TRION ELECTRONIC AIR CLEANER

INSTALLATION OPERATION SERVICE MANUAL

CUSTOM PACKAGED EQUIPMENT
MODEL 71-____-02

ELECTROSTATIC PRECIPITATOR WITH INTEGRAL WASHING SYSTEM

TRION, INC. P. O. BOX 760 • SANFORD, NORTH CAROLINA • 27330

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SECTION I DESIGN

For the System Design Engineer

1. General Description

The standard major components supplied with each unit for installation are as follows:

The Electronic Air Cleaner

The Power Pack(s)

The Control

The Detergent System

A Wash Water Line Strainer, Solenoid Valve and Vacuum Breaker

The Electronic Air Cleaner contains the ionizing-collecting cells (collecting elements), wash manifolds — located to the front and rear of each tier of cells — and metal mesh pre-filters and after-filters. A perforated plate, in lieu of the metal mesh filters, is an option when specified.

Gasketed access doors located on one end of the cabinet, 90 degrees to the direction of the airflow, provide entry for removal of the cells and filters. The location of the access doors, wash manifold drive motors and manifold header pipes may be specified as "right" or "left" handed. The hand designation is determined by standing in the duct work on the air entering side of the unit so the airflow strikes your back.

The Power Pack(s), providing the necessary high voltage for the ionizing-collecting cells, is furnished in a NEMA 12 enclosure and is designed for remote mounting. The distance between the pack and unit must be determined as the interconnecting high voltage leads are furnished to the specified length. Consult factory for distances greater than 150 ft. Cables are not to be spliced at any point along their length.

The Control, which operates the washing cycle, also is furnished in a NEMA 12 enclosure designed for remote mounting, and is a central junction for the primary wiring.

The Detergent System is furnished as a completely assembled unit to be piped directly to the wash water supply, into the wash manifold headers.

The Strainer, Solenoid Valve and Vacuum Breaker are to be installed in the wash water supply line.

2. System Design and Layout

The arrangement of the supplied components and the general layout of the system will vary according to application, adjoining equipment and available space.

However, there are several basic factors pertaining to all installations that must be considered.

To maintain the selected cleaning efficiency, it is important to assure that the total air volume (capacity in CFM) is uniformly distributed across the entire face area of the unit. The metal mesh filters (or perforated plate) provide some resistance to effect even air distribution. However, since most air ducts are designed to handle air velocities greater than the rated velocity of the air cleaner, it is necessary to properly transition any attached ducting. If possible, a contraction ratio of 1 in 3 (approximately 20°) should be maintained. If space prohibits, turning vanes, air baffles or other means may be utilized. Ducting — where attached to the cabinet collars — should be gasketed, caulked or otherwise made water tight.

When there is a danger of rain, snow or trash being drawn into the system with outside air, the make-up air intake should be protected with rain louvers, hooding and hardware cloth to prevent the rain, snow or trash from entering the electronic air cleaner.

Contaminants to be collected — such as oils in a vaporous state — must be condensed into particulate form prior to entering the ionizing-collecting cells in order to maintain the anticipated efficiency. Gases, vapors or any non-particulate cannot be precipitated and will therefore pass through the air cleaner. Any condensing that takes place downstream from the air cleaner defeats the purpose. By the same token, heavy concentrations of water vapor, or other matter that becomes highly conductive when condensed, must be prevented from entering and/or condensing in the collecting elements to prevent electrical arc over and shorting.

Factory designed access to all electrically charged high voltage components contain electrical interlocks for the safety of operating personnel. Any additional access that may be provided in the system, where there is access to high voltage, must be equipped with such interlocks. Interlocks are readily available from the factory.

Water wash drain lines from the cabinet drain basin should be trapped or otherwise sealed against the system pressure. Wash water to the unit must be at the volume required for the specific unit involved, and between 35 PSIG Min. — 50 PSIG Max. at full flow to provide proper spray patterns from the wash nozzels.

Each installation varies according to needs, but normally the power pack(s) and control are located near the air cleaner. Ideal mounting height is at eye level for ease in reading the instrumentation, and to facilitate service.

For ease in maintenance and component removal, adequate space must be provided in front of all access doors, motors, pump and accessory equipment. Special consideration should be given in this respect for installations where the unit is suspended overhead. Catwalks or platforms should be provided.

Refer to Figure 1, Section IV, Page 10. Contact the local Trion Sales Office or the factory if questions arise, or any additional information is required.

SECTION II INSTALLATION

For the Installing Contractor

1. Unpack and Inspect

At the time the unit is received, all shipping containers and their contents should be examined for damage. Any damage occurring in shipment must be immediately reported to the carrier, an inspection report completed and a claim filed at the receiving point.

The unit cabinet is shipped completely assembled and, where size permits, the ionizing-collecting cells are shipped inside the cabinet. On large units the upper tier of cells may be shipped in separate containers. The power supply, control, detergent feeder and any separate accessories are shipped in the containers as noted on the packing list.

2. Position Air Cleaner Cabinet
To reduce weight for ease in handling, remove the pre-filters, after-filters and the ionizing-collecting cells from the cabinet, and place them safely aside. Position the cabinet in the designated location giving consideration to the following points:

A. Provide sufficient clearance in front of the access doors for ionizing-collecting cell and mechanical filter (or perforated plate) removal.
B. Level the cabinet to assure proper drainage from the drain pan.
C. Drain line. Because of low clearance and access to the drain nipple located in the bottom center of the drain basin — especially on larger units — it may be advantageous to install the elbow, or first section of drain line, before the unit is secured.
D. Unless specific design features have been prearranged, the direction of airflow through the cabinet may be either from the right or the left. When the ionizing-collecting cells are reinstalled, the directional arrows on the cells end plates must concur with airflow through the cabinet.

