RECEIVING • INSTALLATION • MAINTENANCE

INSTRUCTIONS

TYPES PS/G and PS/A
HORIZONTAL AIR FLOW—MANUAL WASH
and
TYPES PX/G and PX/A
HORIZONTAL AIR FLOW—AUTOMATIC WASH

Email Westinghouse *

IONITRON *

ELECTRONIC AIR CLEANER

240 VOLT • 50 CYCLE • SINGLE PHASE • A.C.

This Instruction Book describes the installation of the Ionizer Frame Bank, Cells, Spray Eliminators and Power Pack. It also covers routine maintenance (other than washing) and location and correction of faults. For complete information, reference must also be made to the following publications.

Instruction Book 1495—Type RF Power Pack

Instruction Book 1411—Manual Wash Instructions (For all type PS units)

Instruction Book 1415—Automatic Wash Instructions (For type PX Semi-automatic and Fully automatic wash units).

NOTE:This Book supersedes I.B. 1410—7 Dated July,1977

* REG. T.M.

Email Westinghouse Pty.Ltd.,*
(Incorporated in N S W.)
AIR HANDLING PRODUCTS

N.S.W.:	30 AUBURN RD.,REGENTS PARK	Tel.: (02)6442641
	27 CHURCH ST.,WICKHAM	Tel.: (049)691968
	UNIT 2/83 PRINCES HWY.FAIRYMEADOW	Tel.: (042)273674
VIC.:	587 CHURCH ST.,RICHMOND	Tel.: (03)4283711
QLD.:	44 ANNERLEY RD.,WOOLLOONGABBA	Tel.: (07)3930855
S.A.:	17 PRINCESS ST.,FINDON	Tel.: (08)2683055
W.A.:	73 FROBISHER ST.,OSBORNE PARK	Tel.: (092)4449433

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FOREWORD

The Email Ionitron air filtering apparatus is used in ventilating and air conditioning systems of industrial plants and commercial establishments to remove soot, smoke, dust, dirt and other air borne particles.

In order to produce the results expected of the Ionitron Air Filter, it must be properly installed and maintained. Whether installed by itself or in conjunction with air conditioning equipment, this instruction book, together with the complementary instruction books, gives the correct steps and precautions to be taken.

INTRODUCTION

For flexibility, the complete receiving, installation and maintenance information on the various types and models of Email Ionitron Air Filters is divided into a number of separate books.

The following books are available or envisaged:

Instruction Book 1410 – Horizontal Air Flow Type PS (Manual Wash) and Type PX (Automatic Wash)

Instruction Book 1411 – Manual Wash Instructions (for Type PS, PT and PV Units)

Instruction Book 1415 – Moving nozzle Washer & Controls for Type PX and Type PY Automatic Wash Units

Instruction Book 1420 – Vertical Air Flow Type PV (Manual Wash)

Instruction Book 1470 – Model R Agglomerators

Instruction Book 1495 – Type RF Power Pack

Copies of all relevant instruction books are supplied free with every air cleaner. If copies of the other books are required, they may be purchased at a nominal charge.

DESCRIPTION

Models PS and PX electronic air filters as manufactured by the Electrical Engineering Division of Email Limited, are intended for use in air conditioning and ventilating systems, where the air will pass through the cleaner in a horizontal direction.

The Model PS units are designed to be serviced manually, but the Model PX units are equipped with a motor operated servicing header which may be either semi-automatically or fully automatically controlled.

Ionitron air filters utilise strong electrostatic forces to draw the dirt particles from the air and are equally effective on both the large and extremely small ones. Because of this, these cleaners will remove from 6 to 8 times more dirt from the air than a conventional filter. Moreover, they remove the extremely small particles which are the principal cause of smudging, soiling and dirt damage.

Because of this high efficiency in removing dirt from the air, regular washings are needed to dispose of the increased amount of collected dirt. These electronic air filters are designed to permit this dirt to be easily flushed out of the equipment with water.

The dirt particles are removed from the air by first giving them an electrostatic charge, and then forcing the charged particles to deposit on charged plates, Figure 1 shows the principle of operation. To ensure that the dirt will be held after it is thus removed from the air, the collecting surfaces are coated with a water washable adhesive. This, together with the accumulation of dirt, is washed off in the cleaning process and a fresh coating is applied for the next air cleaning cycle.

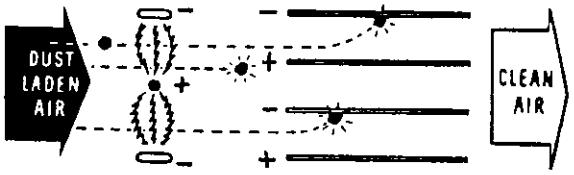

Figure 1. – Principle of Operation Electrostatic Air Filter

The IONIZERS consist of a number of fine tungsten wires supported between a number of grounded electrodes. When a high d.c. voltage (13 kV) is applied between the wires and the ground electrodes, a highly ionized zone is created in the intervening space. Dirt particles passing through this space pick up an electrostatic charge. The ionizers are integrally mounted in frames which are made in two sizes 610 mm (2 ft.) or 915 mm (3 ft.) wide, both 610 mm (2 ft.) high.

The COLLECTOR CELLS comprise an arrangement of two sets of flat metal plates, one set of which is grounded and the other supported on insulators. When a high d.c. voltage (6.5 kV) is applied between the two sets of plates, it produces a strong electrostatic field and the electrostatically charged dirt particles passing through this field are forced towards the surface of the grounded plates and are deposited. The collector cells are made in two sizes also, 610 mm (2 ft.) or 915 mm (3 ft.) wide. Two collector cells of the appropriate width fit into an ionizer frame, one above the other.

The POWER PACK furnishes the voltage applied to the ionizers and the collector cells using a 200 - 240 volt, 1 phase, 50 cycle power source. Power packs include indicating lights to warn the operator when the unit is not functioning properly. An "on-off" circuit breaker is also included to protect the internal elements and to provide a convenient means of shutting off the pack. In-built overload devices are also included.

The SPRAY ELIMINATORS are located on the air leaving side of the collector cells and serve three principal functions.

(i) They prevent water and adhesive carry-over into the clean air duct when the unit is being serviced.

(ii) They act as a back-stop to catch some dirt should the cleaner become too heavily loaded with collected dirt.

(iii) They provide added resistance to the flow of air through the cleaner and thus assist in providing a uniform face velocity over the entire area of the cleaner.

The spray eliminators are usually attached to the air leaving side of the cell bank, but when required, special fittings can be provided so that they may be installed away from the cell bank, at the edge of the foundation. The spray eliminators are made in the same two sizes as the ionizer frames.

PROTECTIVE DEVICES are included for the safety of the operator. Screw operated (time delay) switches are provided in the power pack and for the duct access doors. These switches open the 240 volt supply circuit and delay access to the high voltage parts until the charge in the capacitor has drained off.

These switches should not be tampered with even though the time consumed in turning the screw may be thought to be unnecessary. Red warning lights outside the ducts show when power is connected to the power packs. Manual safety interlock switches inside the duct permit the operator to disconnect all power packs and prevent power from being accidently turned on while he is inside the duct. Signs on the duct doors include a warning of high voltages. Duct lights are included to facilitate inspections and maintenance.

ADHESIVE serves two functions: (a) to bind the dirt to the collector plates as it is precipitated and (b) to render the deposit completely washable with water. Recommended adhesives are compounded to provide the proper balance between dirt binding qualities and washability.

Complete air cleaner units are made up by building up a cleaner bank with the required number of ionizer frames and cells to obtain the required cleaner capacity, and in the arrangement to give the desired dimensions of height and width. A typical Type PS unit is shown in Figure 2. On Type PX units, the washing and adhesive applying header mechanism is fixed to the air entering side of the bank. Units in current production are rated at three face velocities at the corresponding efficiency shown below as determined by the National Bureau of Standards (U.S.) Blackness Test, using atmospheric air (no artificial test dusts added).

1.88 m/s (370 f.p.m.) at 95% efficiency.
2.54 m/s (500 f.p.m.) at 90% efficiency.
2.84 m/s (560 f.p.m.) at 85% efficiency.

Air capacity figures at these three efficiency ratings for the standard range of available sizes are given in Table A in the Appendix. This table also gives the overall dimensions of the unit, the arrangement of the ionizer frames, the number of power packs, the division of the power pack load by columns of frames and the approximate net weight (less Type PX header equipment).

Figure 2 – A Typical Type PS Installation (Type PX Units have a Washing Head)

SYSTEM DESIGN CONSIDERATIONS

Successful installation and operation of an air cleaner requires consideration of the following points both when the system is being designed and also during installation.

1. **Space Requirements** – At least 1 metre (36") clear space is required at the inlet and outlet sides of the frame bank for necessary inspection and maintenance.

2. **Air Handling Requirements** – An electronic air filter is sized to clean a specified quantity of air with an effective efficiency of 85%, 90% or 95%. Overall cleaning efficiency depends a great deal on uniform air flow throughout the whole unit and distribution of air over the face of the filter should be as uniform as is possible to obtain. Connections between the cleaner housing and the duct should taper as gradually as space will allow and the effective slope should not be more than 1:3 as shown in Figure 3. The cleaner should be installed as far away from bends in the duct as possible as shown in Figure 4. The section of duct housing the cleaner should be as square as possible, especially if it is close to a fan. Spray eliminators supplied, help to equalise the air flow. However, they may not be sufficient to overcome stratification, eddying, turbulence or other deficiencies in the duct system. If these conditions exist when the fan is operating, it may be necessary to install baffles or turning vanes ahead or behind the unit as a corrective measure. Total air quantity through the unit should not exceed the rated air capacity. Air velocity through any part of the frame bank should not exceed the rated velocity by more than ten percent.

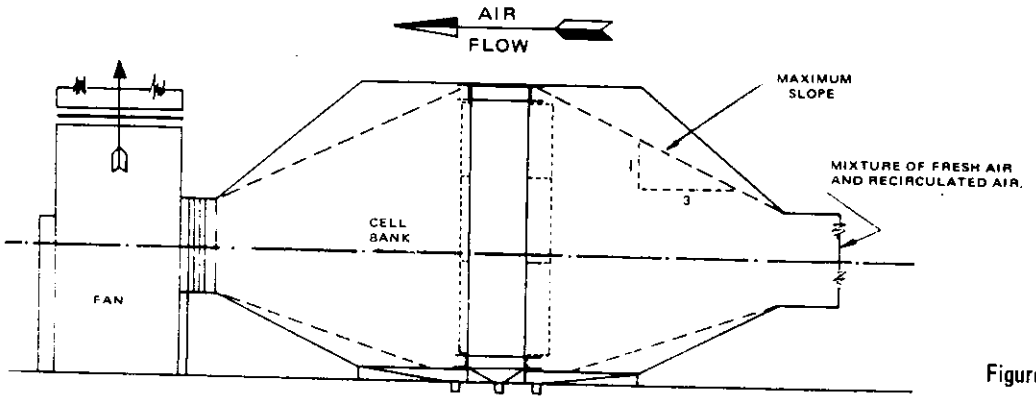

Figure 3.

