

**CUSTOM PACKAGED  
ELECTRONIC  
AIR CLEANER**

**Model 441100**

**VENT FOG PRECIPITATOR  
(VFP) 50 CFM**

- INSTALLATION
- OPERATION
- SERVICE

Electrostatic Precipitators for  
Commercial, Military &  
Industrial Applications



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**101 McNeill Road • Sanford, NC 27330**

(919) 775-2201 • Fax: (919) 774-8771 • (800) 884-0002

**[www.trioninc.com](http://www.trioninc.com)**

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## SAFETY SUMMARY

### GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warning and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein.

#### DO NOT REPAIR OR ADJUST ALONE

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charge by capacitors. Circuits must be grounded and all capacitor discharged prior to attempting repairs.

#### TEST EQUIPMENT

Make certain test equipment is in good condition. If a test meter must be held, ground the case of the meter before starting measurement; do not touch live equipment or personnel working on live equipment while holding a test meter. Some types of measuring devices should not be grounded; such devices should not be held when taking measurements.

#### INTERLOCKS

Interlocks are provided for safety of personnel and equipment and should be used only for the purpose intended. They should not be field-shortened or otherwise modified except by authorized maintenance personnel. Do not depend solely upon safety interlocks for protection. Whenever possible, disconnect power at power distribution source.

#### RESUSCITATION

Personnel working with or near high voltage shall be familiar with approved methods of resuscitation. If someone is injured and stops breathing, initiate resuscitation immediately. A delay could cost the victim's life.

## GENERAL PRECAUTIONS

The following general precautions are to be observed at all times.

1. All electrical components associated with this system/equipment shall be installed and grounded in accordance with applicable regulations and approved practices.
2. Special precautionary measures are essential to prevent applying power to the system/equipment at any time maintenance work is in progress.
3. Do not make any unauthorized alterations to equipment or components.
4. Before working on electrical systems/equipment, check with voltmeter to ensure that system is not energized.
5. The precipitator operates at high voltage (6,800 vdc) and low amperes (milliamps) which can cause serious injury.
6. All circuits not known to be “dead” must be considered “live” and dangerous at all times.
7. When working near electricity, do not use metal rules, flashlights, metallic pencils or any other objects having exposed conducting material.
8. Be sure to de-energize all equipment before connecting or disconnecting meter or test leads.
9. When connecting a meter to terminals for measurement, use range higher than expected voltage.
10. Before operating equipment or performing any tests or measurements, ensure that frames and enclosures are securely grounded.
11. High concentrations of ozone can be hazardous to personnel and equipment. The precipitator must not be operated for any prolonged periods without air flowing through the precipitator.



## **WARNINGS AND CAUTIONS**

**Specific warnings and cautions applying to the system/equipment covered by this manual are summarized below. These warnings and cautions appear elsewhere in the manual following paragraph headings and immediately preceding the text to which they apply. They are repeated here for emphasis.**

### **WARNINGS**

- This equipment operates at HIGH VOLTAGE. The normal precaution when working with high voltage must be observed. All access to high voltage is safety interlocked, but high voltage potential may exist in circuits with the power off. All circuits must be discharged to ground before handling to prevent injury or death.  
(Page 13)
- Disassembly of the vent fog precipitator shall not occur unless system is shut down. Failure to shut down the system can result in oil-laden air entering the space causing injury to personnel.  
(Pages 12, 17, 20)
- Ensure all tag-out procedures are in accordance with current instructions.  
(Pages 13, 17)
- The high voltage circuit of the precipitator contains an energy storage capacitor that will retain an electrical charge after the primary power is deenergized. Primary and secondary circuits shall be discharged to ground before handling to prevent injury or death.  
(Pages 13, 17, 19, 20)
- Some lubricating oils are carcinogenic and harmful to the skin. Direct contact with carcinogenic oil shall be avoided.  
(Pages 13, 17, 19, 20)
- Do not operate equipment without flame arrestor screen installed. Operation without flame arrestor screen installed could result in flames feeding back to the lube oil system.  
(Page 22)

## CAUTIONS

- The detergent must not attack the materials of construction (aluminum, glass-reinforced polyester, silicone rubber, and brass). Deterioration of these materials may result in destruction of, or damage to equipment.  
(Page 21)
  
- Ensure the ionizing collecting cell is dry. Water in the ionizing collecting cell will result in arcing or a short circuit causing damage to the equipment.  
(Page 22)
  
- A broken ionizing wire must be completely removed from the ionizing collecting cell. A portion of the wire remaining in the cell can cause an electrical short circuit.  
(Page 23)
  
- Exercise care to prevent loosened tie rods from slipping onto the cell to dislodge spacers.  
(Page 24)
  
- Special procedures are required for the removal of a tie rod to prevent spacers from becoming disconnected.  
(Page 26)
  
- Tie rods shall be reversed one at a time until all are completed to prevent damage to equipment.  
(Page 26)

# CHAPTER 1

## GENERAL INFORMATION AND SAFETY PRECAUTIONS

### 1-1 SAFETY PRECAUTIONS.

Warnings and cautions appearing throughout this technical manual are of paramount importance to personnel and equipment safety. Prior to any attempt to operate, maintain, troubleshoot or repair any part of the vent fog precipitators, all warnings and cautions should be thoroughly reviewed and understood. Refer to the Safety Summary, which appears in the front matter of this manual. The following paragraphs define warnings, cautions and notes as they are used in this manual.

#### CAUTION

Exercise care to prevent loosened tie rods from slipping onto the cell to dislodge spacers.  
(Page 24)

#### NOTE

Notes are used to highlight certain operating or maintenance conditions or statements which are essential, but not of known hazardous nature as indicated by warnings and cautions.

### 1-2 INTRODUCTION. (See Table 1-1.)

The vent fog precipitator described in this manual is a two-stage electrostatic precipitator. It is a high efficiency air filter for removing fine particles of oil mist from an air stream passing through the precipitator. The oil mist particles are collected by electrostatic force in the precipitator and flow by gravity back to the designated collection point.

### 1-3 LUBE OIL VENTS.

1-3.1 The primary purpose of vents in a lube oil system is to provide a means for the system to breathe. Breathing is induced by changes in the temperature, by changes in the volume of oil in the system, by the actions of operating machinery, and by movement of the oil in the system. The breathing process permits air to flow both in and out of the lube oil system.

1-3.2 Particles of oil mist generated by the operation of the machinery are contained in the air space of the lubrication system. The larger particles settle out by gravity leaving only the fine particles suspended in the air. The fine particles tend to flow through the lube oil vent to the atmosphere with the vented air. The vent fog precipitator, mounted to the lube oil vent, removes the oil mist particles from the vented air.

**Table 1-1. Equipment Supplied**

Quantity	Nomenclature	Model No.	Dimension	Weight & Volume
1 each	Vent Fog Precipitator, 50 CFM	441100	11-1/4 x 10-1/8 x 26 H (Uncrated)	AP 55 lbs. 1.72 Ft <sup>3</sup>

1-4 **EQUIPMENT DESCRIPTION.** (See figure 1-1.)

1-4.1 The equipment consists of an ionizing collecting cell, high voltage power supply, flame arrestor, and oil drain system, all contained in the precipitator housing.

1-4.2 The surge relief valve acts as relief to prevent pressure buildup if a dehumidifier is installed and activated.

1-4.3 The oil drain system permits the collected oil to flow from the precipitator to a designated collection point.

1-4.4 See figure 1-2 for operating performance curve.