After the cabinet has been properly located, it may be secured into place at the predrilled factory mounting pads either by bolting or welding.

3. Connect Adjoining Duct Work
Depending on the application, the installation plan may or may not call for adjoining duct work on the air entering and/or air leaving sides of the cabinet.

When adjoining ducting is to be installed, the bottom of the horizontal duct runs should be relatively flat and sloped toward the cabinet drain pan for an 18 inch length. As a result, any wash water splash-back occurring during the washing operation will run back into the drain pan.

Duct securement to the collar may be completed using the raw edge of the collar opening or the predrilled flange. In either case, the seam should be made air and water tight by caulking or gasketing.

When the blower is installed downstream from the Trion cabinet, the ducting between the cabinet and the blower will be under negative pressure and should also be made air tight to prevent the infiltration of contaminated air.

After the duct work has been installed, clear remaining material or debris of installation from inside ducts and bottom of cabinet, then re-install both the mechanical filters and the ionizing-collecting cells. NOTE: Follow the directional arrows located on the cell end plates. The side of each cell containing the spiked ionizer blades *must* be located on the air entering side of the cabinet.

4. Mount Detergent System
Refer to Detergent Outline Drawing. The detergent system should be located as close to the unit as practical in a level position. Service space must be provided for periodical manual filling of the detergent tank, and to gain access to the pump and motor assembly. When positioned, the assembly may be secured into place at the predrilled factory mounting pads, either by bolting or welding.

5. Connect Drain
Connect a drain line to the pipe nipple provided in the cabinet drain basin in accordance with the governing plumbing codes. The drain line must be sealed with a trap or other means to prevent air by pass. If a trap is used, it should hold sufficient water to overcome the system air pressure and to assure that loss of liquid from evaporation between cleaning periods will not break the seal. The drain line should not be smaller than the drain pipe nipple, or it will otherwise restrict the flow of water.

6. Connect Water Wash Supply
The items furnished to be included in the wash water supply are a strainer, an electrically operated valve, a vacuum breaker and a detergent system. Refer to the Piping Schematic.

Unless otherwise specified, the water wash supply should be hot (125°F minimum) at the volume specified for the given unit, and at a full flow pressure between 35 and 50 PSIG.

Although not required, a pressure gage and a manual service valve are recommended as shown in the diagram. The components should be located within the system to provide for service access.

7. Mount Power Pack(s) and Control
The Power Pack should be mounted at eye level and located as close to the air cleaner as practical. For units requiring two power packs, the packs are normally mounted side by side. Allow sufficient space in front of the access door(s) for service. Refer to Power Pack Outline Drawing for mounting hole layout and dimensions.

Although not necessary, it is advantageous for convenience in operation to locate the Control near the Power Pack(s). The Control should also be mounted at eye level with adequate space provided for service. Refer to Control Outline Drawing for mounting hole layout and dimensions.

8. Complete Wiring
A. *High Voltage Wiring*

CAUTION:

EXERCISE ALL THE NORMAL PRECAUTIONS WHEN WORKING WITH HIGH VOLTAGE.

The high voltage wiring entails interconnecting the power pack(s) to the ionizing-collecting cell(s). All the wiring in the cabinet between the cells has been completed at the factory.

Refer to the Field Wiring Diagram. Two high voltage leads, one blue for the ionizer and one black for the collector, are factory furnished. Each lead is to be run in separate conduit and must be of continuous run (do not splice) between the power pack and ionizing-collecting cell terminals. A conduit connection box is provided on the air cleaner cabinet for conduit securement. The leads are to be run directly through the box to the cell terminals inside the cabinet.

The blue leads connect to the terminal marked "ionizer" in the power pack, and to the center of the top front insulator located in the end plate of the top cell. The black lead connects to the terminal marked "collector" in the power pack, and to the center of the center insulator located in the end plate of the top cell. See Figure 2 and the Field Wiring Diagram.

B. *Primary Wiring*
The Wash Control is the main distribution point for all primary wiring. The various electrical components involved are connected to and powered from the control. Note that the hot line of the 115 volt supply must be connected in series through all of the access door electrical interlock switches before entering the power pack(s). (The power pack(s) interlock is factory wired.) These interlocks are safety switches that prevent access to the charged high voltage components without first turning "OFF" the high voltage by interrupting the primary power source. Refer to the Field Wiring Diagram.

9. Check Out for System Start-up
When the installation has been completed, assure that the equipment is ready for start-up by checking the following:

A. All construction debris is removed from the ionizing-

collecting cells, drain basin and duct work.

B. The inside of the Power Pack(s), Control and Detergent Tank is clear of any foreign materials.
C. The drain line from the Trion drain basin is clear and completely connected to its point of termination.
D. All piping is completed to the manifold headers and wash water is available.
E. Supply line power is available and electrical wiring is completed to the following components:

1. Control
2. Solenoid Valve
3. Detergent Pump Motor
4. Manifold Drive Motors
5. Electrical Interlocks
6. Power Packs
7. Ionizing-Collecting Cells
8. The System Fan

F. NOTE: *Do Not* put the initial supply of detergent into the detergent tank. This is to be done after volume settings are made at start-up.

SECTION III OPERATION

For the Maintenance Engineer

1. Introduction and Principle of Operation

The Trion® Electronic Air Cleaner is technically known as an electrostatic precipitator. In this type of equipment, all airborne particles, even of microscopic size, are electrically charged (positively) as they pass through a high voltage ionizer. These charged particles are then attracted and adhere to a series of parallel collecting plates which form the negative elements of an electrostatic field.

The ionizer consists of charged stainless steel spiked blades spaced between grounded electrodes. The collecting section consists of parallel plates arranged so that each alternate plate is charged while the interleaving plates are electrically grounded.

