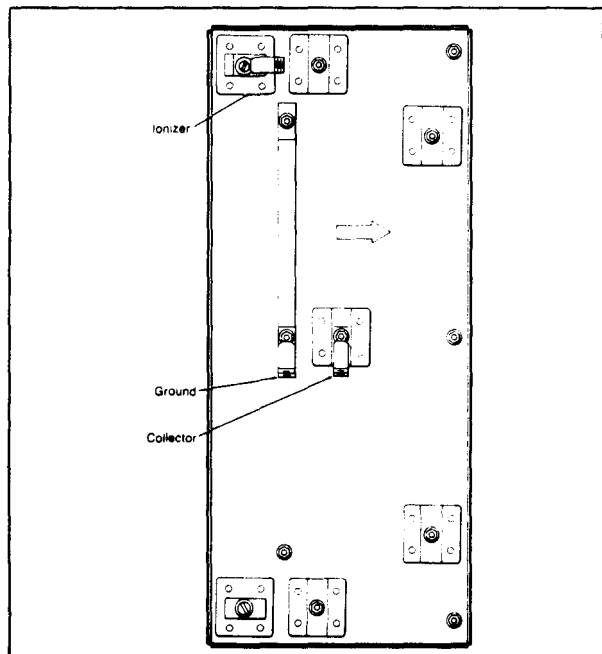


Fig. 23—Cell insulators and contacts.

8. CHECK INDICATOR LIGHT AND LINE VOLTAGE

- Turn the electronic air cleaner OFF and open the cell access door. Remove the panel to gain access to the indicator light.
- Actuate the interlock safety switch and turn the electronic air cleaner on.
- Use a voltmeter to measure the voltage across the indicator light terminals. If the voltage is about 120 Vac, replace the light if necessary.
- If the indicator light voltage is incorrect, use a voltmeter to check the power supply input voltage at terminals L1 and L2 on the control switch.
- If the power supply input voltage is INCORRECT, go to step 9.
- If the power supply input voltage is CORRECT, go to step 10.

9. CHECK WIRING AND POWER SOURCE

- Check the wiring and connectors from the power supply circuit board back to the power source. Repair or replace wiring as necessary.
- Measure the voltage from point R to ground and point Y to ground on the power supply circuit board assembly. See Fig. 31.
- If the voltage is not the same as the cell contact, check the continuity of the wire from the cell contact in the air cleaner to the circuit board.

- If the voltage is the same as the cell contacts of the air cleaner, unplug the 2 quick-connectors on the diodes (Fig. 31), and proceed to step 11.

10. ISOLATE TRANSFORMER FROM VOLTAGE DOUBLER CIRCUIT

- Turn OFF the electronic air cleaner.

CAUTION

Hazardous voltages may be present. Electrical interlocks may not disconnect the air cleaner power with panels removed.

- Remove the blower access door to access to the power supply.
- Unplug the two quick-connectors on the diodes on the power supply circuit board. See Fig. 31. This disconnects the voltage doubler circuit from the high voltage transformer.
- Turn the electronic air cleaner on.
- If the light comes ON, go to step 11.
- If the light remains OFF, go to step 12.

11. CHECK VOLTAGE DOUBLER CIRCUIT

CAUTION

- Be sure the electronic air cleaner is OFF before connecting or disconnecting any component.
- Discharge the capacitors after turning OFF the electronic air cleaner by shorting the capacitor leads to ground with a plastic or rubber handled screwdriver.

- Turn OFF the electronic air cleaner and inspect the voltage doubler circuit components for any sign of physical damage.
- Connect the free end of diode 2 to point Y. Leave diode 1 disconnected at point W. See Fig. 31.
- Turn the air cleaner on. Diode 2 and capacitor 2 are good if—
 - the voltage across capacitor 2 (point Z to ground) is over 3500 Vdc.
 - when discharging the capacitor to ground with a plastic or rubber handled screwdriver, the correct arc is obtained (moderate, blue, snapping spark).
- If the check shows a defective component, unplug diode 2 and temporarily substitute a good diode. Repeat C. A good check proves diode 2 faulty. Replace diode 2. If a good check is NOT obtained, replace capacitor 2.