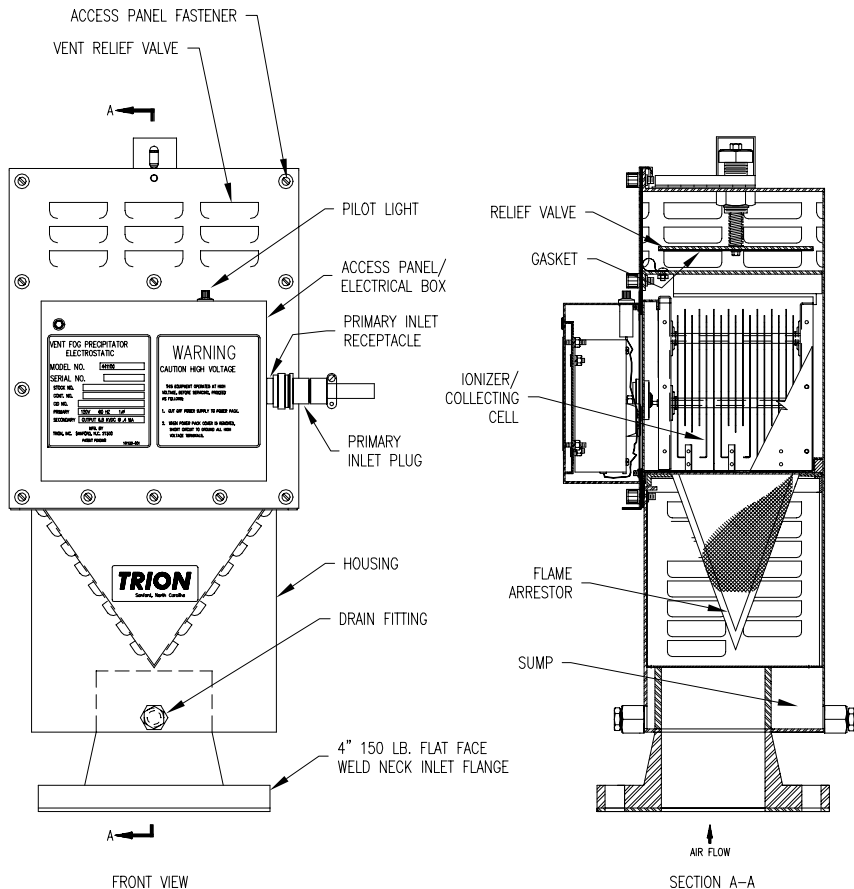


FIGURE 1-1 Vent Fog Precipitator  
(Model 441100)

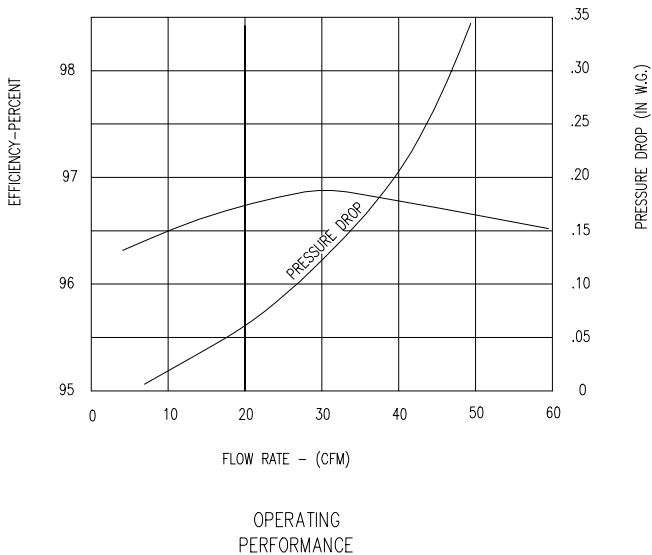


FIGURE 1-2 Operating Performance Curve

## **CHAPTER 2**

### **OPERATION**

#### **2-1 INTRODUCTION.**

- 2-1.1 The vent fog precipitator is designed to remove oil mist particles from an air stream flowing from a lube oil system vent. The particles are removed by electrostatic force and are collected in the precipitator's sump. The collected oil flows back to the designated drain systems and the cleaned air stream is vented to the atmosphere.
- 2-1.2 The electrical circuit is self-regulated and self-protected, requiring no adjustments or controls. There are no moving parts requiring adjustments.

#### **2-2 CONTROLS AND INDICATORS.** (See figure 1-1.)

- 2-2.1 The operating condition of the precipitator is indicated by a pilot light on the precipitator access panel. The pilot light is powered from the secondary high voltage circuit. The pilot light will glow when the high voltage output of the power supply is sufficient for efficient operation of the precipitator.
- 2-2.2 Failure of the pilot light to glow, with the precipitator electrically energized, or flickering of the pilot light are indications of faulty operation. (Refer to Chapter 5, Troubleshooting.)

#### **2-3 OPERATING PROCEDURE.** (See figure 1-1.)

- 2-3.1 **STARTUP.** (See figure 1-1.) To start up the vent fog precipitator, follow the procedure outlined below.
- a. Apply primary power to the power pack.
  - b. Ensure the pilot light is illuminated. A steady glow indicates proper operation of the precipitator. Failure of the pilot light to illuminate or a flickering pilot light indicates faulty operation. (Refer to Chapter 5, Troubleshooting.)

**WARNING**

Operation of the reduction gear without the vent fog precipitator will result in fog build up causing injury to personnel.

2-3.2 **SHUTDOWN.** (See figure 1-1.) To shut down the vent fog precipitator, de-energize primary power to the power pack.



## CHAPTER 3

### FUNCTIONAL DESCRIPTION

#### **3-1 INTRODUCTION.**

- 3-1.1 The vent fog precipitator is designed to remove particles of oil mist from an air stream passing through the precipitator. It is designed for flange mounting to mate with the vent system flange.
- 3-1.2 The equipment consists of an electrostatic precipitator and high voltage power supply enclosed in a sheet metal housing. The relief valve and oil drain systems are incorporated in the precipitator housing.

#### **3-2 SYSTEM OPERATION. (See figure 1-1.)**

- 3-2.1 Oil-laden air flows from the machinery lube oil vents to the precipitator. The air stream enters the precipitator through the inlet flange and the flame arrestor screen. Oil particles that are collected by impingement on the flame arrestor screen and unit housing flow by gravity back to the precipitator's sump.
- 3-2.2 The air stream flows through the ionizing collecting cell where the oil particles are removed by electrostatic force. The collected oil particles accumulate in the precipitator inlet plenum and flow by gravity to the precipitator's sump. The oil drains to the designated collection point. The cleaned air stream is vented to the atmosphere.

#### **3-3 PRECIPITATOR OPERATION. (See figure 1-1.)**

- 3-3.1 The precipitator power supply converts the nominal 115-volt, single-phase, 60-hertz electrical power to the high voltage dc power necessary to energize the precipitator ionizing collecting cell.
- 3-3.2 In the first operating stage in the precipitator, the air stream passes through the ionizing section where all particles in the air stream receive and electrical charge. The ionizing section consists of fine tungsten ionizing wires suspended between electrically grounded parallel aluminum plates. The ionizing wires are charged with the nominal 6.8 KVDC, +/- 0.2 KVDC, output of the power supply. The voltage potential between the charged ionizing wire and the grounded plates creates an intense non-uniform electric field, which

produces a corona discharge and ionized the air. All particles passing through the electric field receive an electric charge.

3-3.3 In the second operation stage, the air stream passes through the collecting section where the charged particles are removed. The collecting section consists of a series of equally spaced parallel plates parallel to the direction of airflow. Each alternate plate is electrically grounded while the interleaving plates are charged with the nominal 6.8 KVDC output of the power supply. The charged particles from the ionizing section are repelled by the charged collector plates and are attracted to and collected on the grounded collector plates.

3-3.4 As the collected oil accumulates on the collector plates, it flows by gravity to the precipitator's sump. The cleaned air stream is vented to atmosphere.