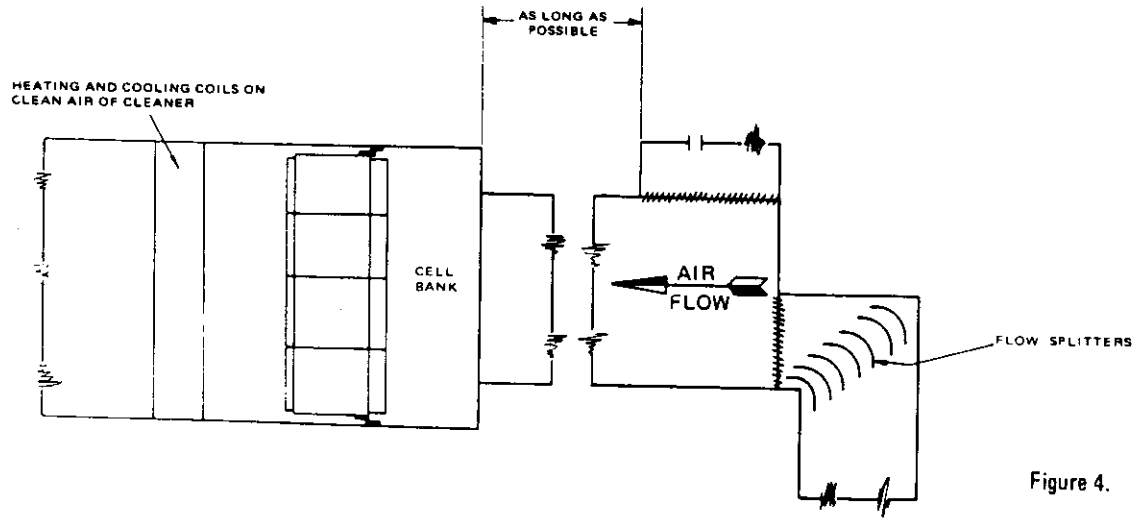

Figure 4.

3. **Heating & Cooling Coils** – Heating and cooling coils should be placed on the clean air side of the cleaner so that dirt build-up on these items will be virtually prevented and heat transfer efficiency maintained. See Figure 4. If the coils are of restricting dimensions they should not be placed so close to the unit as to restrict the air flow through any part of it.

4. **Outside Air Intakes** – These should be sized generously to minimize the amount of dirt that might be sucked in by high air velocities. Air intakes should be located so that they will not bring in high concentrations of heavy dirt, corrosive fumes or electrically conductive particles, and should be properly oriented with respect to prevailing winds. Most important, all outside air intakes should be equipped with vertical weather louvres or dampers to prevent entrance of rain or snow, plus cleanable screens of 6 mm (¼") mesh to keep out leaves, insects, etc.

   It is also recommended that the distance between the unit and the fresh air intake be at least equal to the height of the cleaner. This is to allow rain, snow and large particles which may get through the louvres or screen to settle to the floor instead of being drawn into the unit.

5. **Precautions Against Lint** – When recirculated air is brought into the cleaner, presence of excessive quantities of lint may necessitate some sort of lint screen across the duct opening to prevent this lint from getting into the unit. Lint tends to collect on ionizer wires and wire holders and will generally interfere with the proper functioning of the air cleaner.

6. **Return Air Duct** – The return air duct opening should be located at least 1 metre (36") from the face to the cleaner.

7. **Air Washers** – An air washer, located upstream from the cleaner, must never be operated so that the water droplets or "free moisture" enter the cell bank.

8. **Duct Construction** – Duct work and plenum chambers must be of tight construction to prevent air leaks; particularly leakage of uncleaned air into the cleaned air stream. Access doors should be gasketed and provided with a positive means of clamping shut. Time delay switches supplied are not suitable for this. Adequate clearance must be provided to permit sealing off between the duct sides and the cell bank. See Figure 5.

9. **Foundations** – A foundation made of concrete is recommended because it will not settle or distort and will remain waterproof. Foundation must be level. If a metal base is used, it should be rigid enough to prevent distortion of the unit, and provided with slotted wooden walkways to assure firm footing for maintenance personnel. See Figs. 6 and 7.

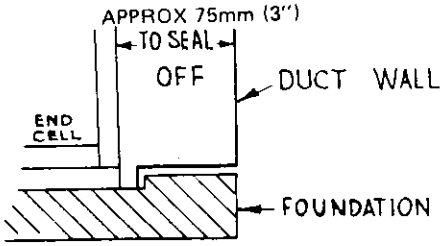

Figure 5. – Fitting of Duct Wall to Base to Prevent Spillout of Water.

10. **Drains** – These are required on the inlet and outlet air sides and in the centre of the unit. See Figs. 6 and 7. They should be equipped with covers, water seals or traps if they are tied together, to avoid leakage of dirty air into the clean air duct. Water seals or traps should hold enough water to prevent evaporation during the periods between cleanings.

11. **Water Supply** – A water supply capable of delivering water with a minimum pressure of 275 kPa (40 p.s.i.) running pressure is required to wash the unit.

    On Type PS units, water of at least 66° C (150° F) to 82° C (180° F) is necessary if a hot water wash adhesive is used. The water line should be provided with a hand valve and with

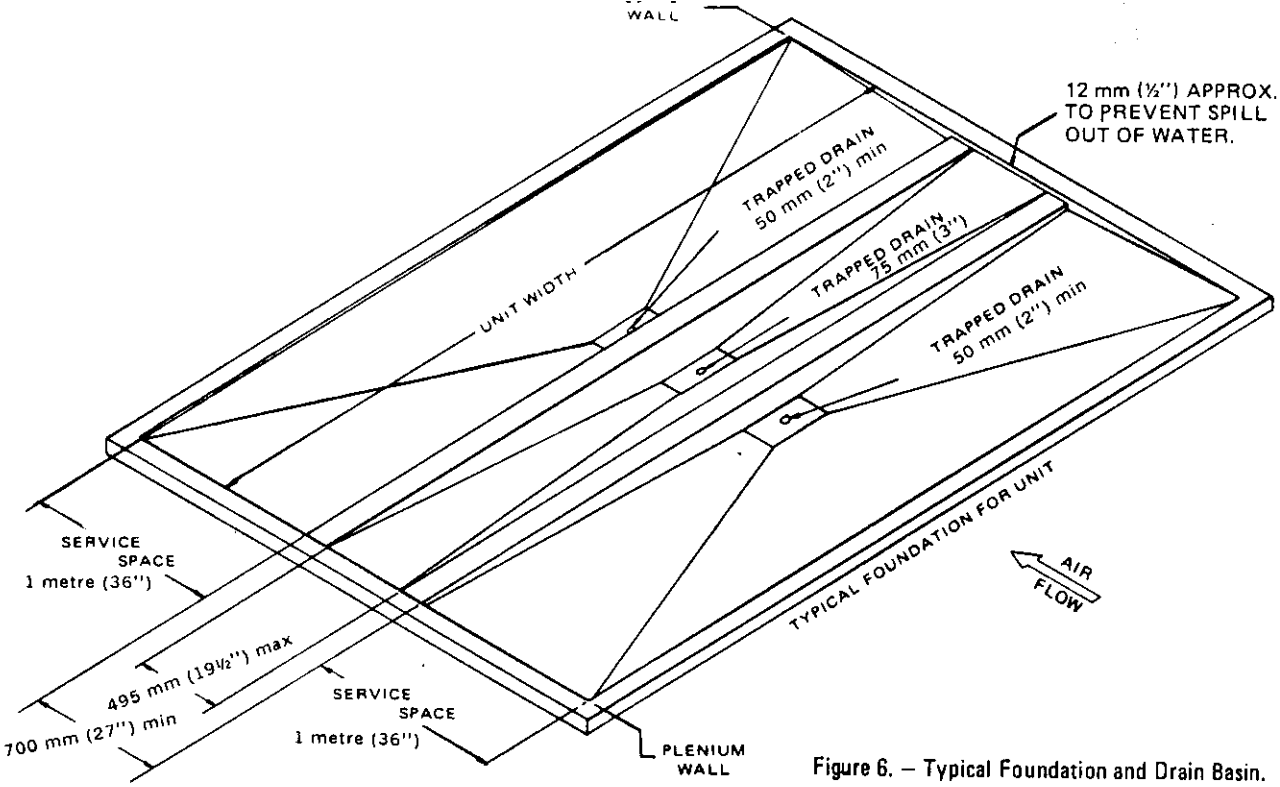

Figure 6. – Typical Foundation and Drain Basin.

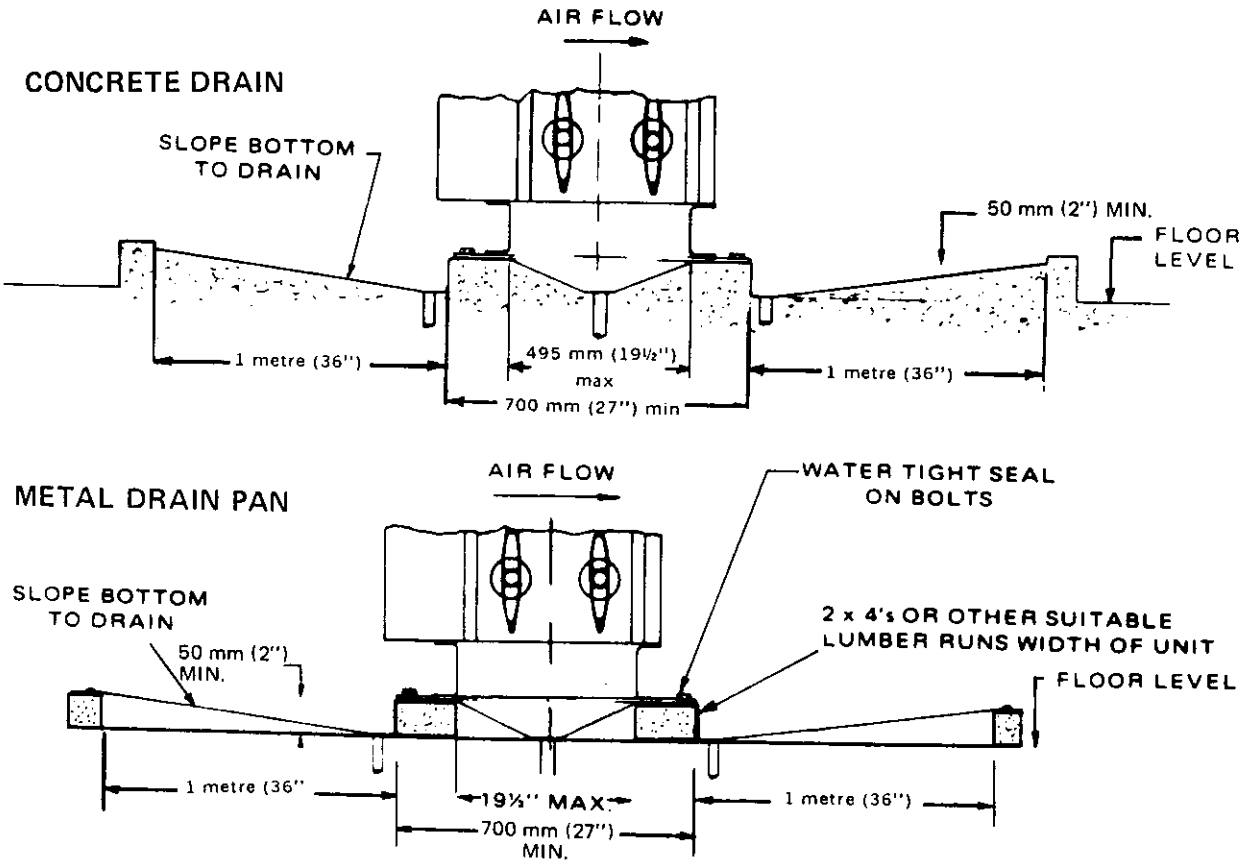

Figure 7. – Suggested Foundation and Drain Cross Section.

