KNOW YOUR EQUIPMENT

READ THIS MANUAL FIRST.

Your Smog-Hog® PSG should provide many years of trouble-free service. This manual will help you understand the operation of your PSG unit. It will also help you understand how to maintain it in order to achieve top performance. For quick future reference, fill in the unit information in the spaces below. Should you need assistance, call the United Air Specialists, Inc. customer service number shown below. To expedite your service, have the following information available when contacting UAS.

UAS ORDER #: ____________________________________________

UNIT MODEL #: ____________________________________________

UNIT SERIAL #: ____________________________________________

SYSTEM ACCESSORIES:
__________________________________________________________
__________________________________________________________
__________________________________________________________

INSTALLATION DATE: _______________________________________

UNITED AIR SPECIALISTS, INC. CUSTOMER SERVICE

1-800-252-4647
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SAFETY PRECAUTIONS

We have provided many important safety messages in this manual on your Smog-Hog PSG. Always read and obey all safety messages.

⚠ This is the safety alert symbol.

This symbol alerts you to potential hazards that can kill or hurt you and others. All safety messages will follow the safety alert symbol and the word “DANGER” “WARNING” or “CAUTION”. These words mean:

⚠ DANGER
Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

IMPORTANT SAFETY INSTRUCTIONS

⚠ WARNING
To reduce the risk of fire, electric shock, or injury when using your air cleaner, follow these basic precautions:

• Wear protective clothing and safety glasses when handling collector components or servicing the unit.
• Use proper lifting and rigging equipment to install your electronic precipitator.
• The electronic precipitator should be properly grounded prior to servicing.
• Disconnect power before servicing.
• Replace all access panels before operating.
• Do not operate the unit with component doors open.
• Electrical connections should only be made by qualified personnel and be in accordance with local and national codes and regulations.
• Do not use in explosive atmospheres.
• Do not collect emissions which are explosive.
• Use non flammable cleaners.
• Keep flammable materials and vapors, such as gasoline, away from unit.
• The unit should be inspected frequently and contaminants removed to prevent excessive accumulation which may result in flash-over or fire damage.
• Operate only in a safe and serviceable condition.
• Operating temperature to the air stream should not exceed 120° F.
1. INTRODUCTION
You are about to install and operate a SMOG-HOG® PSG Series is a two-stage, Penney-type electrostatic precipitator used for removal of submicron, airborne particulate with high efficiency and at a uniquely low expenditure of energy. With proper handling and installation, the PSG becomes a powerful tool in controlling objectionable emissions from a wide range of processes. The PSG can vary in options, consisting of working groups of collection components which may, in turn, be preceded or followed by complimentary conditioning equipment. The PSG may take the form of a simple component cabinet for inclusion in a large air handling system or may be a self-sufficient air pollution control package. Since the PSG generally becomes an integral part of a process exhaust network, installation should be carefully planned, starting with mechanical layout drawings and electrical wiring diagrams provided by United Air Specialists, Inc. (UAS). Reading this manual is important to the successful installation and operation. The PSG Series has been built to rigid specifications. As with all precision equipment, the system requires periodic care and maintenance. This manual contains instructions for standard maintenance and manual cleaning of components. If the system is equipped with In Place Cleaning, there is a separate owner’s manual. If assistance is required please contact Customer Service, United Air Specialists, Inc., 4440 Creek Road, Cincinnati, Ohio 45242, 1-800-252-4647.

1.1 Description of Operation
PSG Series is a two-stage, Penney-type electrostatic precipitator used for removal of submicron hydrocarbon emissions of smoke and other airborne contaminants. The two “stages” consist of an ionizing section and a collecting section, combined in one assembly as a unicell. Each ionizing section consists of a series of (10 mil) wires charged to a high DC voltage and centered between a like series of grounded plates. This high voltage differential generates an intense electrostatic field where airborne particles are “ionized,” i.e., positive polarity. Each collecting section consists of a large number of parallel cell plates, alternately charged at high DC voltage (the same polarity as the ionizer but about half the voltage magnitude) and ground potential, thus forming a magnetic field. Charged particles are simultaneously repelled by the cell charged plates (smaller dimensional plates) and attracted to cell ground plates (large dimensional plates). The result being a highly efficient removal of charged particulate from the airstream as it passes through the electrostatic precipitator. The total current to both the ionizer and collector cell circuits is below 5 milliamps which is non-lethal. Uncell components are usually preceded and/or followed by mesh filters to assure even distribution of air, at low velocity. Air movement is provided by a system blower located behind the unicell components that exhausts cleaned air at a specified cfm rate. More complex systems can include other conditioning equipment.