### **3.4 PRECIPITATOR COMPONENTS.**

3-4.1 **PRECIPITATOR.** The precipitator is made up of a sheet metal housing, access panel assembly, ionizing collecting cell assembly, flame arrestor, and relief valve.

3-4.2 **PRECIPITATOR HOUSING.** The housing is made of stainless steel. The air inlet portion of the housing has a 4-inch flat face flange welded to it, which is used to connect the precipitator to the vent system flange. This portion of the housing contains permanent baffles and a drain fitting.

3-4.3 **ACCESS PANEL/ELECTRICAL BOX.** All electrical components for supplying power to the ionizing collecting cell are located in the access panel/electrical box. The access panel/electrical box, when removed from the precipitator, permits component removal for service or repair.

3-4.4 **IONIZING COLLECTING CELL.** Oil mist particles are removed from the air stream passing through the ionizing collecting cell. Refer to paragraph 3-3.2 under Precipitator Operation.

3-4.5 **FLAME ARRESTOR.** A removable flame arrestor screen is located at the inlet to the precipitator housing. The flame arrestor screen is accessible through the precipitator access panel/electrical box and consists of a triple-wall, fine-mesh conical screen with a rectangular frame.

3-4.6 **RELIEF VALVE.** A spring-loaded relief valve is located in the outlet of the precipitator housing. It is in the open position for normal operation. It is manually closed to prevent moist air from entering a gear case when the system is shut down and to obtain a closed-loop system if a dehumidifier is installed and activated. It also acts as a relief to prevent pressure buildup during dehumidifier.

## **CHAPTER 4**

### **SCHEDULED MAINTENANCE**

#### **4-1 INTRODUCTION.**

- 4-1.1 There are no moving parts to the precipitator that are subject to wear. The precipitator is not subject to wear or deterioration. It is designed for collecting oil mist and is essentially self-cleaning as the collected oil drains by gravity.
- 4-1.2 In actual practice, products of combustion, fine metallic products from machinery wear, and other solid particulate matter are collected in addition to the oil. The collected solid material may accumulate in the collecting cell and cause electrical arcing between the collector plates. In addition, particles collected on the ionizing wires will cause a decrease in the oil mist collection efficiency of the precipitator.
- 4-1.3 The scheduled maintenance instructions in this manual are intended to duplicate those furnished in the Planned Maintenance System (PMS). In case of conflicts, the PMS documentation takes precedence. Such conflicts should be reported immediately on the user comment sheet in accordance with the maintenance procedures for this manual.

#### **4-2 MAINTENANCE SCHEDULE.**

Maintenance for the Model 441100 precipitator shall be scheduled as shown in table 4-1.

**Table 4-1. Maintenance Schedule**

Frequency	Maintenance Action
During Operation	Monitor pilot light for continuous illumination. If pilot light flickers or fails to illuminate, refer to Chapter 5, Troubleshooting
<p>NOTE</p> <p>The frequency of cleaning shall be increased if the need for cleaning is indicated by reduced collecting efficiency or electrical arcing. Reduced efficiency can be determined by observing the air outlet of the precipitator for a visible penetration of oil mist or by a gradual accumulation of oil fog in the machinery space atmosphere. Electrical arcing can be determined by observing the pilot light. The light will flicker with arcing in the precipitator.</p>	
Quarterly	Clean and inspect precipitator in accordance with paragraph 6-3.2.

## CHAPTER 5 TROUBLESHOOTING

### 5-1 INTRODUCTION.

- 5-1.1 Normal operation of the precipitator is indicated by a steady glow of the pilot light and no visible emission of oil mist from the precipitator.
- 5-1.2 Faulty operation of the precipitator is indicated by the pilot light out, the pilot light flickering or a visible emission of oil mist.

### 5-2 TROUBLESHOOTING CHART.

When incorrect operation is observed, it is often possible to reduce the overall servicing time by studying all the symptoms and information in table 5-1.

**Table 5-1. Vent Fog Precipitator Troubleshooting Guide**

Symptoms	Probable Cause	Remedy
1. Pilot light on with visible emission of oil fog in exhaust.	1. Open secondary circuit. 2. Build up of matter on ionizing wires.	1. Refer to paragraph 5-3.3. 2. Refer to paragraph 5-3.3.
2. Flickering pilot light with no visible emission of oil fog in exhaust.	1. Electrical arcing.	1. Refer to paragraph 5-3.2.
3. Flickering pilot light with visible emission of oil fog in exhaust.	2. Electrical arcing.	1. Refer to paragraph 5-3.2.
4. Pilot light with no visible emission of oil fog in exhaust.	1. Pilot light failure	2. Refer to paragraph 5-3.4.
5. Pilot light off with visible emission of oil fog in exhaust.	1. Short circuit.	1. Refer to paragraph 5-3.1.

### 5-3 TROUBLESHOOTING PROCEDURES.

**WARNING**

This equipment operates at HIGH VOLTAGE. The normal precautions when working with high voltage must be observed. All access to high voltage is safety interlocked, but high voltage potentials may exist in circuits with the power off. All circuits must be discharged to ground before handling to prevent injury or death.

**WARNING**

Disassembly of the vent fog precipitator shall not occur unless system is shut down. Failure to shut down the system can result in oil-laden air entering the space causing injury to personnel.

5-3.1 **SHORT CIRCUIT.** (See figure 5-1.) A short circuit is indicated by the pilot light off and a visible emission of oil mist from the precipitator. Locating the problem requires working with electrically energized circuits and access to high voltage. A short circuit can occur in either the precipitator or the power pack. The location of the fault can be isolated by a process of elimination, using a voltage tester.

5-3.1.1 Short Circuit Isolation. To isolate the fault and determine whether the problem is in the ionizing-collection cell or access panel/electrical box, perform the following:

**WARNING**

Ensure all tag-out procedures are in accordance with current shipboard instructions.

- a. De-energize electrical power to precipitator and tag OUT OF SERVICE.
- b. Unscrew the 115 VAC primary input plug by turning counterclockwise and remove from receptacle.

**WARNING**

The high voltage circuit of the precipitator contains an energy storage capacitor that will retain an electrical charge after the primary power is deenergized. Primary and secondary circuits shall be discharged to ground before handling to prevent injury or death.

**WARNING**

Some lubricating oils are carcinogenic and harmful to the skin. Direct contact with carcinogenic oil shall be avoided.

- c. Remove the access panel/electrical box by disengaging the ten fasteners securing the access panel by turning each fastener counterclockwise.
- d. Discharge to ground high voltage contacts. Use a grounding probe to discharge to ground the high voltage contact on the access panel/electrical box and the high voltage contact on the ionizing collecting cell.
- e. Attach a ground clip from unpainted surface of access panel/electrical box housing to a known ground.
- f. With access panel/electrical box free from precipitator housing, reattach 115 VAC primary input plug and support access panel/electrical box so that high voltage contact is not touching anything and pilot light is visible.
- g. Activate ac power to precipitator and depress safety interlock switch. If the pilot light remains off, the fault is indicated to be in the access panel/electrical box; refer to paragraph 5-3.1.2. If the pilot light is on, the fault is indicated to be in the precipitator; refer to paragraph 5-3.1.3.
- h. De-energize electrical power by removing 115 VAC primary input plug from access panel/electrical box primary receptacle.



- i. Discharge to ground high voltage contact. Use grounding probe to discharge to ground the high voltage contact on the access panel/electrical box.