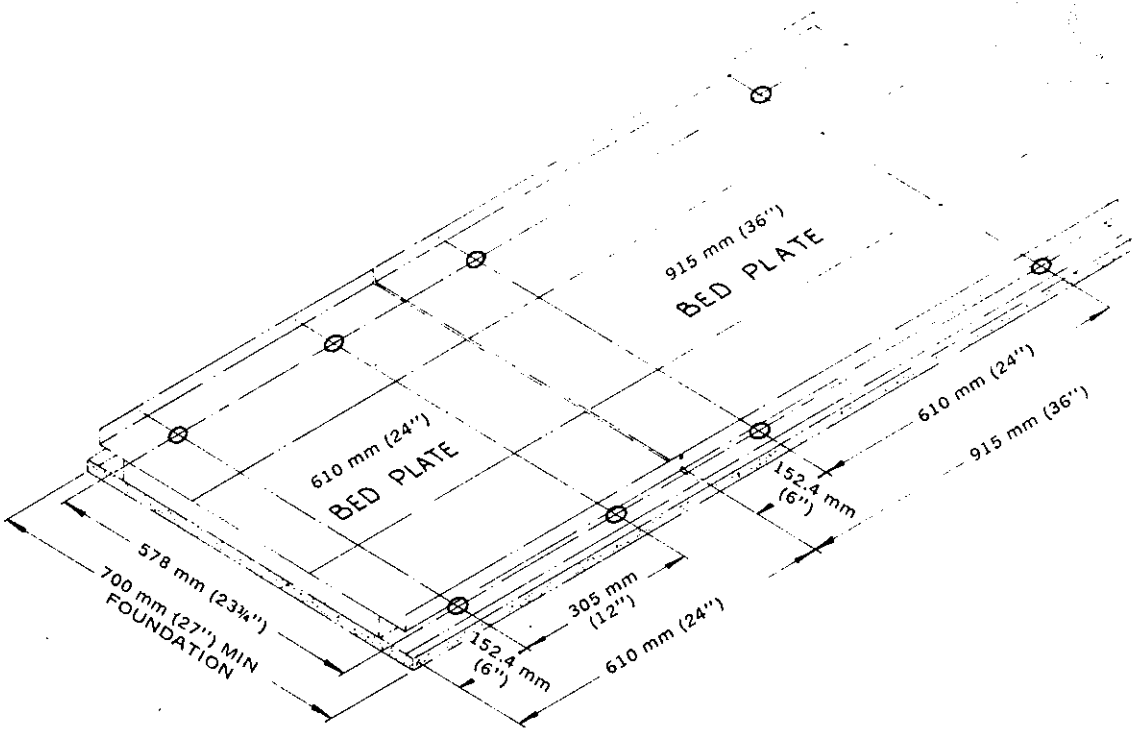

Figure 8. – Bedplate Mounting Hole Details.

a fitting for hose connections. It is advantageous to locate the outlet inside the duct and utilise the drains in the cleaner foundation. If the outlet is located outside the duct a separate drain must be provided. The hose used with Type PS units should be long enough to reach all parts on both sides of the frame bank and fitted with adjustable stream nozzle supplied.

On Type PX units, where the water line will be permanently connected to the washing header through a Solenoid Valve, the line should be terminated with a hand valve close to the unit, outside the duct and between the two access doors. From this point it will be run through the Solenoid valve to a point inside the duct at the top centre of the air entering side of the unit.

12. **Power Supply** – The power supply required is single phase 50 cycle, 200 to 240 Volts with regulation of ± 5 Volts maximum.
When necessary a constant voltage transformer may be obtained from Email Ltd. to maintain the desired regulation.

RECEIVING AND HANDLING

Email Limited supplies the necessary basic parts to erect the complete air filter assembly. This includes frames (with inbuilt ionizers), cells, power pack(s), spray eliminators, bed plates, top plates, special hardware, high voltage cable, special electrical fittings and initial supply of adhesive. For PS a manual or electrical applicator is provided. For the PX units all items required for the automatic washing equipment are supplied. (Refer to instruction book 1.B. 1415 for details) A complete list of equipment supplied is given on the material list included in the instruction package.

The installing contractor or customer supplies regular construction items which are not included in the material list, such as duct work, foundations, mounting bolts, conduit, line voltage wiring, wiring fittings and plumbing.

In addition to the material list, also included in the instruction package are relevant instruction books (except those for the power pack(s) which is included inside the pack itself) and two nameplates.

Contents of this package should be carefully preserved because it is required for receiving installations and operation of the unit.

To facilitate handling and erection, the parts of the complete air filter are packed in individual containers, each marked as to the contents. The complete material list (included with instruction package) may be checked with the shipping notice forwarded with every shipment. A packing list is also included in the package containing the accessories.

Upon receipt of shipment, any evidence of damage or loss should be reported immediately to the last carrier for inspection by an agent of the transportation company. A claim should be filed by the customer against the carrier to cover any shipping damage or loss. A claim for short supply may not be considered by Email Ltd., if lodged after a period of 14 days from date of delivery.

The equipment, although ruggedly constructed, must be handled carefully to prevent breaking rectifiers, cracking insulators, distorting components, breaking ionizer wires or losing any parts. Rough or careless handling may necessitate costly repairs or replacements.

Except for the initial inspection, store the parts until needed in the original shipping containers in a clean, dry location protected from the weather.

NOTE: the following parts will not be required until the unit is commissioned and should be stored in a safe place:

Spool of ioniser wire (in accessory package), adhesive applicator (Type PS units) adhesive tank and strainer, adhesive.

For actual erection, the parts will be used in the following order:—

1. **Instruction Package.** This contains relevant receiving, installation and maintenance instruction books, (except those for the power packs which are included inside the pack itself), and two nameplates.
   The books are to be passed to customer after the installation of the unit.
2. **Bedplate(s)**
3. **Spray Eliminator Holding Bracket**
4. **Frames With Inbuilt Ionizers.** (A bag is tied to each frame and contains rivets for fastening frames together and for fastening frames to both bedplates and topplates. It also contains an ionizer connector, which must be kept until the wiring of the unit.)
5. **Topplate(s).** (A bag is tied to each topplate and contains crossover cables and terminals, which must be kept until the wiring of the unit.)
6. **Cells**
7. **Power Pack(s)**
8. **Contactor** (on units with more than 4 Power Packs).
9. **High Voltage Cable**

10. **Accessory Package.** This contains the following:–

2 only Screw operated duct door interlock switches with time delay.
2 only Manual Safety interlock switches.
2 only Duct lights.
2 only Duct light switches with pilot lights.
1 only Spool ionizer wire
1 only Checking list.

11. **Spray Eliminators**

12. **Moving Nozzle Washer and Ahdesive Applicator.** (Type PX units only, refer instruction book IB1415).

13. **Water Nozzle** (Type PS units only).

14. **Manual or Electric Adhesive Applicator** (Type PS units only).

15. **Adhesive Tank and Strainer.** (Type PS larger units only).

16. **Adhesive.**

ERECTION

The frame bank is easily assembled to the required size, by stacking the parts as indicated in the typical illustrations.

Be sure to install frames and topplates in accordance with air flow direction arrows painted on these parts.

HARDWARE supplied for assembly is contained in bags attached to the component parts. This hardware should be carefully sorted and saved until needed.

It is preferable to use the bedplates as templates when laying out the foundation. Be sure that adjacent bedplates butt closely together. Refer to the material list for the correct number and size of bedplates supplied with the particular unit. Alternatively, layouts can be made up and the mounting holes plotted. See Figure 8. 10 mm (3/8") diameter anchor bolts or studs (not supplied with the unit) are required for bolting and bedplates to the foundation.

The bedplates provide the proper drainage of wash water and prevent by-passing of air under the unit. All bedplates are drilled to take 10 mm (3/8") foundation bolts.

Bolt all bedplates to the foundation making sure that they butt together and are in line and level in both directions. Shim if necessary. Grout any openings under the **inlet** side of the bedplates to prevent leakage of air under the unit.

IMPORTANT – If the particular cleaner is a Type PX unit fitted with a washing header, check the material list for the lengths of header, support track and steadying rails supplied and then lay out the bedplates to suit these lengths. For instance, a 16 ft. wide unit will consist of two columns of 2 ft. wide frames and four columns of 3 ft. wide frames and the automatic washer will be supplied with one 6 ft. and one 10 ft. track together with one 6 ft. and 10 ft. guide rail. The bedplates in this case must be laid out to provide two columns of 3 ft. frames at one end of the filter bank, so that when tracks and rails are fitted, the joining bracket will be at the junction of two filter frames.

The frames with inbuilt ionizers are riveted to bedplates of the corresponding size. In handling be careful not to break the ionizer wires.

Start with one end, and set frames on all bedplates the full length of the bottom row. Rivet the frames together horizontally and to the bedplate using the rivets supplied with each frame, (furnished in a bag with eacn frame).

Note:– For PX units of 4 or more frames high, the bottom steadying rail, the frame and the bedplate must be rivetted together on the entry side of the filter (see Instruction Book 1415).

Next rivet the spray eliminator holding brackets and frames to the bedplates (see fig. 17A).

Check this row for levelness and plumbness and shim if necessary. Continue in this manner until all rows of frames are installed, being sure each row is plumb and level.

The topplates are also supplied in 610 mm (24") and 915 mm (36") lengths and are installed as shown in Figure 9 and rivetted to the frame with hardware supplied. Note for PX units of 4 or more frames high and top steading rail must be rivetted to the topplate and frame on the air entry side (see Instruction Book 1415). On the air outlet side the spray eliminator holding brackets, topplate and frame are rivetted together (see fig. 16).

Be careful not to lose the remaining wire, terminals and hardware packed in the bag. These will be used later for the high voltage wiring.

For proper performance, all air to be cleaned must pass through the air filter frame bank. This means that all spaces around or above the assembly must be sealed.

Air is prevented from by-passing under the frame bank by air baffles built into the bedplates. Topplates have a turned up edge on both inlet and outlet air sides for attaching seal-off or sealing strips between the top of the unit and the duct or plenum ceiling. Drill the turned up edge only, and attach the seal-off strip with sheet metal screws.