1.2 System Definitions
PSG Series is designed for rigorous, often continuous, smoke and particulate removal duty. The system includes mechanical pre filters (as applicable), unicells (combination ionizer and collection cell), power pack enclosures and pre/after filters. The PSG Series has been tested to operate in accordance with national listing standards of agencies such as Underwriters’ Laboratories (UL) and ETL, with local approvals from selected cities as required. PSG units are designed for installation in customer ducting where other system components, including the blower, may be provided by others. PSG systems can include blowers, skids and other factory-assembled equipment, which arrives in the field ready for installation.

1.3 Unit Nomenclature
PSG systems may include various combinations of features connected in series in the direction of airflow. The PSG’s configuration code is defined with a series of letters. Refer to Figure 1. On “single-wide”, (the width of one module which is one or two or three unicells placed in series) the access doors to collecting components face the operator as air flows from left to right. Opposite side access right to left is also available. “Double wide” (the width of two modules placed side by side) have access doors on both sides, each door accessing one module, left to right, and right to left in one system. Air which flows through one set of unicells will make a single cleaning “pass.” When an application dictates, multiple passes can be placed in series in the direction of airflow. A two-pass system is illustrated in Figure 2.

1.4 Description of Components

Typical model identifier:

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Figure 1
PSG SERIES NOMENCLATURE
1.4.1 POWER PACKS
Each power pack converts 115 volt, single-phase AC power to high voltage DC for one or two or three unicells (each with one ionizer and one collecting section). This combination of components comprises a working “module.” Standard packs supply positive DC voltage of 11.0 (nominal) KVDC to each ionizer and 5.5 KVDC to each collection cell. Power packs with special ratings are supplied on certain applications. Power packs are mounted in power pack enclosures located on the module doors to the PSG. Each pack supplies power to a discrete module of unicells with a dedicated, externally mounted indicator light that illuminates to indicate normal operation. The PSG power pack meets UL safety standards. In the event of a short circuit or overload condition to the output side, the power pack’s high voltage collapses and the indicator light is in the flashing mode. Upon removal of the overload, the power pack automatically returns to normal and the indicator light will be illuminated. The power pack is self-protecting against overloads (e.g. dirty components, short circuits in ionizer and cell circuits) and is self regulating from AC voltage variations 90 to 132 VAC.

1.4.2 UNICELL IONIZER SECTION
Each unicell supports ten (10) 10 mil tungsten steel ionizer wires spring mounted and centered between aluminum ground plates. Refer to Figure 6. When high DC voltage is applied to the wires, a powerful field charges contaminated particles. Ionizer standoff convoluted insulators are part of the ionizer wire support bar(s) which separates high voltage from grounded chassis.
1.4.3 UNICELL COLLECTOR CELL SECTION
Each unicell contains a series of parallel plates, alternately charged and grounded, whose planes are in-line with the direction of airflow. Refer to Figure 6. Charged plates are connected electrically and suspended from four triangular shaped insulators on each end of the unicell. The ground plates are independently supported.

1.4.4 FILTERS
Prefilters and afterfilters can take many forms but are normally of the mechanical type, aluminum metal mesh and encased in an aluminum frame. Filters provide even air distribution and collect large particles.

1.4.5 JUNCTION BOXES
PSG mounted junction boxes are equipped with terminal strips for 115 VAC single phase power entry. On factory-assembled systems, three phase field connection is usually to a single point to a UAS Main Electrical Panel or a UAS Blower Panel. Refer to UAS System Layout Drawings and UAS Electrical Drawings which define the required field installation for each application.

1.4.6 OTHER EQUIPMENT
The PSG may be supplied with, in-place cleaning, inlet plenum with baffle filters or aluminum filters, outlet plenums, pre piped for fire protection, carbon or potassium permanganate odor filters, skid mounted, insulated enclosure, cooling/heating coils, and blower. System components may be shipped skid mounted, or as subassemblies. Planning is required to understand the scope of the installation, from handling to assembly to the connection of utilities.

2. INSTALLATION PLANNING
Prior to receipt of equipment, drawings should be reviewed and plans completed for handling and installation. Site selection, support structure, utilities, drains, ductwork and work sequence need to be coordinated.

The following are general guidelines.

2.1 Location
Systems should be located as near as possible to the emission source, but with consideration given to utility proximity and safe maintenance access. Indoor location is preferred since it eliminates climate associated problems such as servicing the system, heat traced/insulated wash water and drain pipes or an insulated system enclosure.