5-3.1.2 Access Panel/Electrical Box Short Circuit. (See figure 5-1.) To isolate the fault, perform the following:

- a. Remove the panel from the back of the access panel/electrical box by removing the seven retaining screws.
- b. Attach a ground clip from an unpainted surface of the access panel/electrical box housing to a known ground.
- c. Activate ac power to access panel/electrical box.
- d. Close interlock by depressing plunger.
- e. Test for presence of 115 VAC at power supply terminal board, by using voltmeter to test at terminals marked 2 and 3.
- f. If voltage is present and primary leads are firmly secured to terminal board replace power supply. If 115 VAC is not present at terminals marked 2 and 3, continue to step g.
- g. Test for power to interlock by using voltmeter to test for 115 VAC between black wire from interlock to power supply terminal board terminal 1 and white wire from power supply terminal board terminal 3 to three-pin receptacle.
- h. If voltage is present to interlock, replace interlock. If 115 VAC is not present at interlock, trace ac circuit to the source.
- i.

5-3.1.3 Precipitator Short Circuit. (See figure 5-1.) If the fault is indicated to be in the precipitator, perform the following:

- a. Lift ionizing collecting cell from precipitator housing. (See figure 6-1.)
- b. Visually inspect cell for the following indications of a short circuit. Clean the cell if necessary. Refer to paragraph 6-3.2, Component Cleaning.
  1. Broken ionizing wire in accordance with paragraph 6-4.2
  2. Bent or misaligned collector plates in accordance with paragraph 6-4.5.
  3. Electrical tracking on insulators in accordance with paragraphs 6-4.3 and 6-4.
  4. Foreign matter between collector plates in accordance with paragraph 6-3.2.

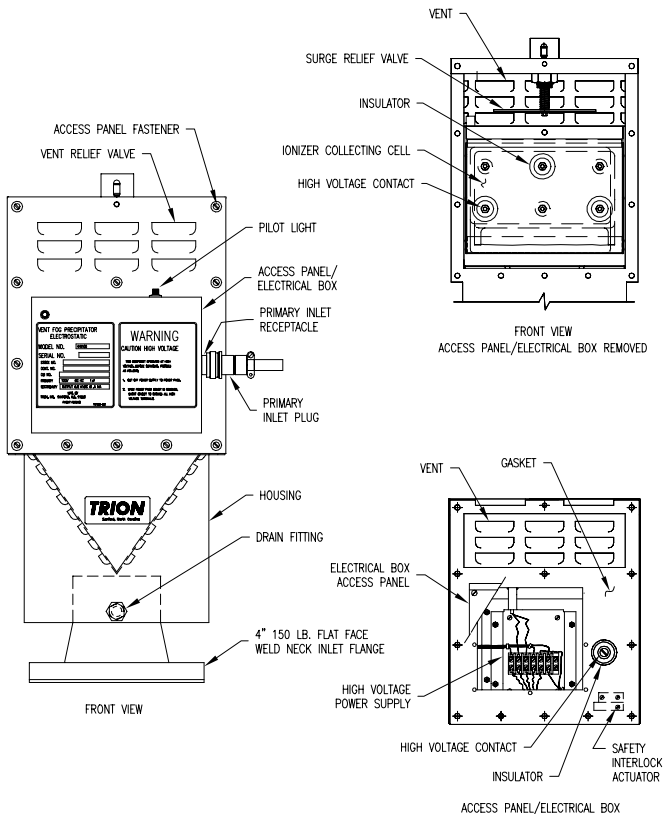


FIGURE 5-1 Access Panel/Electrical Box

### 5-3.2 ELECTRICAL ARCING.

5-3.2.1 Electrical arcing is indicated by a flickering of the pilot light as the light momentarily goes off with each arc. Arcing is usually caused by a decrease in distance between two points of different electrical potential, either through air or across an insulated surface.

5-3.2.2 Occasional arcing, one approximately every 5 minutes, is normal. Frequent arcing can reduce collecting efficiency and can cause electrical components of the power supply to overheat and fail.

5-3.2.3 Arcing most often occurs in the collecting cell resulting from foreign matter which can be removed by cleaning the cell (paragraph 6-4.5) or by a bent or deformed high voltage contact spring failing to make a firm connection to the access panel contact.

5-3.3 **OPEN SECONDARY CIRCUIT.** An open secondary circuit will result in a visible emission of oil mist from the precipitator with the pilot light on. It usually results from the failure of the high voltage output of the power supply to reach the ionizing collection cell. The same indication can be the result of a build up of matter on the ionizing wires.

To locate the fault, perform the following:

**WARNING**

Ensure all tag-out procedures are in accordance with current instructions.

- a. De-energize electrical power to precipitator and tag OUT OF SERVICE
- b. Unscrew the 115 VAC primary input plug by turning counterclockwise and remove from receptacle.

**WARNING**

The high voltage circuit of the precipitator contains an energy storage capacitor that will retain an electrical charge after the primary power is deenergized. Primary and secondary circuits shall be discharged to ground before handling to prevent injury or death.

**WARNING**

Some lubricating oils are carcinogenic and harmful to the skin. Direct contact with carcinogenic oil shall be avoided.

- c. Remove access panel/electrical box by disengaging the ten fasteners securing it to the housing.
- d. Discharge to ground high voltage contacts. Use grounding probe to discharge to ground the high voltage contact on the access panel/electrical box and the high voltage contact on the ionizing collecting cell.
- e. Remove the panel from the back of the access panel assembly by removing the seven retaining screws.
- f. Ensure high voltage lead is firmly connected to the high voltage contact.

**WARNING**

Disassembly of the vent fog precipitator shall not occur unless system is shut down. Failure to shut down the system can result in oil-laden air entering the space causing injury to personnel.

- g. Lift ionizing cell from the precipitator housing. (See figure 5-1.)
- h. Visually inspect cell to ensure all six ionizing wires are installed and cleaned in accordance with 6-3.2.1, step e, and paragraph 6-4.2.

5-3.4 **PILOT LIGHT FAILURE.** The failure of the pilot light is indicated by the indicator light out with the precipitator operating and no visible emission of oil mist. To locate the fault, perform the following:

- a. Secure ac power to precipitator.
- b. Unscrew the 115 VAC primary input plug by turning counterclockwise and remove from receptacle.

**WARNING**

The high voltage circuit of the precipitator contains an energy storage capacitor that will retain an electrical charge after the primary power is deenergized. Primary and secondary circuits shall be discharged to ground before handling to prevent injury or death.

**WARNING**

Some lubricating oils are carcinogenic and harmful to the skin. Direct contact with carcinogenic oil shall be avoided.

- c. Remove access panel/electrical box by disengaging the ten fasteners securing it to the housing.
- d. Discharge to ground high voltage contacts. Use a grounding probe to discharge to ground the high voltage contact on the access panel/electrical box and the high voltage contact on the ionizing collecting cell.
- e. Remove the panel from the back of the access panel assembly by removing the seven retaining screws.
- f. Ensure two light circuit leads are firmly secured to power supply terminal board.
- g. Attach a ground clip from unpainted surface of access panel/electrical box housing to known ground.
- h. Reconnect ac primary input plug. Ensure primary ac circuits are energized.
- i. Using a voltmeter, measure the voltage across pilot light terminals at power supply terminal board terminals marked 4 and 5. (The voltage should be in the range of 1.2 to 2.2 VAC.)
- j. If voltage is present across pilot light terminals, replace the pilot light assembly.
- k. If voltage is not present across the pilot light terminals, replace power supply.

## CHAPTER 6

### CORRECTIVE MAINTENANCE

#### 6-1 INTRODUCTION.

This chapter contains detailed instructions for the disassembly, repair, and reassembly of components of the vent fog precipitator.

#### SECTION I. ADJUSTMENTS AND ALIGNMENT

#### 6-2 ADJUSTMENT AND ALIGNMENT.

All parts of the vent for precipitator are reassembled or replaced using predrilled or preset guides. No adjustment or alignment is required.

#### SECTION II. REPAIR

#### 6-3 DISASSEMBLY/REASSEMBLY OF VENT FOG PRECIPITATOR.

6-3.1 **PRECIPITATOR DISASSEMBLY.** (See figure 1-1.) To disassemble the precipitator for cleaning, perform the following.