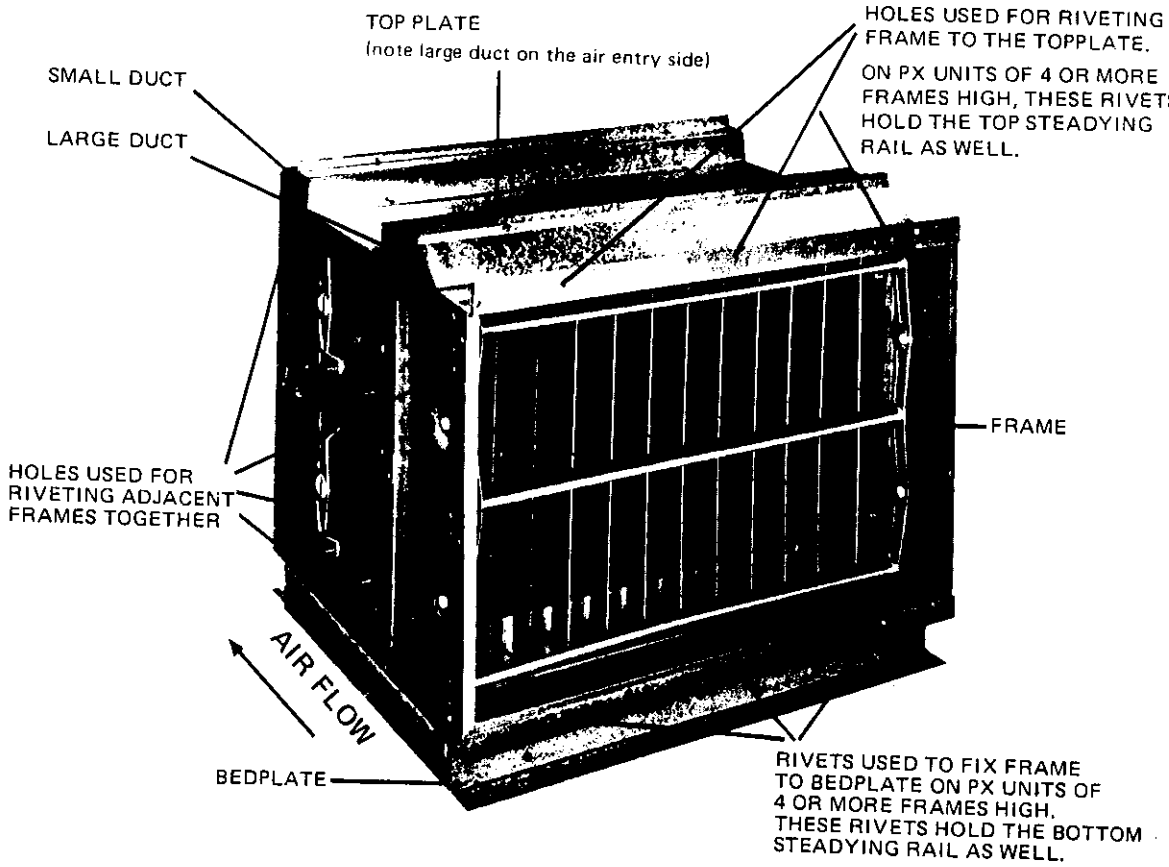

Figure 9 – Single Frame Fitted with Bedplate and Topplate.

CELLS

The cells must be unpacked by the method shown on the carton and should be handled by the end frames to prevent damage to plates.

Remove and Discard the Shipping Braces and Nuts from the Ends of the Cells.
They are pieces of black mild steel, and will cause a short circuit if not removed. See fig. 10.

Retain the cell connectors, secured by the shipping braces, for high voltage connections later.

Carefully inspect all cells to be sure plates are evenly spaced and undamaged.

Place cells in frames with connector lugs on AIR LEAVING side of frames. Push cells into frame until they make contact with Ionizer ground frame, be careful to align cells vertically so that the plate of the upper cell is in line with the corresponding cell below it.

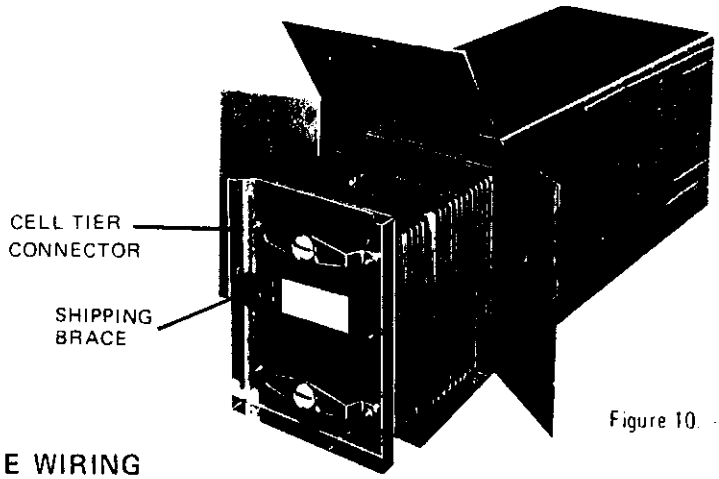

Figure 10. - Collector Cell

LINE VOLTAGE WIRING

Typical line voltage wiring diagram is shown in Figure 12. The 240 volt supply to the power packs should be wired in accordance with SAA wiring code, local service rules and Fire Underwriters requirements.

The power packs should be mounted outside the duct, either on the braced to withstand the weight, on an adjacent building wall, or on a suitable mounting stand. Four 10 mm (3/8") mounting bolts (not supplied with unit) are required for each power pack. Power packs should be grouped together for inspection purposes and clearance should be allowed for opening the front door. Also allow 305 mm (12") space vertically and 150 mm (6") space horizontally between power packs if mounted adjacent to each other for service access. Refer to the instruction leaflet, packed inside the power pack for further details.

NOTE: Locate power packs close to the frame bank. Additional high voltage cable is required if the cable length between the power packs and the nearest top plates exceeds 5 m (15 feet). See "High Voltage Wiring".

A magnetic contactor is supplied only when more than four power packs are furnished. It should be mounted outside the duct adjacent to the power packs as shown in Figure 12.

The red power pack pilot lights (supplied with accessories) should be installed above the two duct access doors. (See Figure 12). These lights glow when power is connected to the power packs.

The screw operated door interlock switches (supplied with accessories, See Figure 13) are provided for installation on the duct doors as a positive means of de-energising the cleaner before the plenum may be entered (See Figure 12).

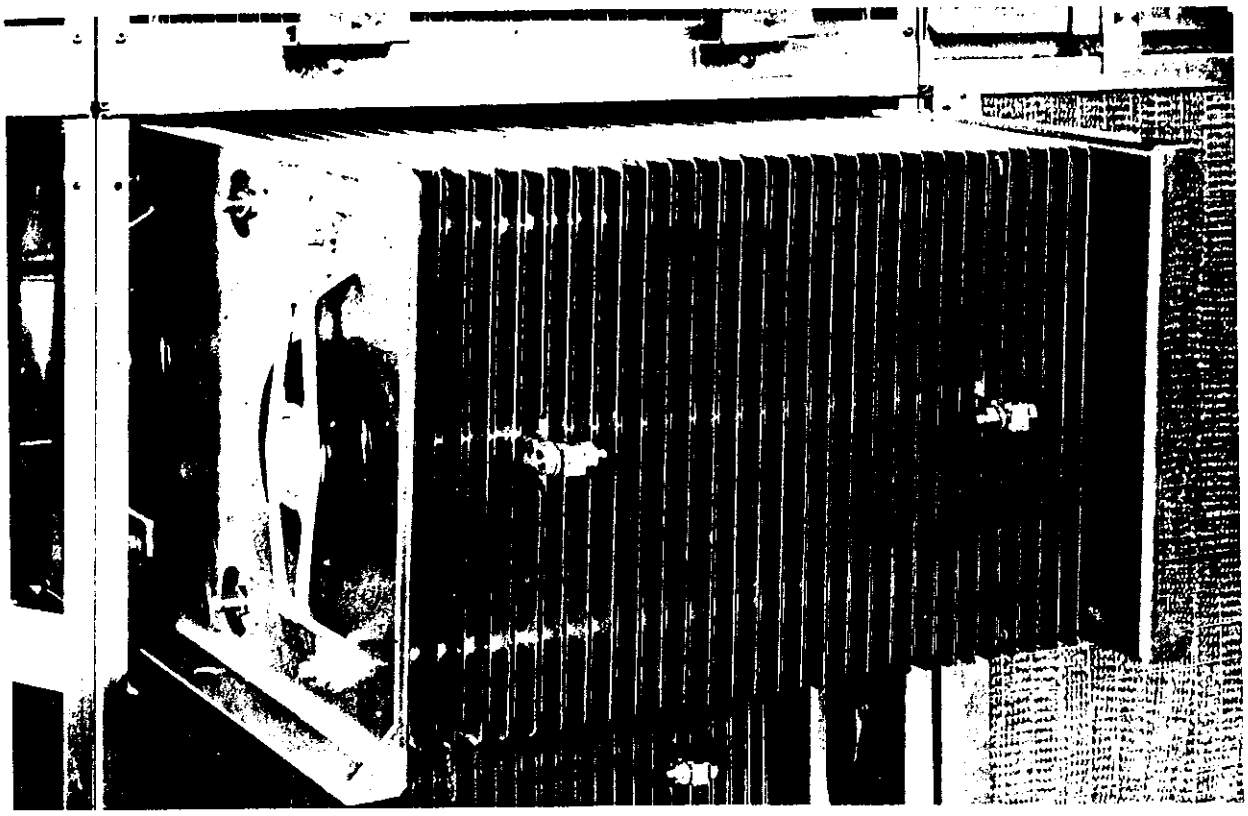

Figure 11. – Inserting Cells in Frames.

NOTE: Any other access doors to the cleaner plenum must be positively locked (or equipped with additional screw operated interlock switches) to prevent unauthorised entry to the high voltage parts.

The manual safety interlock switches (also supplied with accessories) are to be installed inside the duct adjacent to the two duct doors as shown in Figure 12. These permit the operator to disconnect the 240 volt supply and prevent power from being accidently turned on while he is inside the plenum.

The duct lights (supplied with accessories) should be installed at the ceiling on each side of the frame bank to facilitate inspection and servicing (See Figure 12).

The duct light switch and pilot (supplied with accessories) should be installed as shown in Figure 12 to control the duct lights and indicate when they are switched on.

HIGH VOLTAGE WIRING

Cable raceways are provided for the high voltage connection to the cells and ionizer section of the electronic air cleaner. These are situated on the topplates.

NOTE: Do not run 240 Volt wiring in these raceways.

High voltage cable is supplied with the unit. Remove all cable raceway covers from topplates, ready for the installation of H.V. wiring.

Two lengths of H.V. cable are required from each power pack (one for each of ionizer and cell supply). These cables should be installed in conduit between the power packs and cable raceways. The raceway on the air entering side of the unit is for ionizer cables 13KV and the raceways at the rear of the unit are for cell cables 6.5 KV.

The extreme ends of the cable raceway should be covered tightly either by the plenum walls or by sheet metal plates fabricated on the job.

Terminate conduits from the power packs at the plenum wall on fabricated plates or pull boxes, using conduit bushings.

High voltage connections to the cells and ionizers enter only at the top of each column of frames. All cells and ionizers within columns are inter-connected vertically with tier connectors.