Periodically, depending on the type and concentration of contamination in the air, the contaminate is washed from the plates by the integrally constructed water wash system.

Three major functional components comprise the air cleaner:

(1) Ionizing-Collecting Cells to ionize and collect airborne particulate matter.
(2) Power Pack to supply high voltage direct current to the ionizing-collecting cells.
(3) Control operated washer to automatically wash away the collected contaminate.

Normally, systems are designed for collection efficiencies in the range of 90 percent or more. Collecting a contaminate at these efficiencies, especially when there are high concentrations, can result in large accumulations in a relatively short period. Therefore, maintenance must encompass two areas; the operation of the equipment for efficient collection and the systematic removal of the collected contaminate.

2. General Description

The Ionizing-Collecting Cells (contaminate collecting elements) are housed in the cabinet on slide rails. They can be removed from the cabinet as required, through the end access door, by sliding them out like drawers. On multi-cell units, all of the electrical connections between cells in a given tier are automatically made through spring connectors. On the access end, the high voltage leads from the power pack and the connections from cell tier to cell tier on multi-tier units, are made with cables. When installing cells into the cabinet, observe the directional arrows on the cell end plates. The side of the cell containing the spiked ionizer blades always *must* be located on the air entering side.

Both the air entering and air leaving side of the cabinet contain either metal mesh filters or perforated plate, whichever was specified. These items act as trash screens, provide some resistance for even air distribution and help contain splashback from the integral water wash system.

The Power Pack(s) convert the 115 volt, 60 HZ, single phase AC supply to the high voltage DC needed to power the ionizing-collecting cells. Potentials of 13 KVDC are required for the ionizer sections and 6.5 KVDC for the collector sections of the cells. The high voltage leads between the power pack(s) and the ionizing-collecting cells are color coded; blue for the ionizer and black for the collecton The power pack is all solid state and arranged so that individual components or complete assemblies can be easily replaced when required.

The integral wash system consists of a series of spray nozzles soldered into oscillating water wash manifolds. The manifolds are located in the front and rear of each cell tier. They are oscillated through straight drive linkage powered by fractional HP motors. A Detergent System is also incorporated into the wash system. The amount of detergent used for washing is readily adjustable, and that amount is dependent upon the type and amount of collected contaminate.

The washing operation is cycled periodically, and again the frequency is dependent on the type and amount of contaminate collected. The events in a wash cycle are:

(A) Power Pack(s) and System Blower "OFF"
(B) Washer and Detergent "ON"
(C) Washer and Detergent "OFF"
(D) Pause for Detergent to react
(E) Washer "ON" (without detergent for rinse)
(F) Washer "OFF"
(G) Blower "ON" for forced dry
(H) Power Pack(s) "ON"

The time span for all of the events is adjustable.

3. Initial Start-up

A. Inspect the inside of the adjoining duct work and Trion cabinet to be sure it is clean and free of any debris or construction materials. Especially note the opening in the drain basin for any restrictions. The ducting, where secured to the cabinet collars, should be sealed water tight either with gasketing or caulking.
B. Inspect the ionizing-collecting cells to see that all of the ionizing blades are intact, that no large pieces of foreign material are lodged between the plates, and that the cells are properly installed in the cabinet with the spiked ionizing blades located on the air entering side.
C. Check the high voltage leads to see that they are connected to the proper terminals both at the ionizing-collecting cells and inside the power pack. Refer to Figure 2.
(D. Be sure that the drain line from the Trion Cabinet Drain Basin is completely connected and properly terminated. A trap or seal of some type should be incorporated in the line to prevent air by-pass.
E. Check the water supply line to be sure water is available and that the strainer, solenoid valve, vacuum breaker and detergent system are properly installed and connected. Refer to the Piping Schematic.

F. Be sure that electrical power is available, that the wiring is completed and that the system blower is ready to energize.

G. Check the multi-cam timer located in the control to be sure it is in the "home" position. Refer to Figure 3. When in the "home" position the No. 1 switch lever will be bottomed out in its cam recess and the red pointer on the graduated dial will indicate zero. If it is not in the "home" position, loosen the two screws securing the motor assembly and slide the assembly in the slot provided disengaging the gears. When the gears are disengaged rotate the cams by hand until the No. 1 switch lever bottoms out into the cam recess and the graduated dial pointer indicates zero. Then reengage the gear train and tighten the screws. If an automatic time clock was furnished in the control, rotate the large hourly dial so that any of the tabs located on the outer circumference are at least 12 hours away from depressing the activating switch lever.

H. Be sure that all access door interlocks are closed.

I. Close system electrical supply switches making power available to the Trion Control and the system blower.

J. Turn Control "ON-OFF" switch "ON".

K. Turn Power Pack(s) circuit breaker "ON". Electrical arc-over within the ionizing-collecting cells may occur. It is a normal occurrence caused by accumulated construction dust deposits in the cells and should soon subside with the milliammeter reading in the prescribed range as shown on the operating range plate. If the arc-over is secure and does not subside, recheck the routing of the high voltage leads between the power pack and the cells. Refer to Figure 2. If the milliammeter does not read within the prescribed operating range, adjust the variable lead taps on the front of the high voltage transformer in accordance with the instructions on the label located on the inside of the power pack door. If constant arc-over still occurs, or diffulty other than outlined above, refer to the Trouble Shooting Guide in this section, Page 8.

L. Be sure the detergent tank is clean, then fill the tank ⅛ full with *clean water. Do not fill* with the detergent until start-up adjustments have been made.