#### WARNING

The high voltage circuit of the precipitator contains an energy storage capacitor that will retain an electrical charge after the primary power is deenergized. Primary and secondary circuits shall be discharged to ground before handling to prevent injury or death.

#### WARNING

Some lubricating oils are carcinogenic and harmful to the skin. Direct contact with carcinogenic oil shall be avoided.

**WARNING**

Disassembly of the vent fog precipitator shall not occur unless system is shut down. Failure to shut down the system can result in oil-laden air entering the space causing injury to personnel.

- a. Tag “Out of Service” and secure AC power to precipitator.
- b. Unscrew the 115 VAC primary input plug by turning counterclockwise, and remove from receptacle.
- c. Disengage the 10 fasteners securing the access panel/electrical box to precipitator housing by turning each fastener counterclockwise.
- d. Remove access panel/electrical box from precipitator housing.
- e. Use grounding probe to discharge to ground the high voltage contact on the access panel/electrical box and high voltage contact on the ionizing collecting cell.
- f. Lift ionizing collecting cell from precipitator housing and set in a safe area.
- g. Lift flame arrestor screen from precipitator housing and set in a safe area.
- h. Visually inspect gaskets for cracks or wear; replace if required.

**6-3.2 COMPONENT CLEANING.**

6-3.2.1 The ionizing collecting cell and flame arrestor screen can be cleaned by soaking in a mild detergent and warm water solution. Clean components as follows:

**CAUTION**

The detergent must not attack the materials of construction (aluminum, glass-reinforced polyester, silicone rubber, and brass). Deterioration of these materials may result in destruction of, or damage to equipment.

**NOTE**

Better cleaning action can be achieved by agitating the water solution with compressed air to create bubbles to flow between the collector plates to help remove collected material.

- a. Place components in cleaning solution and allow soaking until particulate matter is loosened.
- b. After soaking, flush components with a mild spray of warm water to remove detergent and remaining particulate matter.
- c. Inspect ionizing collecting cell for cleanliness by looking through cell toward a light source. Ensure all large particles are removed. If not, resoak.
- d. Clean insulators with a cloth or soft brush. (See figure 6-1.)
- e. Remove any accumulation of ionizing-wires with lint-free cloth. (See figure 6-1.)
- f. Inspect cell for bent or misaligned collector plates that could cause electrical arcing. Ensure there are no broken or missing ionizing wires. Replace wires in accordance with paragraph 6-4.2. (See figure 6-1.)
- g. Clean electrical box contacts with a cloth. (See figure 5-1.)
- h. Inspect flame arrestor screen for cleanliness and structural damage.

**6-3.3 PRECIPITATOR REASSEMBLY. (See figure 1-1.)** To reassemble precipitator, perform the following:

**WARNING**

Do not operate equipment without flame arrestor screen installed. Operation without flame arrestor screen installed could result in flames feeding back to the lube oil system.

- a. Install flame arrestor screen in precipitator inlet.



**CAUTION**

Ensure the ionizing collecting cell is dry. Water in the ionizing collecting cell will result in arcing or a short circuit causing damage to the equipment.

- b. Install ionizing collecting cell with ionizing wires facing toward the flame arrester screen and the high voltage contact facing outward. The ionizing collector cell is indexed and will only fit the housing in this position.
- c. Install and secure access pane/electrical box.
- d. Connect ac primary input plug to receptacle.
- e. Remove safety tags and energize precipitator electrical circuits.
- f. Observe pilot light for a steady glow. If pilot light is not on or is flickering (indicating electrical arcing), refer to the troubleshooting procedures.

**6-4 IONIZING COLLECTING CELL REPAIRS. (See figure 7-3.)**

6-4.1 **COLLECTING SECTION.** Disassembly of the collector plates in the collecting section of the ionizing collection cell is a depot level function and is not provided in this manual.

6-4.2 **IONIZING WIRE REPLACEMENT.** (See figure 7-3.) To replace ionizing wires, perform the following:

**CAUTION**

A broken ionizing wire must be completely removed from the ionizing collecting cell. A portion of the wire remaining in the cell can cause an electrical. Ensure the ionizing collecting cell is dry. Water in the ionizing collecting cell will result in arcing or a short circuit causing damage to the equipment.

- a. Disassemble the precipitator in accordance with paragraph 6-3.1.
- b. Grip one terminal of ionizer wire (3) with needlenose pliers.

- c. Attach opposite terminal end in the slot of one of the ionizing wire supports (7).
- d. Stretch wire and install terminal end, gripped by needlenose pliers, in the opposing slot of opposite ionizer wire support.
- e. Reassemble precipitator in accordance with paragraph 6-3.3.

6-4.3 **IONIZER INSULATOR REPLACEMENT.** (See figure 7-3.) To replace ionizer, perform the following:

- a. Disassemble the precipitator in accordance with paragraph 6-3.1.
- b. Remove ¼-20 nut (9); lift insulator (2) from tie rod (4).
- c. Set new insulator on the rod and reverse step b.
- d. Reassemble precipitator in accordance with paragraph 6-3.3.

6-4.4 **COLLECTOR INSULATOR REPLACEMENT.** (See figure 7-3.) The collector insulators are mounting brackets for the tie rods that support the collector plates. The tie rods are bolts with a bolthead on one end and a nut on the other end.

6-4.4.1 To replace the insulator on the nut end of the rod, perform the following:

- a. Disassemble the precipitator in accordance with paragraph 6-3.1.

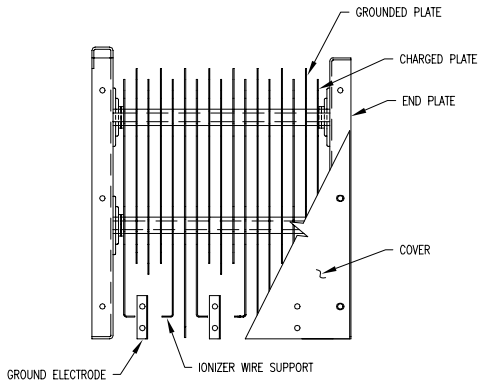
**CAUTION**

Exercise care to prevent loosened tie rods from slipping into the cell to dislodge spacers.

- b. Remove ¼-20 nut (9) while holding bolt end. Lift insulator (2) from tie rod (4).
- c. Before installing replacement insulator (2), support both ends of tie rods (4) to prevent their slipping into a cell.
- d. Set new insulator on the rods and reverse step b.
- e. Reassemble precipitator in accordance with paragraph 6-3.3.

6-4.4.2 To replace insulator on the bolt end of the tie rod, perform the following:

- a. Disassemble the precipitator in accordance with paragraph 6-3.1.



VIEW A-A

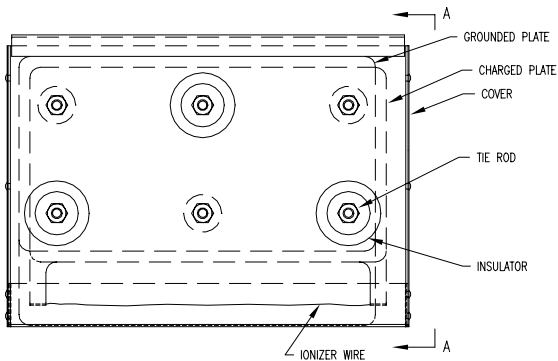


FIGURE 6-1 Ionizing Collecting Cell

**CAUTION**

Special procedures are required for the removal of a tie rod to prevent spacers from becoming disconnected.

**CAUTION**

Tie rods shall be reversed one at a time until all are completed to prevent damage to equipment.