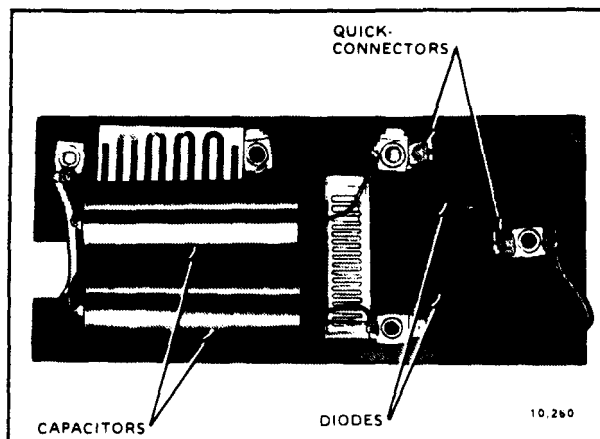


Fig. 24—The High Voltage Transformer.

- e. Turn OFF the electronic air cleaner and disconnect diode 2. Reconnect diode 1.
- f. Turn the electronic air cleaner ON. Diode 1 and capacitor 1 are good if—
 - the voltage across capacitor 1 (point Z to ground) is over 3500 Vdc.
 - when discharging the capacitor to ground with a plastic or rubber handled screwdriver, the correct arc is obtained (moderate, blue, snapping spark).
- g. If the check shows a defective component, unplug diode 1 and temporarily substitute a good diode. Repeat 11c. A good check proves

diode 1 faulty. Replace diode 1. If a good check is NOT obtained, replace capacitor 1.

- h. If a good check is still not obtained, go to step 12.

12. CHECK THE HIGH VOLTAGE TRANSFORMER

- a. Check the resonant capacitor for any sign of physical damage, such as leaking oil or damaged insulators. If it appears damaged, replace it. See Fig.
- b. If the capacitor is good, the problem is probably in the high voltage transformer. Replace the transformer.