M. Set the detergent pump running time for 60 seconds by adjusting the knob on the 1.2 to 120 second timer inside the control. Manually initiate the control by initiating the start button. The wash control duration is 80 minutes and will sequence the events as shown in the Control Schematic Sequence of Operation Diagram. When the detergent pump is energized, note the amount that is used by observing the reduction in the liquid level in the tank. The usage should be approximately 1 part of detergent to 20 parts of water. The water requirements for each unit model are listed in GPM, on the Piping Schematic. To adjust the volume output from the pump, refer to the Detergent System Outline. The pump is a constant displacement type and the amount of detergent forced into the water supply to wash the unit is dependent upon the setting of the control valve in the by-pass return line to the reservoir. The side of the translucent reservoir is marked with volume markers. Adjust the control valve to obtain the correct usage for the given unit model, then secure the setting with the Allen Head set screw located in the valve adjustment knob. When the correct adjustment has been made, remove the remaining water from the reservoir and fill the tank with initial supply of detergent furnished.

N. When the wash control has cycled out and an initiator time clock has been provided in the control for automatic operation, set the clock as follows:

(a) Estimate the washing frequency desired. Normally once per week is adequate for normal dirt loads.

(b) Each dial tab on the outer edge of the large hourly time dial represents approximately 15 minutes. These tabs can be tilted in and out with the fingers.

(c) Tilt all the tabs outward.

(d) Select the time of the day the wash cycle is to be initiated and tilt the dial tab on that time inward.

(e) Rotate the large hourly time dial counterclockwise by hand until the correct time of day is indicated by the triangle time arrow on the nameplate.

(f) The small seven spoke wheel at the lower right of the large hourly time dial moves ahead once each day at 2:00 a.m. Each spoke is marked with a day of the week. Insert a knurled brass screw in all the spokes except the spoke marked with the day the unit is selected to wash. CAUTION DO NOT ATTEMPT TO INSERT SCREW IN SPOKE WHILE IT IS POINTING TO THE LARGE ARROW. IF NECESSARY TURN THE SPOKE WHEEL BY HAND. THEN INSERT THE SCREW.

(g) If later than 2:00 a.m. turn the spoked wheel by hand until the present day of the week is opposite the large arrow. (Between midnight and 2:00 a.m. the setting must be made to the day just ended at midnight.)

4. Wash Control and Detergent System Settings

The total time required for the complete wash cycle is 80 minutes. The four main events that take place during the cycle are: Wash, Soak, Rinse and Dry. Once the Wash Control has been initiated, either by manually pushing the washer start button or through the means of an automatic time clock, the time for each event is controlled by the multi-cam timer located inside the control housing. The time duration for each event with the 80 minute cycle is adjustable.

In addition to the multi-cam timer settings, the detergent cycle has two additional settings; A "fine tune" time adjustment and a volume adjustment (ratio of detergent to water).

These adjustments enable the washing operation to be set most effectively for the particulate type and amount of dirt loading for a given installation. Some dirts being more tenacious than others are more difficult to remove and require a longer wash time or a stronger detergent solution. Average settings have been factory set and are outlined in the Control Schematic, sequence of operation. Best possible settings for any given installation, however, are best determined through experience. Determination can be made by visually examining the ionizing-collecting cells after the first few washings.

To change the multi-cam timer settings refer to Figure 3. Each disc on the double disc cams is adjustable by turning the adjusting screws located on the side of each disc. The time between the "OFF" operation of Switch 3 and the "ON" operation of Switch 4 is the soak time. NOTE: Switch 3 controlling the detergent, should never be set for less than 2 minutes (120 seconds). The detergent time is "fine tuned" with the adjustable, 1.2 to 120 second, time delay relay which overrides Switch 3.

To set the time for any given event, except detergent, simply turn the adjusting screws to adjust the length of the cam recess. Open the recess to increase the time or close the recess to decrease the time. When adjustment is made to one of the cams the other cams may have to be adjusted to bring the time relationship between the cams in proper sequence. The operation of any one event *must not* overlap the operation of any other event.

To adjust the volume of detergent used within the given time setting, loosen the knurled knob with an Allen wrench on the control valve located in the by-pass line. Refer to the Detergent System Outline. Turning the knob clockwise increases the volume and counterclockwise decreases the volume. When adjustment has been made, be sure to retighten the set screw.

5. Routine Maintenance

A. *Washing Frequency*

The frequency that the collected dirt is to be washed from the

unit depends upon the type and amount of dirt in the air to be cleaned. Dirt which is greasy in nature tends to harden after collection and should be washed away often. Likewise, units operating under extremely heavy dirt loads should be washed more often as a large build-up of collected material will have a tendency to "blow-off" if permitted to remain on the collecting elements for long periods of time. In that the type and amount of dirt varies geographically (and from one location to another in any given area) it is recommended to start operation with a washing frequency of at least once a week. This schedule may then be altered as needed after visual examinations of the collected material contained on the ionizing-collecting cells. Daily washing is not unusual for units operating on heavy welding fume or similar contaminants.

B. *Detergent*
Effective washing is dependent upon detergent. The detergent reservoir should be examined on a routine basis, a minimum tank level established and never permitted to empty. An empty tank not only means poor washing but can be detrimental to the pump. The inside of the tank should be kept clean, free from dirt and foreign objects. The detergent as supplied by Trion, Inc. is formulated specifically for Electronic Air Cleaners. If substitutes are used, they should be safe for use in ventilation systems and non-caustic as 95% of the ionizing-collecting cells are constructed of aluminum.

C. *Electrical Operation*
The front of the power pack(s) is equipped with a milliammeter. Some models also contain a voltmeter. The milliammeter should be observed on a routine basis to be sure that it is reading within the prescribed operating range as marked on the data plate. For those units containing a voltmeter, the collector voltage should be between 6 and 7 KV and the ionizer between 12.5 and 13.5 KV.