2.2 Clearances

2.2.1 COMPONENT ACCESS
A clearance of 36” is recommended for maintenance and component removal/installation to the access door(s) side, refer to UAS System Layout Drawing for clearances.

2.2.2 ELECTRICAL ENCLOSURE ACCESS
A minimum of 18” is required from overhead obstructions to allow access to electrical top boxes. A side clearance of 48” usually is recommended for access to electrical panels, refer to NEC for specified clearance.

2.2.3 BOTTOM WORKING CLEARANCE
Plumbing access should be at least 18” beneath the unit.

2.3 Supports

2.3.1 SKIDDED SYSTEMS
Lifting points for skid mounted PSG Series systems are illustrated to the UAS System Layout Drawings including installation notes. Field structural support design is the responsibility of the installer. Good design practice should be followed in allowing adequate clearance for plumbing, conduit installation, and maintenance.

2.3.2 UNSKIDDED SYSTEMS
When PSG Series components are shipped unassembled, care should be taken to provide adequate bearing support on the field support structure.

CAUTION
Ducting and accessories attached to the PSG unit should be independently supported.

| CAUTION |
| UAS Electrical Panels provide the necessary electrical interlocks and controls for the PSG. If electrical control panels supplied by others are not per UAS specifications the PSG is operating in an UNSAFE mode, voiding the warranty. |
2.3.3 UTILITIES/DRAINS
Mechanical, electrical service requirements and system entry points are clearly marked on the UAS System Layout Drawing and UAS Electrical Drawings. The PSG main drain pipe should be have a drain trap. Refer to Figure 5. When a PSG is equipped with In Place Cleaning, operating water pressure (working pressure), flow rates (gpm) and hot water specified are based on factory testing, refer to UAS System Layout Drawing or In Place Cleaning Owner’s Manual for specifications. Failure to achieve In Place Cleaning specifications will result in an ineffective wash cycle, increasing system maintenance costs. If the PSG is located outside and there are climate associated problems (32°F or below), exposed piping wash/drain including solenoid valves should be heat traced and insulated. Do not heat trace the solenoid valve coil.

2.3.4 DUCTING
Quality ducting is important system performance. Sealed connections prevent air and liquid leakage during operation. Welded duct connections are required with ducting pitched towards the PSG. Duct design air velocities are typically 1,500 to 2,500 FPM. Gaskets and sealant, where used, should be compatible with the material collected and the temperature of the airstream. Wet airstreams (high humidity) typically require insulation to prevent condensation.

3. INSTALLATION

3.1 Receiving Inspection
The PSG system components are thoroughly checked and tested at the factory. Although precautions have been taken to ensure against shipping damage, be sure to carefully inspect contents upon delivery. Notify your carrier immediately and enter a claim for any damage found. Check the material received against shipping papers for any shortages.

NOTE: Damage to cartons, skids, shrink wrap, etc., may indicate that rough handing has caused internal damage. Careful inspection, including the opening of all shipping containers, should precede acceptance of equipment.

3.2 Unloading By Forklift
As shown in Figure 3A, the PSG unit, duct transition or skidded system may be unloaded by use of forklift trucks. Extreme caution should be exercised to guarantee that the load is lifted at its center of gravity. When placing the unit on the ground, blocks should be located under the component exactly where placed during shipment. The preferred method of forklift removal of large components involves using a spreader bar. Refer to Figure 3B. This guarantees vertical pull on lifting eyes/lugs on the system or component.

3.3 Unloading By Crane
Handling of large, skidded PSG systems is a job for a competent rigger. Figure 3C is for a typical PSG unit and Figure 3D illustrates lifting lugs for a skidded system. Spreader bars should be located over the two front lugs and the two rear lugs of the system skid, with a spacer bar between them to assure vertical pull. Lugs are located to minimize tilting during lift.
3.4 Unit Storage or Delay to System Installation

If PSG installation is delayed for an extended period (one month or more), protect system components as follows:

1. Store in a cool, dry location. Do not disassemble. Do not remove components.
2. Cover duct and unit openings with plastic sheeting and duct tape; cover plumbing openings with plastic hole plugs.
3. Cover skidded systems with plastic sheeting and seal with duct tape. Do not use black plastic sheeting. When removing components from storage, check gaskets, seals and electrical components for long term effects of exposure to moisture and dust before proceeding with installation.
4. The system exhaust blower should be protected from the weather. Failure to do so could damage the motor, bearings, belts, and electrical components. The following are guidelines.
   - Store in an area with no vibration.
   - Cover blower with a tarp do not use a black tarp which will promote condensation.
   - Remove drive belts.
   - Rotate fan wheel monthly

Also consult the blower manufacturer for storage and start up recommendations.