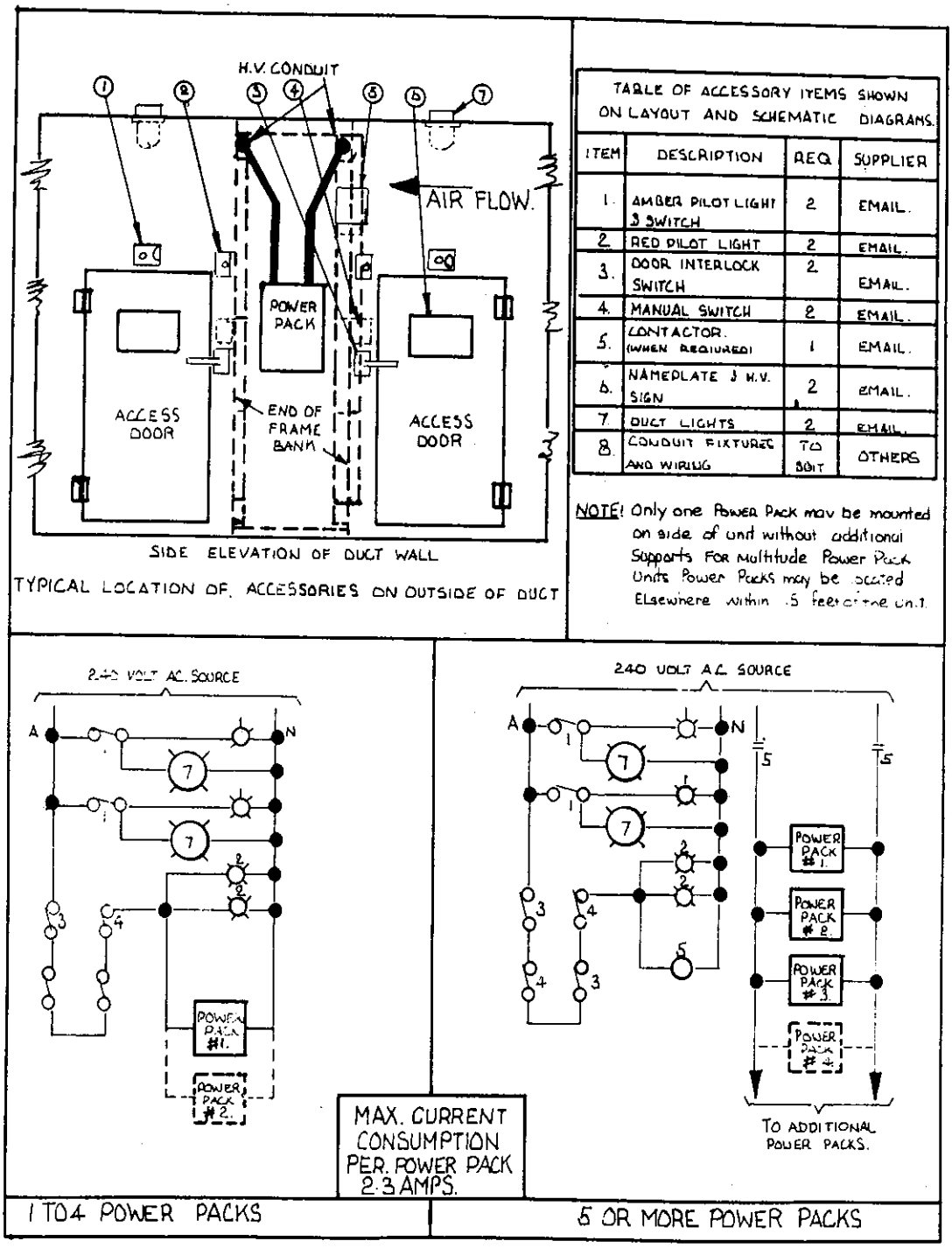

Figure 12. – Low Voltage Schematic Wiring Diagram.

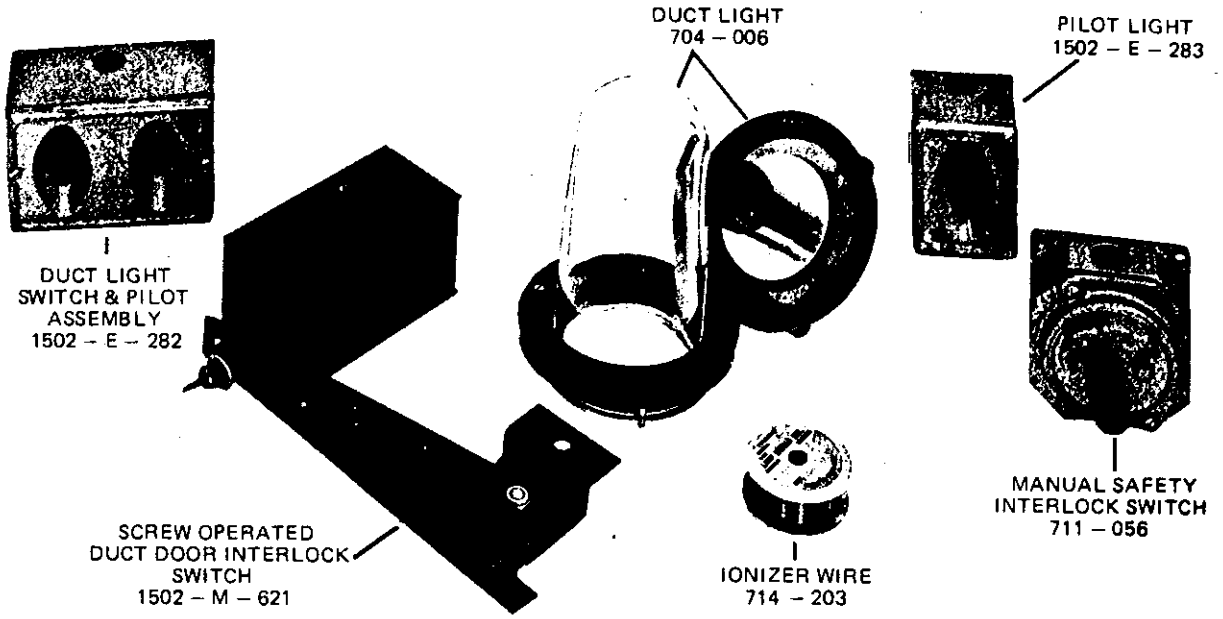

Figure 13. – Items in Accessory Packages.

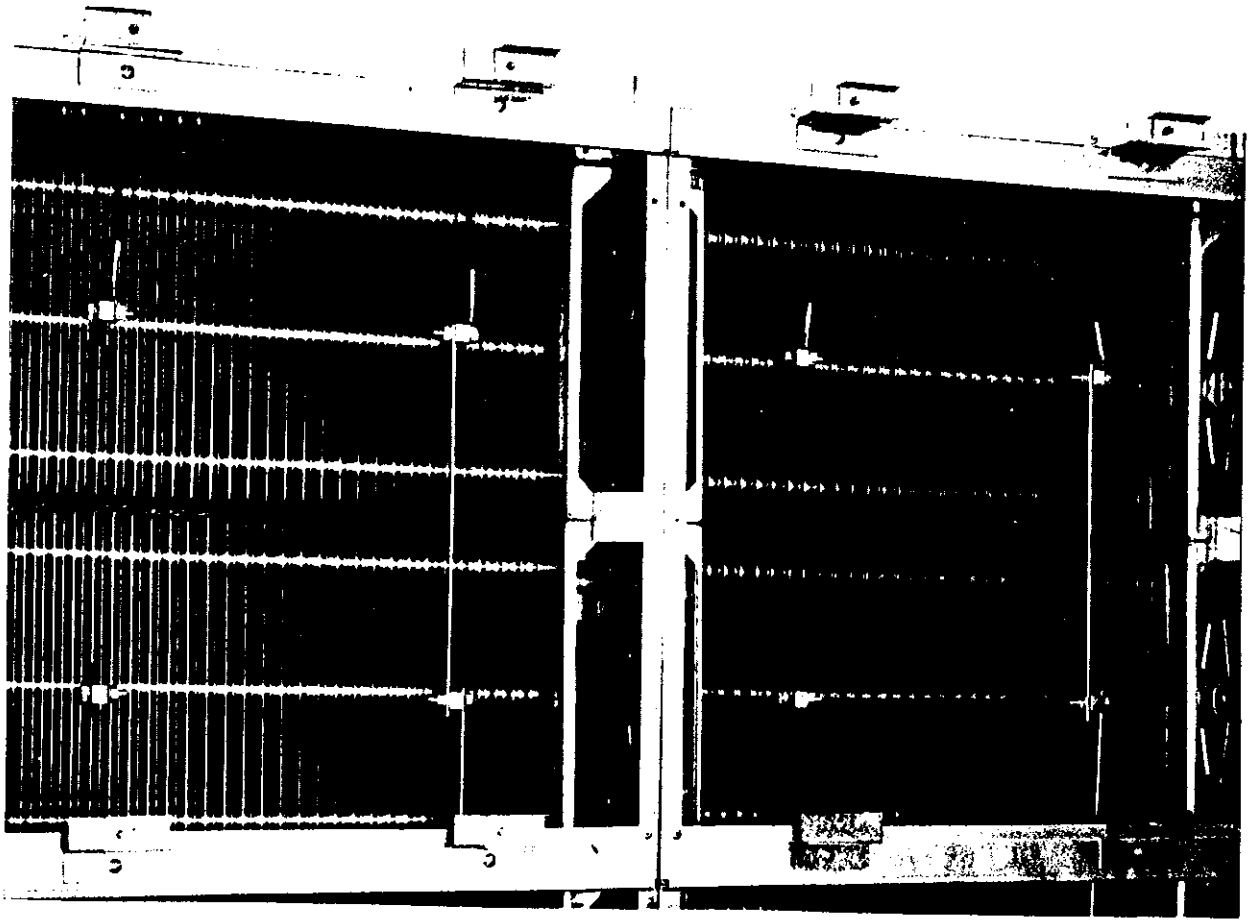

Figure 14. – Installation of Cell Tier Connectors and Jumper Between Tiers of Cells.

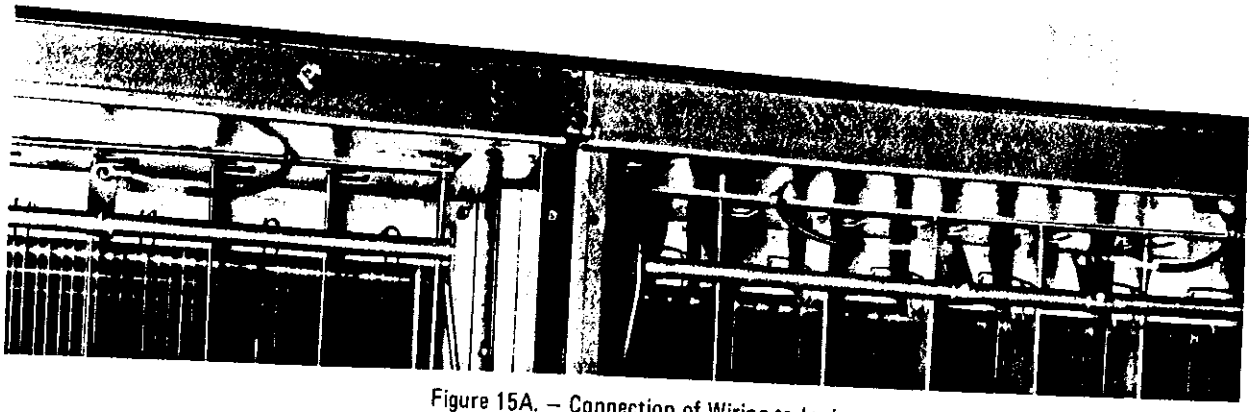

Figure 15A. – Connection of Wiring to Ionizers.