6. Periodic Maintenance

A. *Water Wash System - Every 6 Months*
The water wash spray pattern should be checked on each nozzle to be sure a full spray pattern is developed. Distorted patterns are usually caused by dirt in the nozzle orifice, which can be cleaned by inserting a small gage soft copper wire into the orifice. If any one manifold contains several nozzles that are restricted, the drain plug at the idler end of the manifold should be removed, after the nozzles have been cleaned, and the manifold flushed with clean water. The main supply line strainer and the strainer in the detergent system should be checked and cleaned. Check the wash manifold drive linkage connections and tighten or adjust as required.

B. *Power Pack(s) and Control - Every 12 Months*
The inside of the Power Pack(s) and Control should be examined for accumulated dirt and dust. If required, the components should be cleaned using a good brand of electrical contact cleaner. All terminal connections should be checked for securement, tightened or reworked as required.

C. *Ionizing-Collecting Cell - Every 12 to 18 Months*
Remove and inspect the ionizing-collecting cells for excessive dirt accumulations not removed by the integral washing system. Manually clean as required in a soak tank, commercial car wash or with a pressure hose or pressure cleaner using a low pressure setting. At this time, particular care should be taken in cleaning each of the insulators.

D. *Motors - Every 24 Months*
As the operation of detergent pump motor is limited, frequent oiling is not required. Lubricate with several drops of SAE 10 motor oil every two years. DO NOT OVER OIL. The manifold drive motors are factory lubricated for life and require no oiling.

7. Troubleshooting

WARNING:
EXERCISE THE USUAL PRECAUTIONS WHEN WORKING WITH HIGH VOLTAGE. THE MAXIMUM OPERATING OUTPUT FROM THE POWER SUPPLY IS 18,000 VDC AND 25 MA.

IF SAFETY SWITCHES ARE CLOSED AND CIRCUIT IS ENERGIZED, DO NOT TOUCH HIGH VOLTAGE. WHEN THE CIRCUIT IS DE-ENERGIZED ALWAYS BLEED OFF REMAINING STATIC CHARGE WITH AN INSULATED HANDLED SCREW DRIVER BY SHORTING ACROSS CAPACITOR TERMINALS OR GROUND AND POINTS OF HIGH VOLTAGE DC POTENTIAL.

A. *General*
Outages in electrostatic precipitators occur more frequently in the high voltage circuit rather than in the auxiliary systems such as the controls and washer. Other than the basic hand tools, it is advantageous to have a standard volt/ohm milliammeter with both a 25 KVDC and 10 KVAC high voltage probe. These instruments are standard catalog items by several manufacturers.

B. *Secondary Short Circuits*
The most common outage is a short in the secondary circuit and is best located through the process of elimination. Normal symptoms are a high milliammeter reading accompanied by the circuit breaker tripping out. It may be located in the ionizing-collecting cells, high voltage cables or the power pack. To isolate the short circuit to any one of these three components, proceed as follows:

1. Disconnect both high voltage leads from their respective terminals inside the power pack and energize the pack. If the circuit breaker remains "on" and the milliammeter registers zero, the pack is indicated to be normal. (The milliammeter should register zero as the normal load, as well as the short load, have been removed.) If the circuit breaker continues to trip and/or the milliammeter registers some value, the trouble is indicated to be within the power pack. Refer to Trouble Reference Chart in this section, Page 8.
2. Next, reconnect both high voltage leads to their terminals inside the power pack. Disconnect them at the terminals at the ionizing-collecting cells and support them free from any point of contact. Energize the pack. If either or both leads are defective, it will be indicated by some value registered on the milliammeter and/or the circuit breaker tripping out. If the leads are indicated to be defective, one can be checked independently from the other by disconnecting and energizing them one at a time. When a lead is found to be defective, replace it in its entirety. It is not recommended to attempt a high voltage repair or splice.
3. When both the power pack and high voltage leads are found to be noraml, the trouble is indicated to be in the bank of ionizing-collecting cells. The trouble then can be isolated to a tier of cells, a single cell, or the ionizing or collector section of a given cell as follows:
   a. First determine if the short is in the ionizing section or the collecting section by connecting each high voltage lead to its respective section, one at a time, and energizing the power pack. (The lead not connected must be supported away from any point of contact.) The short symptoms will still exist for the section in which the short is located. If the trouble causing the short is bridging both sections, then the short will be indicated in both sections when they are individually connected.
   b. If the unit is more than one tier of ionizing-collecting

cells high, determine which tier is shorted by disconnecting the jumper wires between cell tiers and proceeding as described above. Start by disconnecting the bottom tier of cells first and work upward.

c. When the short is isolated to one cell tier, remove all the cells within the tier and visually check the sections indicated to contain the short.
   (1) If the short is in the ionizer section look for a broken or defective insulator.
   (2) If the short is in the collector section look for a large piece of foreign material bridging the collector plates or a defective insulator.
   (3) If the short is indicated to be in both sections, it will probably be a foreign object bridging the air gap between the ionizer and the collector.

C. *Open Circuits*
Although open circuits can occur in the secondary circuit they usually take place in the primary. The common indications are "zero" milliammeter reading, indicating light "out" and the circuit breaker "on". As all access panels and doors contain electrical interlocks, these switches should be checked first to see that they are electrically sound and properly closed mechanically. It is usually most expedient to start with the power pack safety switch and work back to the primary source of supply. Next, check the power pack circuit breaker to be sure it is electrically closing when the switch lever is in the "on" position. If power is traced to the load side of the circuit breaker, check the power pack primary wire connections and determine if power is being supplied to the high voltage transformer. Refer to Wiring Diagram, shown on the Power Pack Outline.