3.5 Installing The System

Skidded PSG systems arrive from the factory ready for final plumbing and wiring, with proper planning refer to Section 2, Installation Planning final installation should be straightforward. When PSG sub-assemblies are to be installed on customer's structure, further instructions are in order.

3.5.1 PSG SYSTEMS

The majority of skidded systems are shipped with unicells and filter installed. The system may be lifted into place without removing the unicells and filter. However, when job circumstances and or shipping requirements dictate, unicells and filters are shipped on a separate skid. These components should not be installed until the system is in place. Individual units should be rigidly mounted, with front-to-back bearing support in the direction of airflow. Clearance for plumbing access should be provided under each unit, refer to Installation Planning. The PSG main drain pipe should have a drain trap and multiple passes require drain connection(s) for each pass. Structural field installed support channels should not interfere with proposed plumbing and wiring. Where the PSG is to be suspended, refer UAS System Layout Drawing. Do not support ducting, plumbing or other field hardware from the PSG.
3.5.2 INLET/OUTLET PLENUMS
As supplied by UAS, transition plenums have all-welded seams. Inlet plenums include baffle filters or aluminum media to promote even air distribution across subsequent system components.

3.5.3 MOTOR/BLOWERS
Motor/blower assemblies installed in the field should be equipped with vibration isolators and adequate structural support. When supplied by others, the motor/blower assemblies should meet air volume specifications to the PSG model; refer to UAS System Layout Drawing.

3.5.4 PRE-CONDITIONING EQUIPMENT
For the PSG to operate at peak efficiency, certain pre-conditioning equipment may be required. When supplied by UAS, this equipment should be installed per UAS System Layout Drawing and UAS Electrical Drawings. Incorrect installation of such devices as cooling coils or other equipment may alter system performance and void the UAS warranty.

3.5.5 ORDER OF INSTALLATION
When the PSG is shipped in sections refer to the UAS System Layout Drawing for proper installation.

⚠️ WARNING
The PSG unit should be secured with appropriate hardware by the installing contractor.

3.5.6 LEVELING
As base-mounted sections are installed, each section should be leveled to ensure proper drainage and mutual alignment. If a unit is not level within 1/8" (front-to-back and side-to-side), place suitable Shims between unit and support structure surface. Shims should run the entire length of the mating surfaces. Skidded systems should be level to within 1/8" per 4 feet of length and width.

3.5.7 BLOWERS WITH VIBRATION ISOLATORS
Skid mounted units with blowers are normally shipped with vibration Isolators between blower and skid. Refer to Figure 4. These assemblies are shipped with isolators in a restrained condition, remove shipping bands.

Notes: 1. Before the isolators are adjusted, the weight of the equipment will cause the top plate to come to rest on the housing. The isolators should be adjusted to provide a minimum clearance of ¼” between the top plate and the housing.

2. Compress the springs by turning the adjusting nut clockwise. Start at one isolator and make four turns on the adjusting bolt. Move to the next isolator and make four turns, etc., until all isolators have been adjusted four turns. Repeat this procedure until a 1/4” clearance is obtained between top place and housing.

3. Check the level of the equipment. The equipment may now be leveled by making small adjustments of individual isolators at the high and low points.

Figure 4
Spring Type Vibration Insulator
3.5.8 DRAIN PIPE CONNECTIONS
The PSG modular cabinet is supplied with drain connections refer to UAS System Layout Drawing. The number of drain connections will depend on the PSG model. All PSG cabinet drain connections should be connected to one main drain pipe with a drain trap and properly sloped to the building drain pipe connection. Refer to Figure 5. Air passing through the system is under negative pressure. A drain trap is required serving as a vacuum break and to assure proper drainage during system operation. The trap “height is equal to the system static pressure, plus three additional inches of water. Cleanout plugs should be installed to the trap to facilitate cleaning. If required per code a grease trap should be installed. Drain pipes should be heat traced and insulated if particulate tends to solidify at expected ambient temperatures. This precaution also applies to drain and water pipes exposed to cold climates.

3.5.9 WASH WATER SUPPLY CONNECTIONS
Wash water is required for systems with In-Place Cleaning, refer to the UAS System Layout and the In-Place Cleaning Owner’s Manual for installation, operation and specifications.