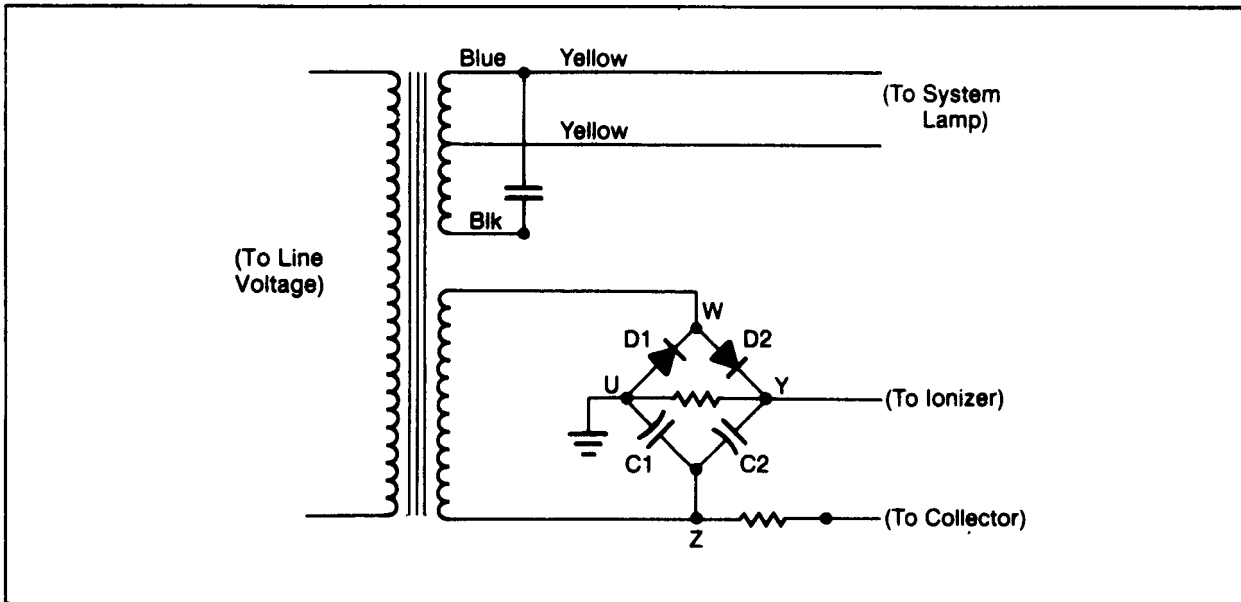


Fig. 25—High Voltage Power Supply Schematic

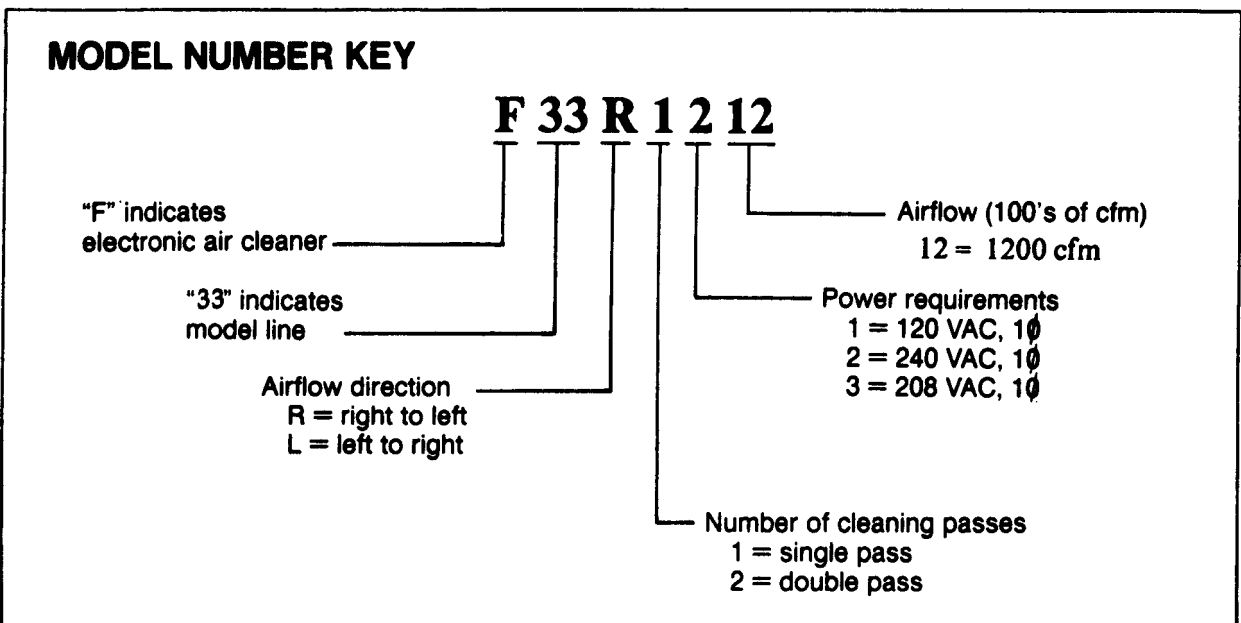
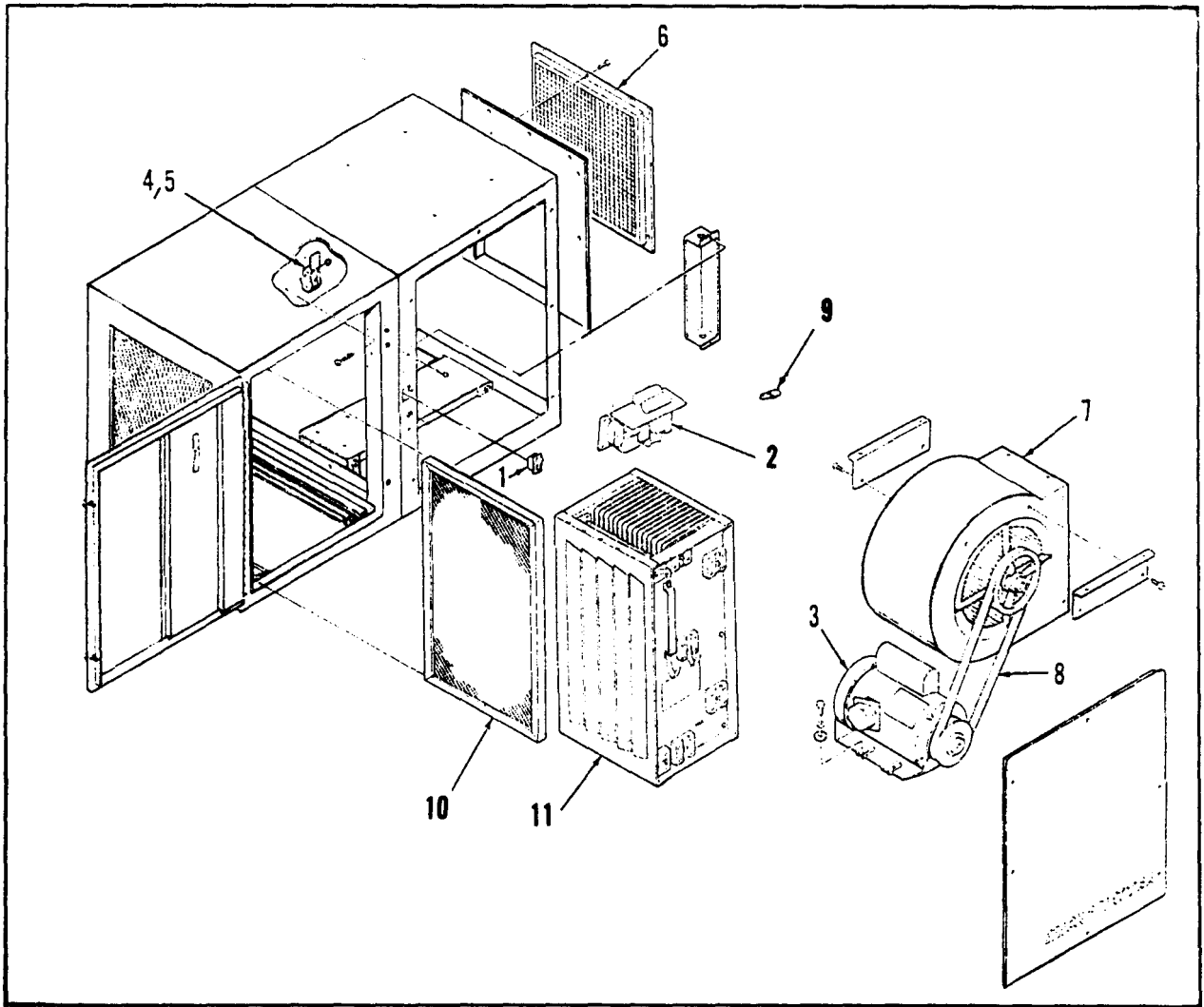


Fig. 26—Model Number Key



ITEM	PART NO.	DESCRIPTION
1	10140	Switch, Power
2	10122	Power Supply (120V, 60 Hz)
3	40019	Motor (1 ϕ)
4	10079	Interlock Switch
5	10176	Interlock Switch w/Blade
6	30530	Outlet Grille
7	37020	Blower
8	30531	Belt
9	10097	System Lamp
10	41075	Pre or Post-Filter
11	38003	Electronic Cell

ACCESSORIES:

07073	Source Capture Plenum
07056	Sump Adapter Kit
07072	Impinger Assembly