D. *Problems other than Short and Open Circuits*
Refer to Trouble Reference Chart in this section.

8. Spare Parts

Recommended spare part quantities are usually based on the unit size and the amount of units per installation. For specific recommendations, consult the Trion factory or nearest Sales Office. Consideration, however, should be given to stocking the following components:

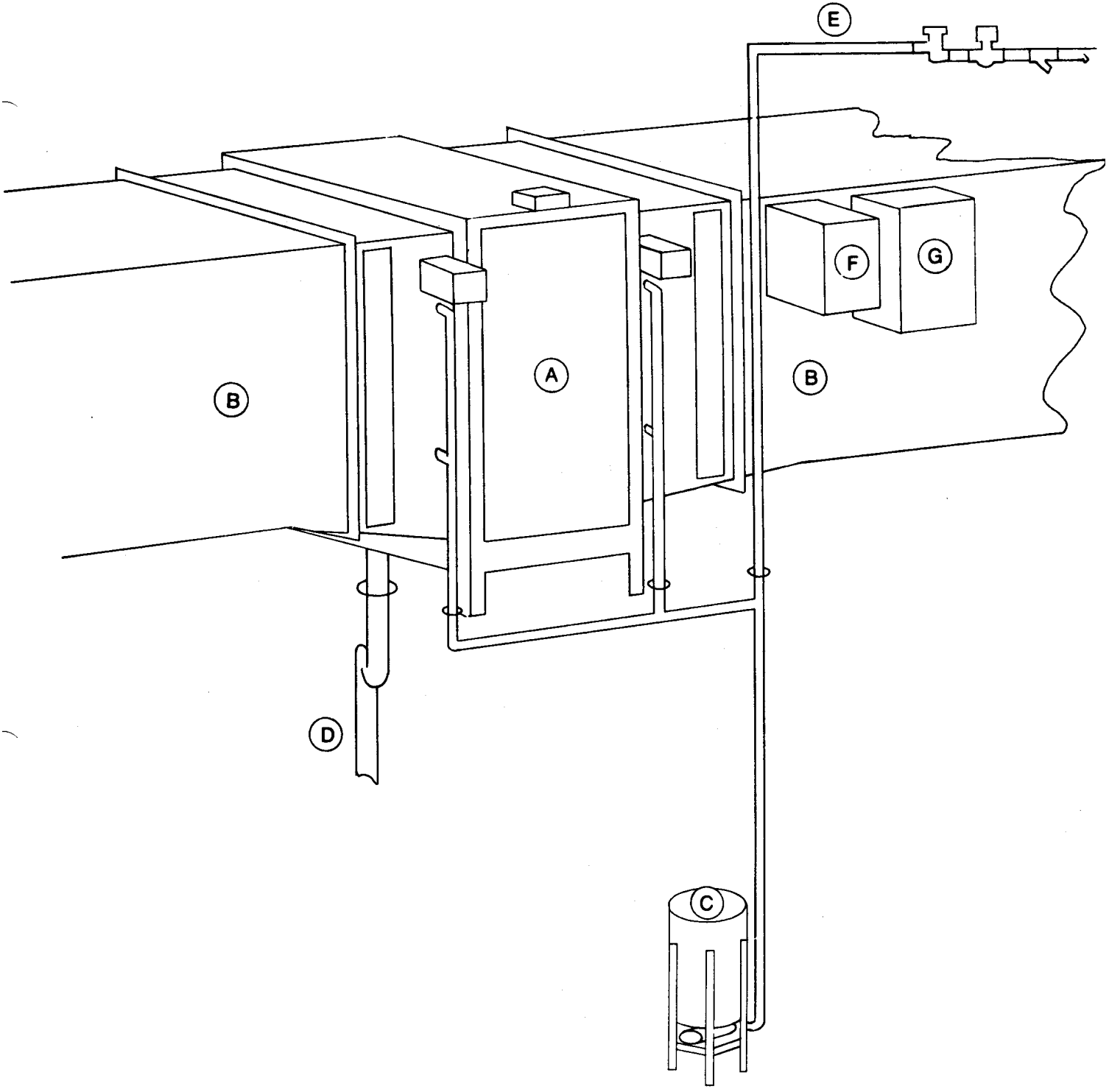
DESCRIPTION	*QTY.*
Secondary Component Board Assembly	1
Cell Insulators	6
Milliammeter	1
High Voltage Transformer	1

Part Numbers are not listed as they are subject to change. Always state Unit Model and Serial Numbers when ordering parts or service.