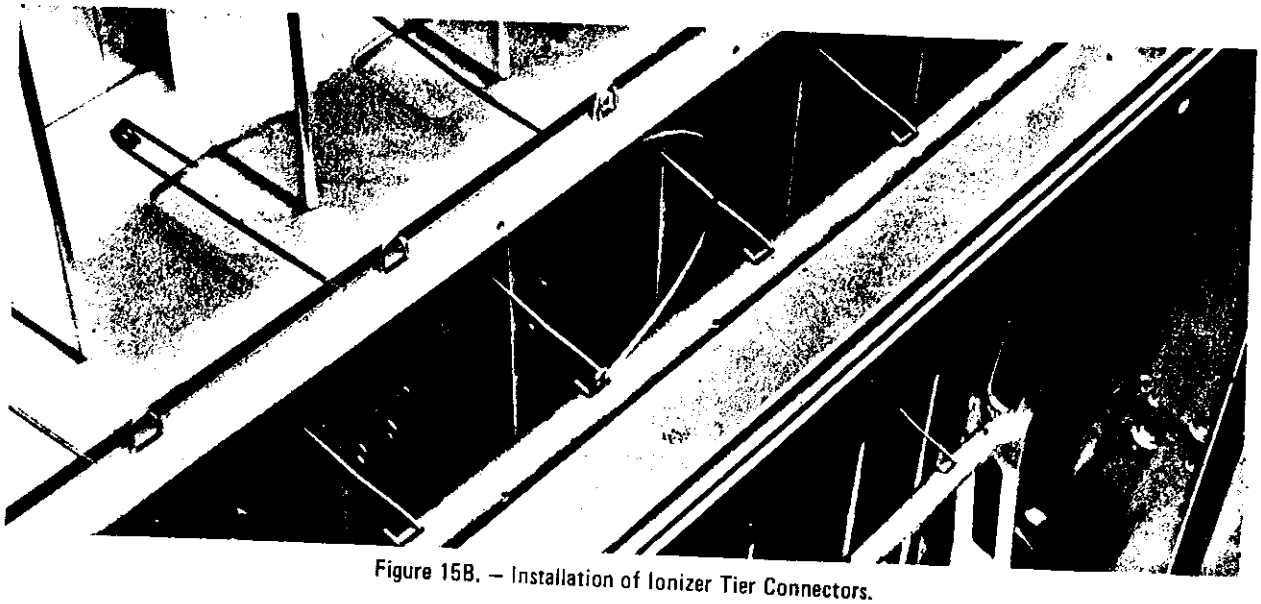

Figure 15B. – Installation of Ionizer Tier Connectors.

METHOD OF PREPARING AND INSTALLING HIGH VOLTAGE CABLE

Cable for the high voltage connections for these electronic air filter must be properly prepared and installed for trouble-free operation.

Cable is supplied in suitable lengths for most installations as a standard item. In the event of longer than normal runs, special negotiations should be carried out to obtain sufficient high tension cable to make high tension connections without joints. UNDER NO CIRCUMSTANCES MUST THERE BE ANY JOINT IN HIGH TENSION CABLE BETWEEN THE POWER PACK AND THE POINT OF CONNECTION TO THE CELLS OR IONIZERS.

When baring the ends of the cable, either to solder spade terminals which are used for connections between cell banks on a common power pack or for the bare end termination of the cable at the incoming connections to either cell or ionizer, the cable must be prepared as follows:–

(1) Strip the insulation from the wire for a length of approximately 25 mm (1") making certain that the paring knife does not cut any of the copper conductors.

(2) Carefully par back the P.V.C. sheathing covering the inner Polythene insulation for a length of 75 mm (3") from the exposed conductors. Once again be careful that the paring knife does not cut into the outer end of the P.V.C. sheathing and tearing it back and cutting it approximately square round the cable with a pair of scissors. Do not scarf with a paring knife because of the danger of cutting into the Polythene insulation.

The high tension cable from the point of leaving the cable raceway to the point of connection to cell or ionizer must be stretched reasonably tight and the cable kept at least 25 mm (1") clear of grounded metal excepting where it enters the clearance hole in the cable trough. The exposed section of this cable must be wiped clean with a dry, clean cloth before energising the power pack for the first time.

Figure 15A shows the correct method of attaching and placing this cable at the ionizer. The aluminium connecting lug must be assembled so that it points vertically UP NOT DOWN. Figure 14 clearly shows the connection to the cells.

Ionizer tier connectors are furnished, in bags supplied with the frames and are installed as shown in Figure 15B. One connector is required vertically between each frame. It must not be installed further from the end than the third hole.

Cell tier connectors are furnished on the cell, see Figure 10 (held in place by the shipping braces) and are to be installed as shown in Figure 14. One connector is required vertically between each cell, the number connected together being determined from Table A in the Appendix.

Connections between adjacent Vertical tiers of both ionizers and cells are made when jumper leads which are run from one tier to the other through the appropriate cable raceway. An ionizer inter tier connector (cross over cable) is shown on Figure 16B whilst that for cells is on Figure 16A.

When two or more power packs are furnished, columns are combined to proportion the load as shown in Table A (See Appendix). It is important to make connections as specified in this table to prevent overloading individual power packs.

NOTE: On some models it is necessary to connect frames, of an adjacent column to achieve proper loading of the power pack. On these units two suitable positioned holes must be drilled (one for the cells and another for the ionizer) on site and suitably bushed to protect the high voltage conductor. Refer to figure 16 for Cross over connection through top raceway and figure 17 for Cross over connection at intermediate and base levels.

Under no circumstances can the cell and ionizer be connected together.

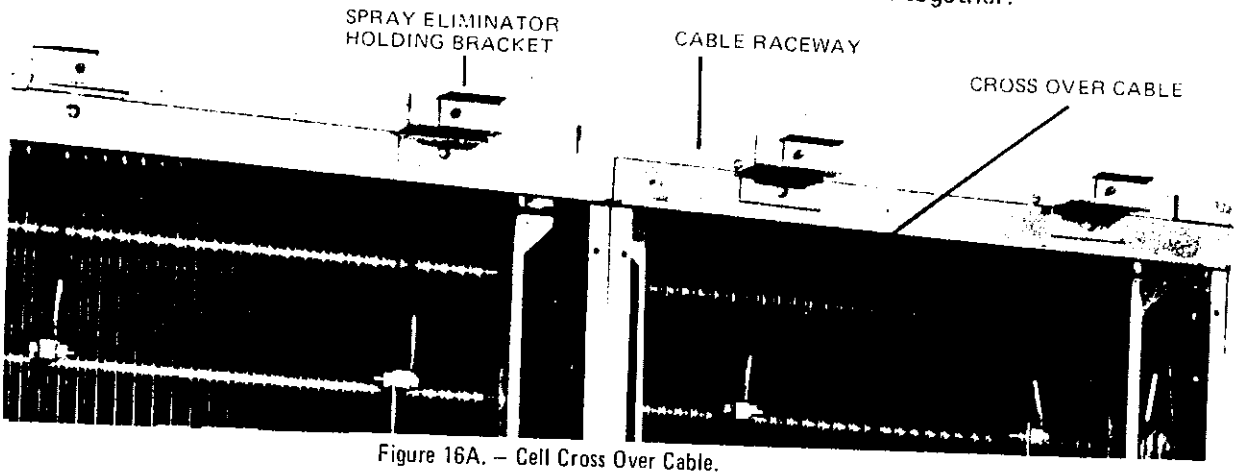

Figure 16A. – Cell Cross Over Cable.

Figure 16B. – Ionizer Cross Over Cable.

Figure 17A. – Cell Cross Over Cable at Base Level.

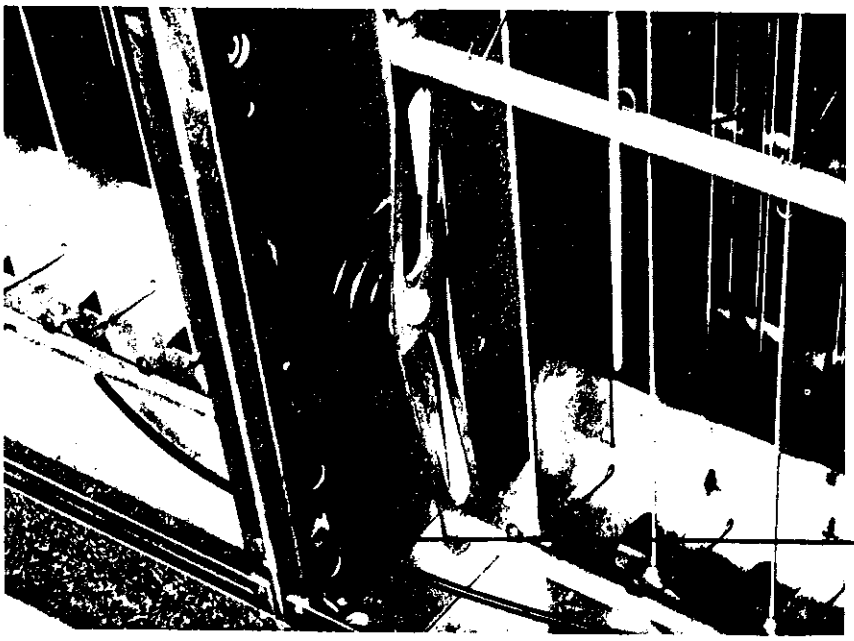

Figure 17B. – Ionizer Cross Over Cable at Base Level.

GROUNDING THE EQUIPMENT

High voltages are supplied from the power packs to the cells and ionizers with single conductor cables. A common ground return is required for these circuits as shown in Figure 18. Also, this grounding is necessary for safety purposes because of the high voltage involved.

Connect the duct, power pack cases and frame structure to a common low resistance ground, using 7/.036 earthing conductor.

If ground is a water line, it may be necessary to install a jumper wire around the water meter, since some meters are insulated electrically.

After the line and high voltage wiring is completed the following inspections should be carried out.

CHECKING THE INSTALLATION

ELECTRICAL INSPECTION

All cell plates should be evenly spaced and undamaged. If any cell plates are bent during erection they should be carefully straightened.

All ionizer wires should be under correct tension and midway between the ground electrodes. Replace broken wires using the spare spool or wire supplied with the accessories, making the new wire exactly the same length as the existing wire to ensure correct tension.

Length of each ionizer wire is 543 mm (21⅜").

All wiring should be installed in accordance with the wiring diagrams and connections should be tight, utilising fittings and terminal lugs supplied.

MECHANICAL INSPECTION

1. Check the plenum and ducts, for air leakage or by-passing of dirty air around the frame bank.

   Check the air distribution through the unit, and make sure the rated capacity of the cleaner is not exceeded. (See Air Handling Requirements, on Table A in appendix).

3. Nameplates and operation chart should be installed conspicuously.

4. Wash the frame bank thoroughly to remove dust and dirt which may have accumulated during installation. (See Instruction Book 1.B.1411 for model PS units and Instruction Book 1.B.1415 of model PX units.

COMMISSIONING

Once the installation has been completed and checked contact should be made with Email Ltd, Electrical Engineering Division to arrange for a Service Engineer to carry out the commissioning service.

Telephone numbers are shown on the front cover.

MAINTENANCE

Regular maintenance is the key to good performance and efficient operation of an electronic air filter. This includes (a) periodic inspections, (b) prompt correction of any faults and (c) regular washing and adhesive procedures.