- g. Remove ¼-20 nut (9) from one tie rod (4) while holding bolt end.
- h. Use ¼-inch diameter straight rod, approximately 10 to 12 inches long, to carefully push loosened tie rod (4) through cell.
- i. Replace insulator in accordance with paragraph 6-4.4.1, steps c and d.
- j. Use removed tie rod (4) to carefully push straight rod through cell to reverse direction of tie rod.
- k. Replace insulator in accordance with paragraph 6-4.4.1, steps c and d.
- l. Reassemble precipitator in accordance paragraph 6-3.3.

6-4.5 **COLLECTOR PLATE REPAIR.** Disassembly of the cell to repair or replace damaged collector plates is not recommended. If bent collector plates are visible at the outlet end of collector, perform the following:

- a. Use needlenose pliers or flat blade screwdriver to straighten plate. Avoid putting sharp bends in the plate, which will cause electrical arcing.
- b. Observe plates to ensure plates are equally spaced and plates are straight.

**6-5 POWER SUPPLY REPLACEMENT. (See figure 7-2.)**

- 6-5.1 To remove the power supply, follow instructions as shown on Figure 8-3, steps 1 through 9.
- 6-5.2 To replace the power supply, follow instructions as shown on Figure 8-3, steps 10 through 17.

**6-6 FLAME ARRESTOR REPLACEMENT. (See figure 1-1.)**

To replace the flame arrestor, follow procedures as provided in paragraph 6-3.1, steps a through g, and paragraph 6-3.3

**6-7 ACCESS PANEL INSULATOR REPLACEMENT. (See figure 7-2.)**

- a. Disassemble the precipitator in accordance with paragraph 6-3.1, steps a through e, and paragraph 6-5.1, step a.
- b. Remove screw while holding nut and remove high voltage lead, insulators (12) and spacer (13).
- c. To replace, install new insulators and reverse step b.
- d. Reassemble precipitator in accordance with paragraph 6-3.3.

**6-8 PILOT LIGHT REPLACEMENT. (See figure 7-2.)**

- a. Disassemble the precipitator in accordance with paragraph 6-3.1, steps a through e and paragraph 6-5.1, step a.
- b. Disconnect wire from power supply terminal board.
- c. Remove pilot light assembly (5) from access panel.
- d. To replace, install new pilot light assembly and reverse steps b and c.
- e. Reassemble precipitator in accordance with paragraph 6-3.3.

## **CHAPTER 7**

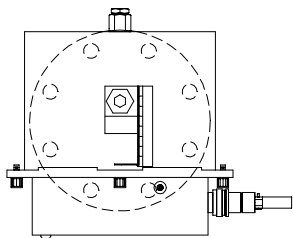
### **PARTS LIST**

#### **7-1 INTRODUCTION.**

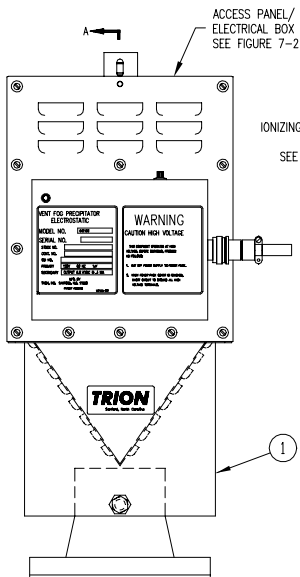
- 7-1.1 **COMPONENTS.** The major components of the precipitator are illustrated on figure 7-1 and identified on the accompanying parts list. The major subassemblies are referenced on the precipitator parts list and illustrated on figures 7-2 and 7-3 with component parts listed on the accompanying parts lists.
- 7-1.2 **DATA PLATE.** The data plate on the precipitator identifies the model number of the precipitator. The model number is also shown on figure 7-2 and accompanying parts lists.
- 7-1.3 **PARTS IDENTIFICATION.** To locate and identify parts, refer to appropriate figure, locate figure, and index number. Refer to parts list and locate figure and index number, in which you will find tabulated on the line description, quantity per assembly, contractor and government entity number, and manufacturing part number.

**Table 7-1. List of Manufacturers**

Manufacturer	CAGE	Manufacturer	CAGE
Amphenal/Broadview II Bunker Ramo 8201 Corporate Dr. No. 740 Landover, MD 20785-2230	02660	Micro Switch Div. of Honeywell 11 W. Spring St. Freeport, IL 61032-4316	91929
Parker-Hannifin Corp. Tube Fitting Division 3885 Gateway Blvd. Columbus, OH 43228	30780	Southa Co., Inc. 210 North Brinton Lake Road Concordville, PA 19331	94222
American Nut & Bolt Fastener Corporation Pittsburgh, PA	73436	Trion, Inc. 101 McNeill Road Sanford, NC 27330	95802
Waldes Kohinoor Inc. 47 16 Austel Pl. Long Island City, NY 11101-4402	79136	Wright Mfg. Co. 5677 Airline Rd. PO Box 100 Arlington, TN 38002	13165
Heyco Molded Products PO Box 160 Kenilworth, NJ 07033	28520		



TOP VIEW



FRONT VIEW

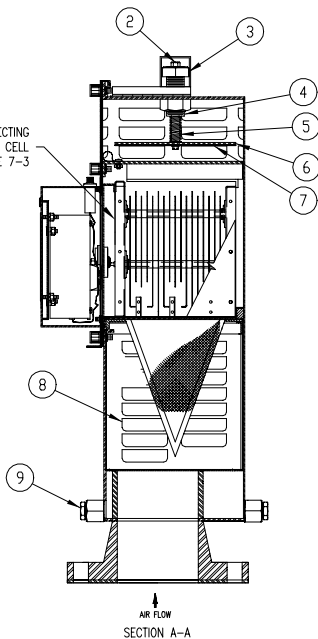
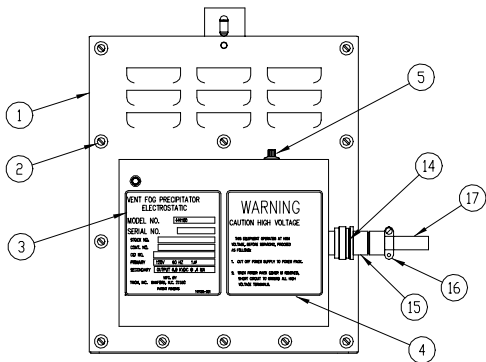


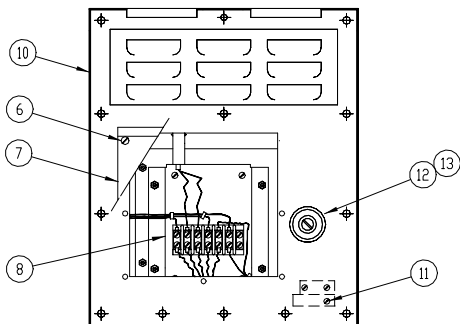
FIGURE 7-1 Vent Fog Precipitator  
(Model 441100)



FIGURE AND INDEX NO.	DESCRIPTION	QTY	CAGE	PART NUMBER/FSN
7-1-0	VENT FOG PRECIPITATOR MODEL 441100	1	95802	441100-001/1H 4460-01-311-3732
7-1-1	HOUSING WELDED ASSEMBLY	1	95802	441037-001
7-1-2	DISK VALVE ROD	1	95802	141050-001
7-1-3	DISK VALVE SCREW	1	95802	141109-001
7-1-4	RETAINER RING	1	79136	141045-001
7-1-5	COMPRESSION SPRING	1	95802	123683-003
7-1-6	DISK VALVE	1	95802	241108-001
7-1-7	GASKET	1	95802	341065-002
7-1-8	FLAME ARRESTOR	1	95802	444126-001
7-1-9	PIPE PLUG	1	30780	141283-001