NOTES

TROUBLE REFERENCE CHART

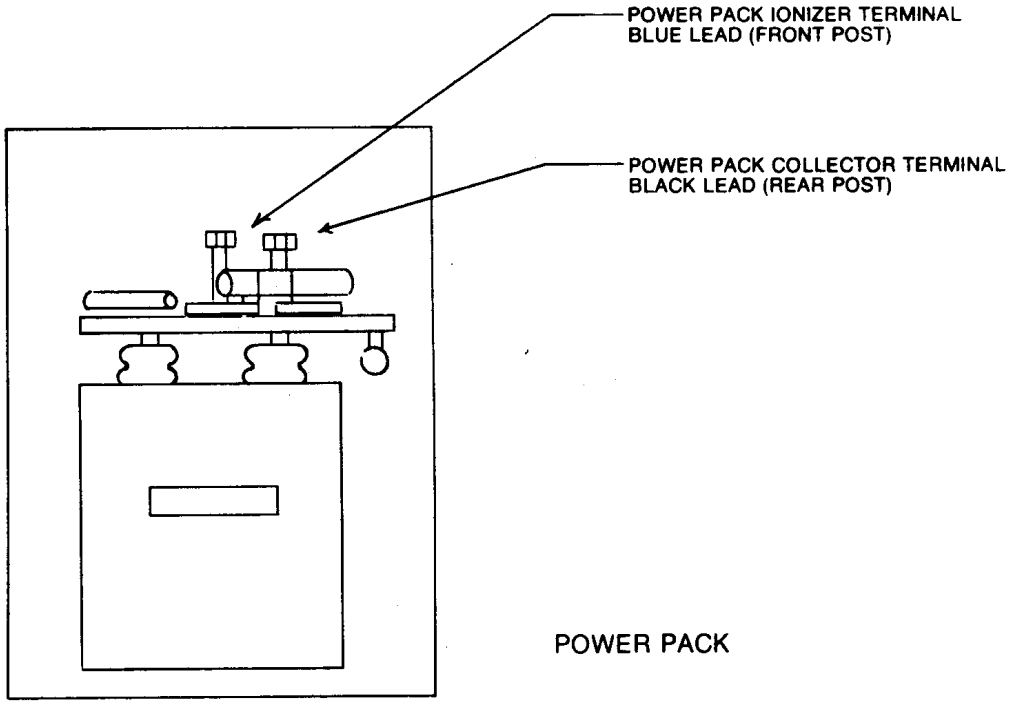
TROUBLE SYMPTOM	PROBABLE CAUSE	LOCATION	REASON - CORRECTION
Circuit breaker tripping off and/or excessive arcing.	Short circuit	Ionizing section of cell	1. Defective insulator(s) - replace 2. Dirty insulator(s) - clean
		Collecting section of cell	1. Foreign material bridging plates - clean 2. Defective insulator(s) - replace 3. Dirty insulator(s) - clean 4. Bent plates - straighten or replace cell
		Power Pack	1. Defective capacitor - look for traces of oil leakage or bulged case - dead shorts may be indicated with ohm meter - confirm by replacement. 2. Defective rectifier - look for obvious defect in case. No practical field method for positive check. Confirm by replacement. 3. High voltage transformer. Check AC output. Approximately 8,000 VAC open circuit.
		High voltage leads	1. Defective leads - replace. 2. Ionizer leads connected to plate section. Interchange.
High milliammeter meter reading	Dirty insulators	Ionizing-Collecting Cell	1. Wash unit.
	Bent components in ionizer	Ionizing-Collecting Cell	1. Correct as required.
	Increase in supply line voltage	Primary input	1. If condition is permanent, adjust variable taps on transformer. Refer to wiring diagram on the inside of the power pack access door.
Low milliammeter reading	Dirty ionizing blades	Ionizing-Collecting Cell	1. Wash unit.
	Open rectifier	Power Pack	1. Confirm by replacement.
Indicating light does not glow	Circuit breaker tripped	Power Pack	Reset circuit breaker.
	Electrical interlock open	Primary Circuit	Reset each switch mechanically and/or electrically check switch and replace if required.
	No primary power	Primary input	Check line service.
	Indicating light burned out	Power Pack	Check and replace.
No milliammeter reading, circuit breaker "on", indicating light glowing.	Open circuit	Cell or Power Pack	Ionizer high voltage lead disconnected. Reconnect.
	Open circuit	Power Pack	Disconnect lead. Check all connections and reconnect.
	Defective milliammeter	Power Pack	Check for secondary high voltage. If voltage is correct. replace meter.



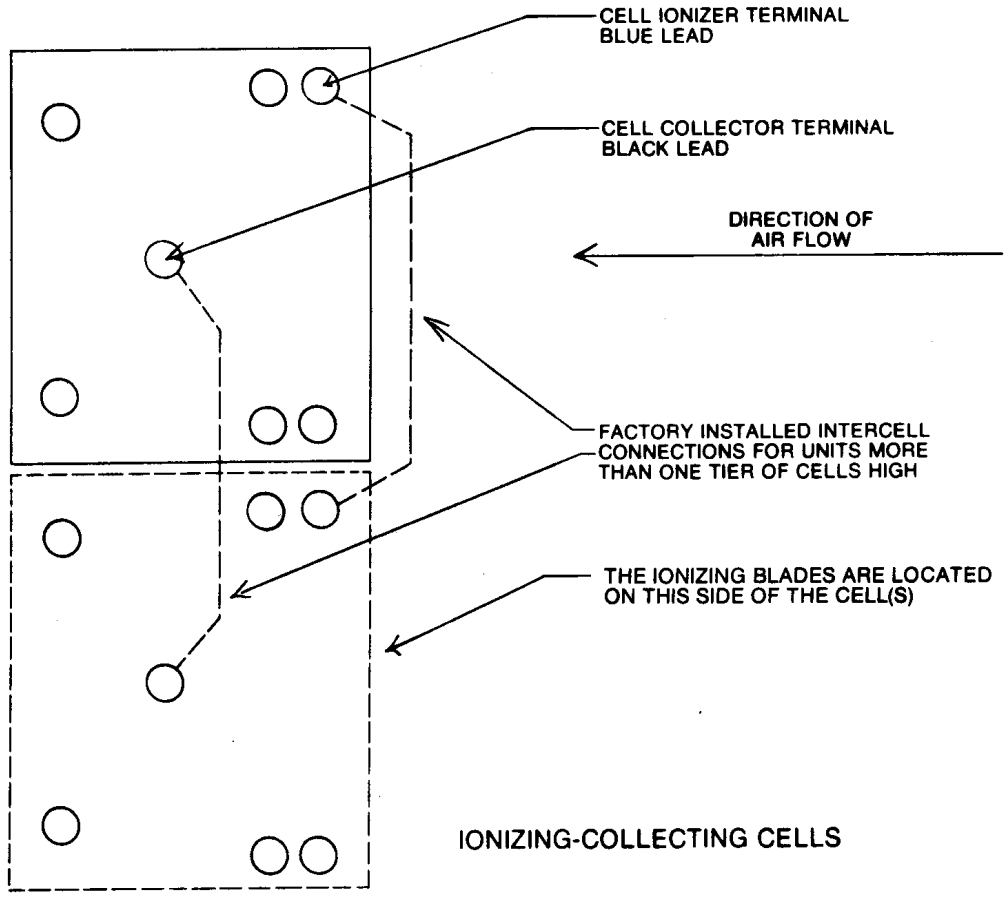
MAIN STEPS IN INSTALLATION:

1. POSITION UNIT Ⓐ
2. ATTACH ADJOINING DUCTWORK Ⓑ
3. MOUNT DETERGENT SYSTEM Ⓒ
4. CONNECT DRAIN Ⓓ
5. CONNECT WASH WATER SUPPLY Ⓔ
6. MOUNT POWER PACK Ⓕ AND CONTROL Ⓖ
7. COMPLETE WIRING (NOT SHOWN)

TITLE	GENERAL COMPONENT ARRANGEMENT	
	FIGURE 1	DWG



POWER PACK

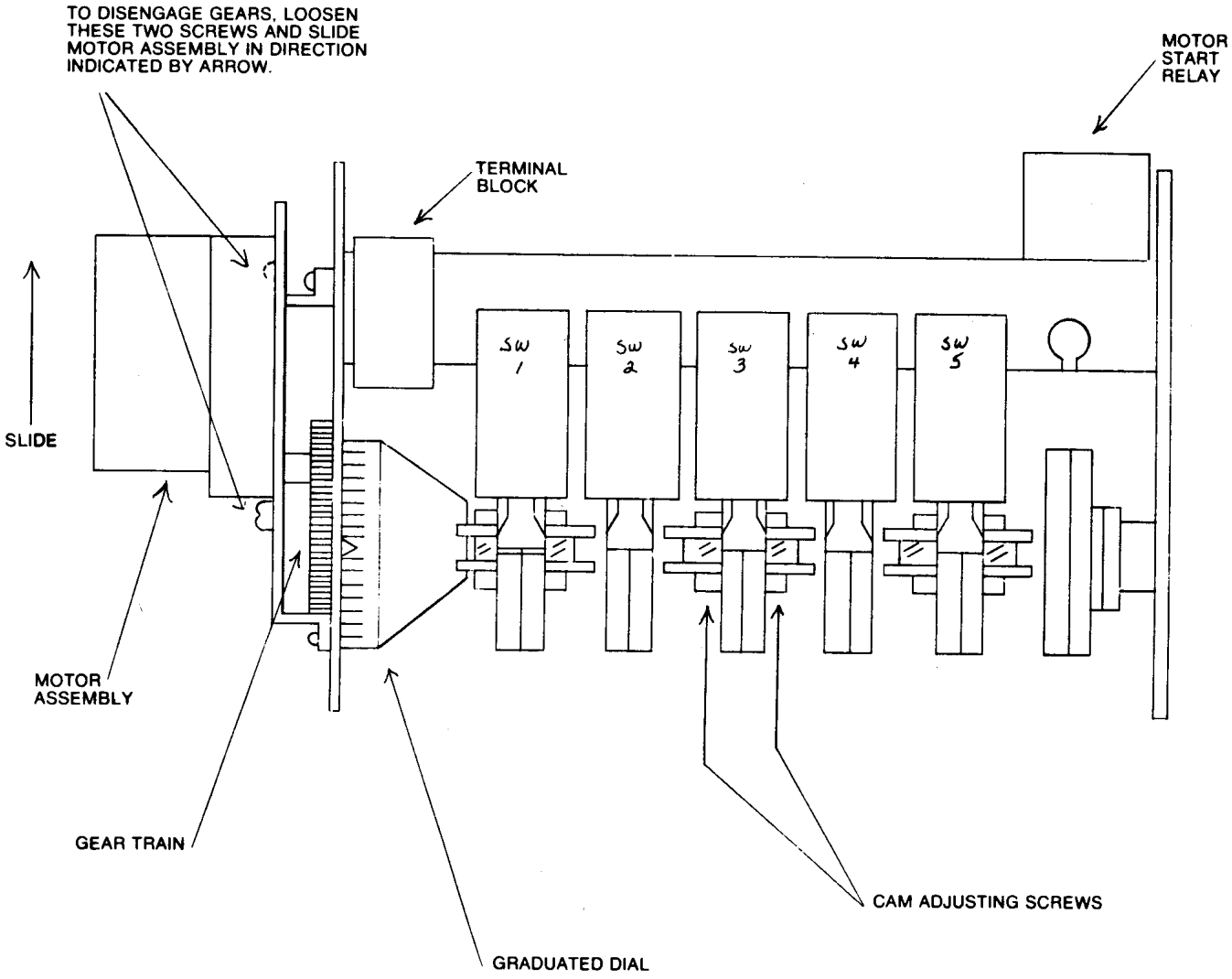


IONIZING-COLLECTING CELLS

TITLE: HIGH VOLTAGE LEAD CONNECTING TERMINALS	
FIGURE 2	DWG

DOUBLE DISC ADJUSTABLE CAMS OPERATE SWITCHES TO CONTROL THE FOLLOWING COMPONENTS:

SWITCH NO.	*COMPONENTS*
1.	TIMER MOTOR
2.	POWER PACK(S)
3.	MANIFOLD MOTORS WASHWATER SOLENOID VALVE DETERGENT PUMP MOTOR
4.	MANIFOLD MOTORS WASHWATER SOLENOID VALVE
5.	SYSTEM BLOWER



TITLE MULTI-CAM TIMER	
FIGURE 3	DWG

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