Information on periodic inspections and correction of faults is given in this instruction book. For routine cleaning however, please refer to the following instruction books.

Instruction Book 1411 — Type PS Units
Instruction Book 1415 — Type PX Units

Routine Inspection — A simple daily inspection of the power pack is recommended to insure that the normal operation light is glowing. A weekly inspection of all Ionizer wires, checking that no wires have broken.

Any faults that may develop must be promptly corrected. Refer to the fault finding chart on page 24.

Occasionally an ionizer wire may break due to careless handling or prolonged use. Replace with tungsten wire (spare spool supplied in accessory package) cut a pice of tungsten wire 543 mm (21.3/8") long and fit to the spring clips on the H.V. frame so that the wire is under light tension. The wire must be terminated within the coils of the spring clip to eliminate "Corona" discharge from the ends of the tungsten wire. The ionizer should be adjusted in the centre of the ground plates and 25 mm (1") from the ends of the clips to the ground frame.

Be careful not to kink the wire because it will be weakened at this point. When replacing wires be sure to remove all broken pieces and discard outside the duct. Loose pieces of wire can cause short circuits and are very hard to locate.

CAUTION: The following test procedure involves handling parts which are normally charged with high voltage. Always turn "OFF" the power packs and allow at least ½ minute before touching the high voltage parts. This time delay is to permit the residual charge in the capacitor and cells to drain to a safe value through discharge resistor, in the power pack. It is also good practice to ground the part with a grounded prod equipped with a suitable insulated handle.

If high voltage short circuit cannot be located by inspection disconnect the cell and ionizer cables at the power pack terminals (see caution above). Close the power pack door and turn on the circuit breaker. Continued glowing of the short circuit light indicates that the trouble is in the power pack. Consult the power pack instruction book for detailed corrective procedure. If the short circuit light does not light after disconnecting these cables, the trouble is either in the cells, ionizers or high voltage cables. This can be localised by alternately connecting one cable to the power pack and then disconnecting cell or ionizer jumper cables and tier connector until the faulty part is located. The individual cell or ionizer high voltage section may be removed if necessary for close examination and correction of the fault.

APPENDIX

POWER PACK DISTRIBUTION (TABLE – A)

These tables should be used in conjunction with the section 'High Voltage Wiring'.

How to use the tables:

(i) Locate from the appropriate column the model number required.

(ii) Check to see that the information given as to number of frames high; number of 2' wide columns; number of 3' wide columns and number of Power Packs is correct.

(iii) Read off under "Power Pack Distribution" the size and number of frames which are energised by each Power Pack:–

For example:
A PSA 7024 with 7 frames high, two 2' wide columns and four 3' wide columns has four power packs.

Under power pack load distribution.

The first power pack energises 14 – 2' frames
The second power pack energises 9 – 3' frames
The third power pack energises 9 – 3' frames
The fourth power pack energises 10 – 3' frames
(See Figure 18)

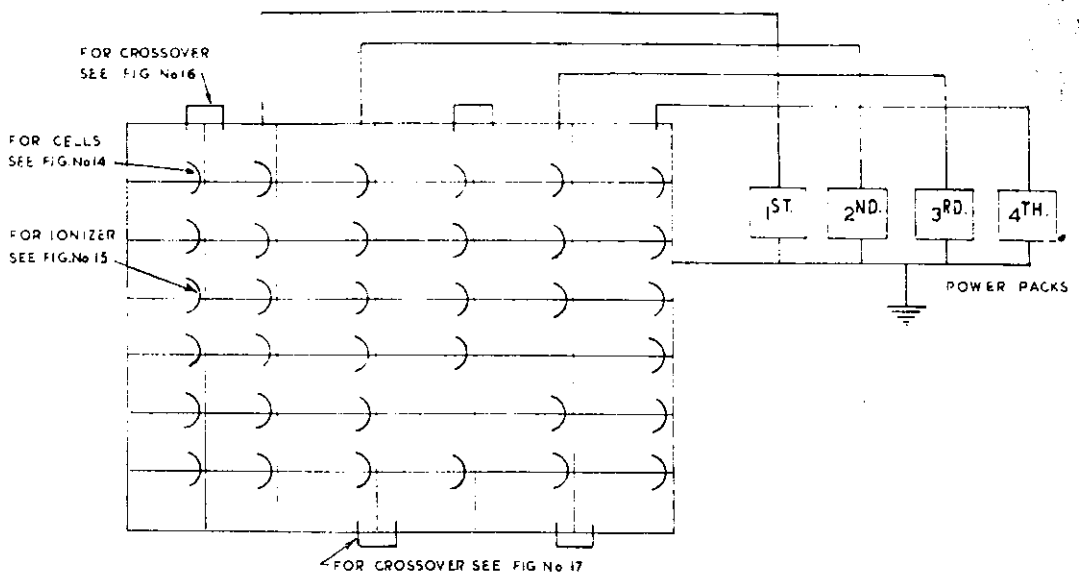

Figure 18. – High Voltage Wiring Layout of Frame Arrangement for P.S.G./P.S.A. 7024

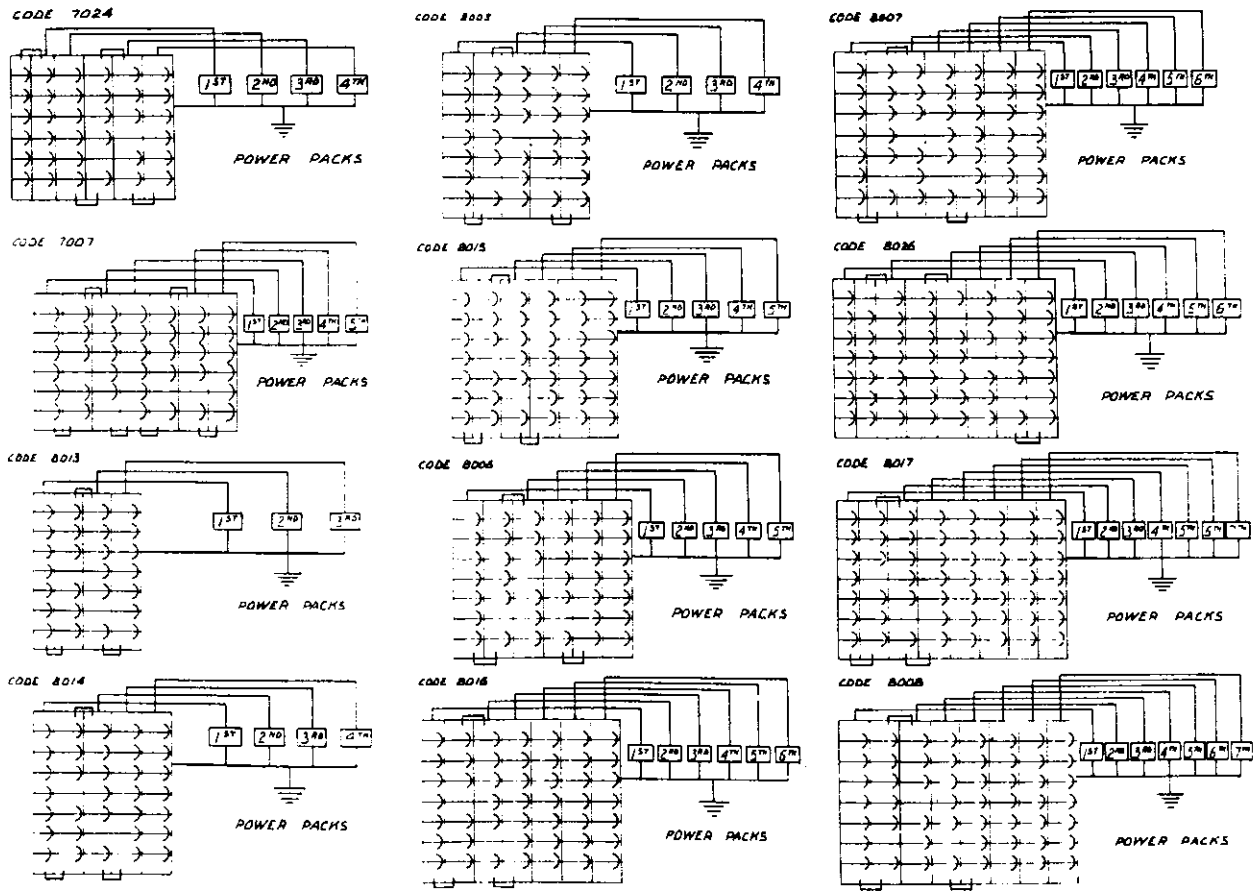

Figure 19. – Special Wiring Diagrams – refer to Footnotes Table A.

POWER PACK DISTRIBUTION TABLE A – continued.

MODEL NUMBER	ARRANGEMENT			P/P load Dist. by No. of Frames									CAPACITY (c.f.m.) † AT DUST SPOT EFFICIENCY OF			Approximate Weight for P.S.G. (lbs) *	Approximate Weight for P.S.A. (lbs) *
	Tiers of Frames High	COLUMNS OF FRAMES WIDE		Number of Power Packs	1st P/P		2nd P/P		3rd	4th	5th	6th	7th					
		2' wide	3' wide		2' Frames	3' Frames	2' Frames	3' Frames	3' Frames	3' Frames	3' Frames	3' Frames	3' Frames	95%	90%	85%		
1010	1	1	–	1	1	–								1475	2000	2240	134	110
1001	1	–	1	1	–	1								2220	3000	3350	180	154
1020	1	2	–	1	2	–								2950	4000	4480	268	220
1011	1	1	1	1	1	1								3700	5000	5600	314	264
1002	1	–	2	1	–	2								4440	6000	6700	360	308
1021	1	2	1	1	2	1								5200	7000	7850	448	374
1012	1	1	2	1	1	2								5900	8000	8950	494	418
1003	1	–	3	1	–	3								6650	9000	10100	540	462
1022	1	2	2	1	2	2								7400	10000	11200	628	528
2010	2	1	–	1	2	–								2950	4000	4480	242	195
2001	2	–	1	1	–	2								4440	6000	6700	321	269
2020	2	2	–	1	4	–								5900	8000	8960	484	388
2011	2	1	1	1	2	2								7400	10000	11200	563	463
2002	2	–	2	1	–	4								8880	12000	13400	642	538
2021	2	2	1	1	4	2								10400	14000	15700	805	657
2012	2	1	2	1	2	4								11800	16000	17900	884	732
2003	2	–	3	1	–	6								13300	18000	20200	963	807
2022	2	2	2	1	4	4								14800	20000	22400	1126	926
3001	3	–	1	1	–	3								6650	9000	10100	462	384
3020	3	2	–	1	6	–								8880	12000	13400	700	556
3011	3	1	1	1	3	3								11100	15000	16800	812	662
3002	3	–	2	1	–	6								13300	18000	20200	924	768
3021	3	2	1	1	6	3								15500	21000	23500	1162	940
3012	3	1	2	1	3	6								17800	24000	26800	1274	1046
3003	3	–	3	1	–	9								19900	27000	30200	1386	1152
3022	3	2	2	1	6	6								22200	30000	33600	1624	1324
3013	3	1	3	2	3	3	–	6						24400	33000	37000	1736	1430
3004	3	–	4	2	–	6	–	6						26600	36000	40300	1848	1536
3023	3	2	3	2	6	3	–	6						28900	39000	43700	2086	1709
3014	3	1	4	2	3	6	–	6						31000	42000	47000	2198	1814
3005	3	–	5	2	–	9	–	6						33300	45000	50400	2310	1920
4020	4	2	–	1	8	–								11800	16000	17900	916	724
4011	4	1	1	1	4	4								14800	20000	22400	1061	861
4002	4	–	2	1	–	8								17800	24000	26900	1206	998
4021	4	2	1	1	8	4								20700	28000	31400	1519	1223
4012	4	1	2	2	4	4	–	4						23700	32000	35800	1664	1360
4003	4	–	3	2	–	4	–	8						26600	36000	40300	1809	1497
4022	4	2	2	2	8	–	–	8						29600	40000	44800	2122	1722

† 1000 c.f.m. = 0.4719 m^3/s

* 1 lb = 0.454 Kg

POWER PACK DISTRIBUTION TABLE A – continued.