FRONT VIEW



REAR VIEW

FIGURE 7-2 Access Panel/Electrical Box

FIGURE AND INDEX NO.	DESCRIPTION	QTY	CAGE	PART NUMBER/FSN
7-2-0	ACCESS PANEL/ELECTRICAL BOX ASSEMBLY	1	95802	341382-001
7-2-1	ACCESS PANEL/ELECTRICAL BOX WELDED ASSEMBLY	1	95802	341062-001
7-2-2	CAPTIVE SCREW ¼-20	10	94222	141081-001
7-2-3	DATA PLATE	1	95802	141133-001
7-2-4	WARNING PLATE	1	95802	129181-001
7-2-5	PILOT LIGHT LED ASSEMBLY	1	95802	241101-011
7-2-6	RETAINING SCREWS, COVER	7	73436	122884-054
7-2-7	COVER	1	95802	241110-001
7-2-8	POWER SUPPLY	1	95802	345027-001/9G-6130-01-380-5489
7-2-9	NOT USED			
7-2-10	GASKET	1	95802	341065-001
7-2-11	SAFETY INTERLOCK SWITCH	1	91929	141053-001/1H 5930-01-311-5365
7-2-12	INSULATOR	2	95802	222961-001/1H 5930-01-311-3631
7-2-13	SPACER	1	95802	141054-001
7-2-14	RECEPTACLE	1	02660	122773-001
7-2-15	STRAIGHT PLUG	1	02660	133179-001
7-2-16	CABLE CLAMP	1	02660	122775-002
7-2-17	RUBBER BUSHING	1	02660	122776-003

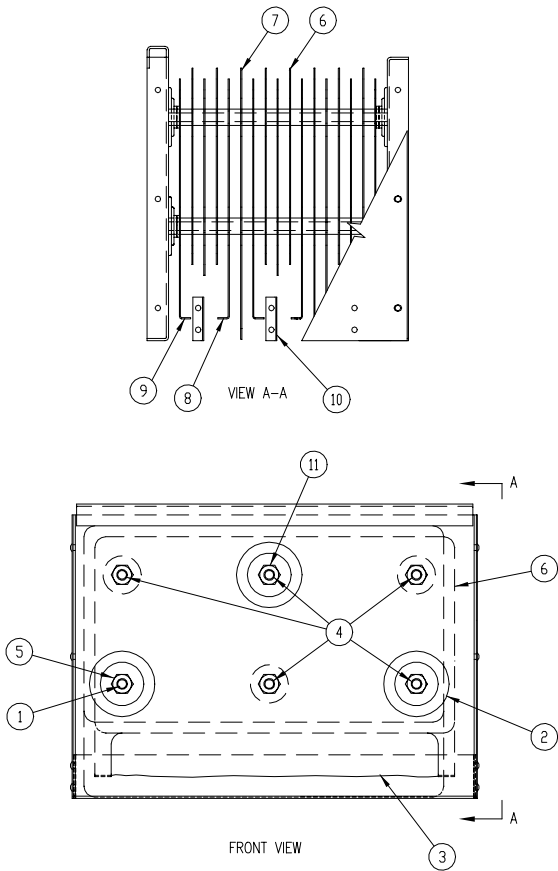


FIGURE 7-3 Ionizing Collecting Cell

FIGURE AND INDEX NO.	DESCRIPTION	QTY	CAGE	PART NUMBER/FSN
7-3-0	RETROFIT IONIZING COLLECTING CELL	1	95802	354849-001/1H 4460-01-482-1776
7-3-1	SPRING PLUNGER	1	95802	154856-001
7-3-2	CERAMIC INSULATOR	6	95802	250938-001
7-3-3	IONIZING WIRE	6	95802	22011-908
7-3-4	TIE ROD	5	95802	233137-038
7-3-5	TIE ROD	1	95802	233137-039
7-3-6	GROUND & HIGH VOLTAGE PLATE, COLLECTOR	9	95802	254851-001
7-3-7	EXTENDED GROUND PLATE	2	95802	254851-002
7-3-8	WIRE SUPPORT PLATE, Right Hand	3	95802	254852-001
7-3-9	WIRE SUPPORT PLATE, Left Hand	3	95802	254852-002
7-3-10	GROUND ELECTRODE, IONIZER	3	95802	254854-001
7-3-11	NUT, ¼ - 20	6	73436	121098-008

## CHAPTER 8 INSTALLATION

### 8-1 INTRODUCTION.

- 8-1.1 The vent fog precipitator describe din this manual is a two-stage electrostatic precipitator. It is a high efficiency air filter for removing fine particles of oil mist from an air stream passing through the precipitator.
- 8-1.2 The vent fog precipitator is to be vertically mounted at the lube oil system vent discharge so that oil fog emitted from the inlet.

### 8-2 SITE SELECTION.

- 8-2.1 Aside from the physical space requirements, consideration must be given to the following points:
- a. Unrestricted view for the indicating light.
  - b. Service access.
  - c. Electrical power supply.
  - d. Vent line piping.
  - e. Drain line piping, if installed.
- 8-2.2 The precipitator should be installed as close as practical to the lube oil sump tank, and vent piping must be kept to minimum.
- 8-2.3 The temperatures of the vented air containing oil mist at the precipitator must not exceed the temperature at which any substantial quantity of oil would be in a vapor state. As the precipitator cannot collect any matter in a vapor state, the vented air containing oil vapor will pass beyond the precipitator and then condense when it reaches the cooler atmosphere. To avoid this condition and to maintain maximum efficiency, previsions must be made to have the vented air cooled to 160°F or less before it enters the precipitators.
- 8-2.4 The water content of the warm moist air exhausted through the lube oil vent will condense in the cooler vent piping. To prevent the water form returning to the lube oil sump, the vent piping should be trapped near the outlet from the lube oil tank and drained

to a receptacle. When it is necessary to use an extensive length of vent piping, the piping should be insulated to reduce the amount of condensation.

### **8-3 UNPACKING.**

The precipitator is shipped in one box. The equipment should not be unpacked until just prior to installation to prevent damage to the components. Inlet flange shipping cover and mounting hardware is to be removed and discarded. No other special unpacking or precipitator procedures are required.

### **8-4. MOUNTING.**

The precipitator must be located in the vent piping to provide sufficient access clearance. The inlet flange of the precipitator is used for mounting the precipitator to the mating flange of the vent piping.

### **8-5 ELECTRICAL CONNECTION. (See figure 8-1.)**

The vent fog precipitator is supplied with all the internal electrical wiring complete. Installation requires only connecting primary ac electrical power. The precipitator operates on an input of 115 volt, single-phase, 60 hertz, type I power of MIL-STD-1399, Section 103. The precipitator high voltage power supply is current limited and self-protecting, requiring no external circuit protection to the respective terminal at the electrical connection box.

8-5.1 **PLUG AND RECEPTACLE.** The three-pin plug and receptacle transfers ac power from the electrical connection box to the access panel/electrical box. It also acts as a safety device, as it must be unplugged to remove one of the access panel/electrical box capture screws.

8-5.2 **SAFETY INTERLOCK SWITCH.** The safety interlock switch interrupts power to the step down transformer when the access panel/electrical box is removed. It also prevents the unit from operating if the flame arrestor is not in place.

8-5.3 **POWER SUPPLY.** The power supply converts the 115 VAC input to an output of approximately 6800 VDC.

8-5.4 PILOT LIGHT ASSEMBLY. The pilot light indicates proper operation of the precipitator. The pilot light will glow when secondary high voltage is sufficient to energize the ionizing collecting cell.

**8-6 INSTALLATION CHECKOUT.**

The precipitator installation can be checked electrically by energizing the primary input. Refer to paragraph 2-3, Operating Procedures.



QTY.	ITEM	PART NO.	DESCRIPTION
1	1	345027-001	POWER SUPPLY ASSEMBLY
1	2	241101-011	LED ASSEMBLY
1	3	141136-999	WIRE RUN
1	4	122773-001	BOX MOUNTING RECEPTACLE
1	5	141052-001	SCHEMATIC LABEL
1	6	341376-001	PANEL WELDED ASSEMBLY
4	7	120609-006	LOCKWASHER #8
4	8	120607-005	HEX NUT #8-32
3	9	220771-005	WIRE TIE
1	10	245106	RETROFIT KIT DRAWING
1	11	124986-003	CARTON

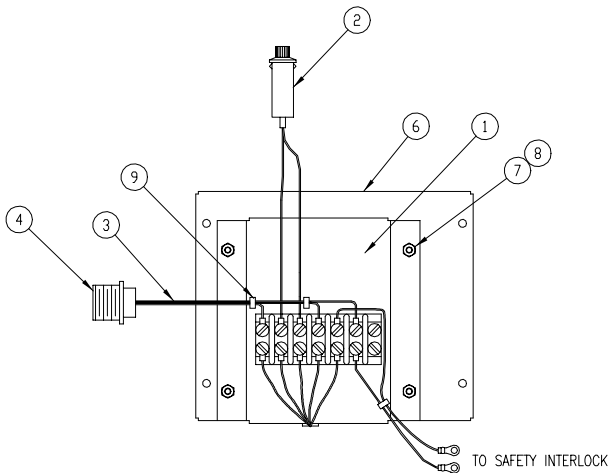


FIGURE 8-2  
Power Supply Retrofit Kit

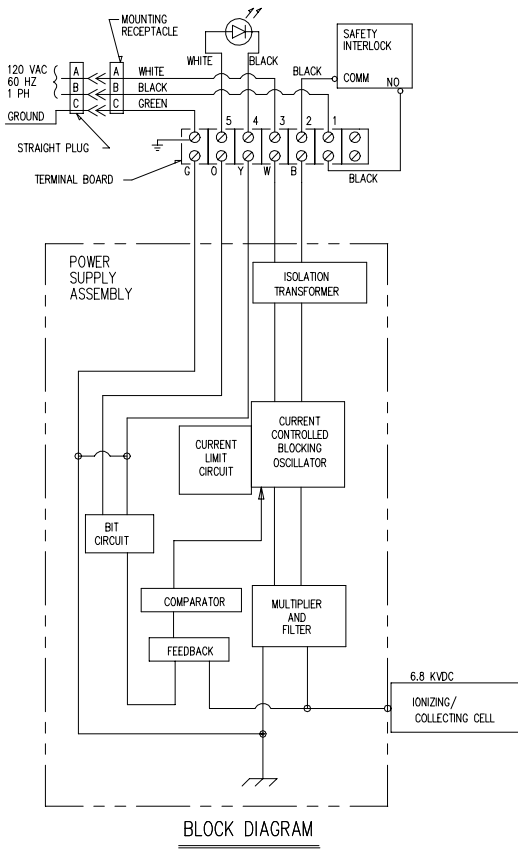


FIGURE 8-1 Vent Fog Precipitator  
Electrical Connection

INSTRUCTIONS FOR INSTALLING POWER SUPPLY RETROFIT KIT  
IN 50 CFM VENT FOG PRECIPITATOR (MODEL 441100)

1. DISCONNECT INPUT POWER STRAIGHT PLUG FROM MOUNTING RECEPTACLE LOCATED ON SIDE OF ACCESS PANEL/ELECTRICAL BOX ASSY.
2. LOOSEN (9) CAPTIVE SCREWS SECURING ACCESS PANEL/ELECTRICAL BOX ASSY TO PRECIPITATOR HOUSING AND REMOVE ACCESS PANEL/ELECTRICAL BOX ASSY.
3. REMOVE (7) #8 FLAT HEAD MACHINE SCREWS SECURING COVER TO INSIDE OF ACCESS PANEL/ELECTRICAL BOX ASSY AND SET COVER & HARDWARE ASIDE.
4. REMOVE LED BY DISCONNECTING LEADS FROM POWER SUPPLY, DISENGAGING TABS ON LED BODY AND SLIDING LED ASSY OUT OF MOUNTING HOLE. DISCARD LED.
5. DISCONNECT HIGH VOLTAGE LEAD FROM INSULATOR BY REMOVING (1) 1/4" PAN HEAD MACHINE SCREW. NOTE SEQUENCE OF DISASSEMBLY AND SAVE HARDWARE, INSULATORS, SPACERS, AND FIBER WASHER(S).
6. REMOVE BOX MOUNTING RECEPTACLE BY REMOVING (4) #4 PAN HEAD MACHINE SCREWS AND SLIDING RECEPTACLE OUT OF MOUNTING HOLE. SAVE HARDWARE.
7. REMOVE SAFETY INTERLOCK BY REMOVING (2) #6 PAN HEAD MACHINE SCREWS. NOTE ORIENTATION OF INTERLOCK AND SAVE HARDWARE.
8. REMOVE PANEL/POWER SUPPLY/TRANSFORMER ASSY BY REMOVING (4) #8 HEX NUTS & WASHERS, SAVE HARDWARE. NOTE: IT MAY BE NECESSARY TO REMOVE TRANSFORM AND/OR POWER SUPPLY FROM PANEL TO FACILITATE REMOVAL OF COMPONENTS FROM ACCESS PANEL/ELECTRICAL BOX ASSY.
9. DISCONNECT SAFETY INTERLOCK FROM WIRE LEADS (COMPONENT OF PANEL/POWER SUPPLY/TRANSFORMER ASSY REMOVED IN STEP 8 ABOVE). DISCARD REMAINDER OF COMPONENTS REMOVED IN STEP 8 ABOVE (EXCEPT HARDWARE).
10. CONNECT SAFETY INTERLOCK TO WIRE LEADS OF RETROFIT KIT AS SHOWN ON SCHEMATIC LABEL IN RETROFIT KIT.
11. MOUNT RETROFIT KIT IN ACCESS PANEL/ELECTRICAL BOX ASSY USING HARDWARE REMOVED IN STEP 8 ABOVE.
12. MOUNT SAFETY INTERLOCK IN ACCESS PANEL/ELECTRICAL BOX ASSY USING HARDWARE REMOVED IN STEP 7 ABOVE.
13. MOUNT BOX MOUNTING RECEPTACLE IN ACCESS PANEL/ELECTRICAL BOX ASSY USING HARDWARE REMOVED IN STEP 6 ABOVE.
14. CONNECT POWER SUPPLY HIGH VOLTAGE LEAD USING HARDWARE REMOVED IN STEP 5 ABOVE (SEQUENCE OF ASSY: PAN HEAD MACHINE SCREW, INSULATOR, ACCESS PANEL/ELECTRICAL BOX ASSY, SPACER, FIBER WASHER(S), INSULATOR, HEX NUT, HIGH VOLTAGE LEAD TERMINAL, LOCKWASHER, HEX NUT).
15. MOUNT LED BY REMOVING WIRE LEADS FROM POWER SUPPLY TERMINAL BOARD, SLIDING LED ASSY THRU MOUNTING HOLE (FROM OUTSIDE OF ACCESS PANEL/ELECTRICAL BOX ASSY) AND SECURING LEADS TO POWER SUPPLY TERMINAL BOARD AS SHOWN ON SCHEMATIC LABEL IN RETROFIT KIT.
16. PEEL SCHEMATIC LABEL FROM INSIDE OF COVER REMOVED IN STEP 3 ABOVE AND SECURE NEW SCHEMATIC LABEL FROM RETROFIT KIT IN SAME GENERAL AREA.
17. RE-ASSEMBLE PRECIPITATOR BY REVERSING STEPS 1, 2 & 3.