MODEL NUMBER	ARRANGEMENT				P/P load Dist. by No. of Frames									CAPACITY (c.f.m.) † AT DUST SPOT EFFICIENCY OF			Approximate Weight for P.S.G. (lbs) *	Approximate Weight for P.S.A. (lbs) *
	Tiers of Frames High	COLUMNS OF FRAMES WIDE		Number of Power Packs	1st P/P		2nd P/P		3rd	4th	5th	6th	7th					
		2' wide	3' wide		2' Frames	3' Frames	2' Frames	3' Frames	3' Frames	3' Frames	3' Frames	3' Frames	3' Frames	95%	90%	85%		
4013	4	1	3	2	4	4	–	8						32600	44000	49300	2267	1859
4004	4	–	4	2	–	8	–	8						35500	48000	53800	2412	1996
4023	4	2	3	2	8	4	–	8						38500	52000	58300	2725	2221
4014	4	1	4	2	4	6	–	10						41400	56000	62800	2870	2358
4005	4	–	5	2	–	10	–	10						44400	60000	67200	3015	2495
4024	4	2	4	3	8	–	–	8	8					47400	64000	71600	3328	2720
4015	4	1	5	3	4	4	–	8	8					50300	68000	76200	3473	2857
4006	4	–	6	3	–	8	–	8	8					53300	72000	80600	3618	2994
4025	4	2	5	3	8	4	–	8	8					56200	76000	85200	3931	3219
4016	4	1	6	3	4	6	–	9	9					59200	80000	89600	4076	3356
5011	5	1	1	1	5	5								18500	25000	28000	1310	1060
5002	5	–	2	1	–	10								22200	30000	33600	1488	1228
5021	5	2	1	2	10	–	–	5						25900	35000	39200	1876	2120
5012	5	1	2	2	5	–	–	10						29600	40000	44800	2054	1674
5003	5	–	3	2	–	10	–	5						33300	45000	50400	2232	1842
5022	5	2	2	2	10	–	–	10						37000	50000	56000	2620	2120
5013	5	1	3	2	5	5	–	10						40700	55000	61600	2798	2288
5004	5	–	4	2	–	10	–	10						44400	60000	67200	2976	2456
5023	5	2	3	3	10	–	–	10	5					48100	65000	72800	3364	2734
5014	5	1	4	3	5	–	–	10	10					51800	70000	78400	3542	2902
5005	5	–	5	3	–	10	–	10	5					55500	75000	84000	3720	3070
5024	5	2	4	3	10	–	–	10	10					59200	80000	89600	4108	3348
5015	5	1	5	3	5	5	–	10	10					62900	85000	95200	4286	3516
5006	5	–	6	3	–	10	–	10	10					66600	90000	100800	4464	3684
5025	5	2	5	4	10	–	–	10	10	5				70300	95000	106000	4852	3962
5016	5	1	6	4	5	–	–	10	10	10				74000	100000	112000	5030	4130
5007	5	–	7	4	–	10	–	10	10	5				77700	105000	118000	5208	4298
5026	5	2	6	4	10	–	–	10	10	10				81400	110000	123200	5596	4576
6012	6	1	2	2	6	6	–	6						35500	48000	53800	2444	1988
6003	6	–	3	2	–	9	–	9						40000	54000	60500	2655	2187
6022	6	2	2	2	12	2	–	10						44400	60000	67200	3118	2518
6013	6	1	3	3	6	–	–	9	9					48800	66000	73900	3329	2717
6004	6	–	4	3	–	8	–	8	8					53300	72000	80600	3540	2916
6023	6	2	3	3	12	–	–	9	9					57700	78000	87400	4003	3247
6014	6	1	4	3	6	6	–	9	9					62200	84000	94100	4214	3446
6005	6	–	5	3	–	10	–	10	10					66600	90000	100800	4425	3645
6024	6	2	4	4	12	–	–	8	8	8				71000	96000	108000	4888	3976
6015	6	1	5	4	6	–	–	10	10	10				75500	102000	114000	5099	4175

† 1000 c.f.m. = 0.4719 m^3/s

* 1 lb. = 0.454 Kg

POWER PACK DISTRIBUTION TABLE A.

MODEL NUMBER	ARRANGEMENT				P/P load Dist by No. of Frames									CAPACITY (c.f.m.) † AT DUST SPOT EFFICIENCY OF			Approximate Weight for P.S.G. (lbs) *	Approximate Weight for P.S.A. (lbs) *
	Tiers of Frames High	COLUMNS OF FRAMES WIDE		Number of Power Packs	1st P/P		2nd P/P		3rd	4th	5th	6th	7th					
		2' wide	3' wide		2' Frames	3' Frames	2' Frames	3' Frames	3' Frames	3' Frames	3' Frames	3' Frames	3' Frames	95%	90%	85%		
6006	6	–	6	4	–	9	–	9	9	9				79900	108000	121000	5310	4374
6025	6	2	5	4	12	–	–	10	10	10				84400	114000	128000	5773	4705
6016	6	1	6	4	6	6	–	10	10	10				88800	120000	134000	5984	4904
6007	6	–	7	5	–	10	–	10	10	6	6			93200	126000	141100	6195	5012
6026	6	2	6	5	12	–	–	10	10	10	6			97600	132000	147800	6658	5434
6017	6	1	7	5	6	6	–	10	10	10	6			102100	138000	154500	6869	5633
6008	6	–	8	5	–	10	–	10	10	10	8			106600	144000	161200	7080	5832
7003	7	–	3	3	–	7	–	7	7					46600	63000	70500	3078	2532
7022	7	2	2	3	14	–	–	7	7					51800	70000	78400	3616	2916
7013	7	1	3	3	7	5	–	9	7					57000	77000	86300	3860	3146
7004	7	–	4	3	–	9	–	9	10					62200	84000	94100	4104	3376
7023	7	2	3	4	14	–	–	7	7	7				67300	91000	102000	4642	3760
7014	7	1	4	4	7	5	–	9	7	7				72500	98000	110000	4886	3990
7005	7	–	5	4	–	9	–	9	10	7				77700	105000	118000	5130	4220
7024	7	2	4	4	14	–	–	9	9	10				82800	112000	125000	5668	4604
7015	7	1	5	4	7	5	–	10	10	10				88000	119000	133000	5912	4834
7006	7	–	6	5	–	9	–	9	10	7	7			93200	126000	142000	6156	5064
7025	7	2	5	5	14	–	–	9	9	10	7			98400	133000	149000	6694	5448
7016	7	1	6	5	7	5	–	9	9	9	10			103000	140000	157000	6938	5678
7007	7	–	7	5*	–	10	–	10	10	10	9			110900	147000	165000	7182	5908
7026	7	2	6	6	14	–	–	9	9	10	7	7		111400	154000	172000	7720	6292
7017	7	1	7	6	7	5	–	9	9	9	10	7		119000	161000	181000	7964	6522
7008	7	–	8	6	–	9	–	9	10	9	9	10		124000	168000	188000	8208	6752
8022	8	2	2	3	15	–	1	8	8					80000	59200	89600	4114	3314
8013	8	1	3	3*	8	4	–	10	10					88000	65200	98600	4391	3575
8004	8	–	4	4	–	8	–	8	8	8				96000	71000	107600	4668	3836
8023	8	2	3	4	15	–	1	8	8	8				104000	77000	116600	5281	4273
8014	8	1	4	4*	8	4	–	10	10	8				112000	82800	125600	5558	4534
8005	8	–	5	4*	–	10	–	10	10	10				120000	88800	134400	5835	4795
8024	8	2	4	5	15	–	1	8	8	8	8			128000	94800	143200	6448	5232
8015	8	1	5	5*	8	4	–	10	10	8	8			136000	100600	152400	6725	5493
8006	8	–	6	5*	–	10	–	10	10	10	8			144000	106600	161200	7002	5754
8025	8	2	5	6	15	–	1	8	8	8	8	8		152000	112400	170400	7615	6191
8016	8	1	6	6*	8	4	–	10	10	8	8	8		160000	118400	179200	7892	6452
8007	8	–	7	6*	–	10	–	10	10	10	8	8		168000	124400	188200	8169	6713
8026	8	2	6	6*	15	–	1	8	10	10	10	10		176000	130400	197200	8782	7150
8017	8	1	7	7*	8	4	–	10	10	8	8	8	8	184000	136200	206200	9059	7411
8008	8	–	8	7*	–	10	–	10	10	10	8	8	8	192000	142000	215200	9336	7672

*Refer to Special Wiring Diagram

† 1000 c.f.m. = 0.4719 m^3/s

* 1 lb. = 0.454 Kg

OPERATION CHART

NORMAL OPERATION	FAULT INDICATION	PROBABLE CAUSES
Sentinel Breaker on. Normal indicating lamp lit. Short circuit lamp not lit.	Normal indicating lamp not lit. Sentinel Breaker on. Short Circuit lamp not lit.	(1) No power supply voltage to power pack. (2) Door switches not closed. (3) Poor contact in a door interlock switch. (4) Burnt out indicating lamp.
	Short circuit lamp lit. Sentinel breaker on, or breaker has tripped and short circuit lamp lights as breaker is reset.	(1) Foreign conducting material between cells plates. (2) Broken ionizer wire touching grounded equipment. (3) Short circuited wiring inside power pack. (4) Faulty H.V. Transformer or Capacitor.
	Sentinel Breaker is tripped (system otherwise normal when breaker is reset).	(1) Temporary short circuit which has cleared. (2) Momentary surge of excessive line (primary) voltage.
Occasional arcing or crackling between cell plates is not serious, usually being due to large particles passing between the plates. Some arcing may occur after applying adhesive but should soon stop. (No more than ten discharges per minute for the first 15 minutes.)	Continuous crackling or arcing in cells.	(1) Excessive dirt build-up is short circuiting cells. (2) Insulators are dirty, cracked broken. (3) Broken ionizer wire drawn into cell. (4) Burnt out rectifier in power pack.
Only clean air should appear on the leaving air side of the cell bank, with circuits, indicating lamps and voltages normal.	Filters excessively dirty or dirt particles on clean air plenum floor or walls.	(1) Dirt on ionizer causing inefficient ionizer operation (2) Low voltage or a defective power pack. (3) Cell plates not properly coated with adhesive. (4) Improper air distribution: (a) baffles improperly placed. (b) fan speed increased or system resistance reduced. (c) dampers have shifted. (5) Leakage of dirty air into ductwork on clean side of cell bank.