3.5.10 HEATING/COOLING COILS
For systems with heating or cooling coils, refer to UAS System Layout Drawing.

3.5.11 ELECTRICAL FIELD INSTALLATION

⚠️ DANGER
ELECTRICAL SHOCK HAZARD

⚠️ CAUTION

When electrical control panels are supplied by others an electrical interlock should be provided for the power pack circuit to the Smog-Hog PSG and the system exhaust blower. This provides safe operation of the PSG. Do not operate the power pack circuit with the system exhaust blower off line.

All electrical work should be performed by a qualified electrician in accordance with local electrical codes. Disconnect electrical power before installing or servicing electrical components. The PSG is manufactured per job specifications and UAS specifications, refer to UAS Electrical Drawings. Dashed lines on UAS Electrical Drawings identify field wiring requirements and possible certain recommended equipment not supplied by UAS. When additional equipment is specified for field installation, refer to UAS System Layout Drawing and UAS Electrical Drawings. If the PSG is skid mounted, interconnection wiring may have been completed at the
factory. Do not mount auxiliary electrical equipment on or inside UAS equipment unless specifically authorized by UAS. Such unauthorized action may void the system warranty. UAS provides solid-state programmable logic controllers (PLC) on various systems. The PLC operates on a low (24 VDC/120 VAC voltage and is susceptible to faults induced by the close proximity to higher voltage wires. Accordingly, the following should be observed during electrical installation:

1. Three-phase leads should not be located within 4 inches of the solid-state controller.
2. Care should be exercised when drilling conduit entry holes to protect PLC and other electrical components from metal chips and dust. Failure to comply with these instructions can result in a fault condition requiring repair or replacement by authorized service personnel. Costs of such repair or replacement are the responsibility of the user/installing contractor.

### 3.5.12 REMOTE STATUS

This panel serves as a monitoring device indicating the operational status to each power pack enclosure for the end user; refer to UAS Electrical Drawings or Sequence of Operation documentation to determine if the remote status panel is part of the PSG system. The remote status panel or UAS Main Electrical Panel (if amber lights are integrated to main panel) should be located remotely from the PSG system preferably in an area which is accessible and not installed by the PSG system. The panel located by the PSG system serves no purpose since there is an indicator light to each power pack enclosure. The remote status could also consist of a beacon light assembly located in an accessible area for monitoring. The illumination of the beacon light indicates a failed condition to one of the power pack enclosures. Flasher modules for each power pack enclosure is either located in a separate panel, the UAS Main Electrical Panel, or in each power pack enclosure.

### 3.5.13 BUILDING MAINTENANCE SYSTEM (BMS)

An alternative to the remote status panel is the BMS (signal relay modules) which also includes additional features other than only monitoring the power pack enclosure(s); refer to UAS Electrical Drawings or Sequence of Operation documentation to determine if the BMS is part of the PSG system. Some of the additional features (from the PSG system to BMS), a common signal indicating high voltages are not within specifications to the power pack enclosures, indicating the operational status of the PSG system, indicating the operational status of the In Place Cleaning System, (from BMS to PSG system), placing PSG system on or off line, and fire system contact disabling the PSG power pack circuit and make up blower. Signal relays for the BMS are usually located in the UAS Main Electrical Panel or the power pack enclosures, refer to UAS Electrical Drawings. The Building Maintenance System (BMS) is supplied by others.

---

**THE FOLLOWING SECTIONS ARE FOR THE USE OF TRAINED SERVICE PERSONNEL ONLY.**

---

**WARNING**

The PSG unit should be inspected frequently and collected contaminant removed from the system regularly to prevent excessive accumulation which may result in a flashover or risk of fire.

---

**WARNING**

Hazardous live and moving parts are exposed during the troubleshooting procedures.

---

**WARNING**

Power pack enclosure(s) service voltage is 120VAC. This can be lethal. Voltage (120 VAC is present within the power pack enclosure even though the toggle switch is placed in the off position.

---

**CAUTION**

Risk of electrical shock. The high voltage circuits to the ionizer and collector should be grounded before removing the power pack, high voltage wires, door feed through insulators and unicell(s). The grounding procedure can be accomplished by waiting one minute after placing the toggle switch in off position to the power pack enclosure or refer to Figures 12 and 13. The power pack total current output is limited to a maximum of 5 milliamps to assure personnel safety.
### Replacement Parts

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NO.</th>
<th>DESCRIPTIONS</th>
<th>QUANTITY REQUIRED</th>
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<tr>
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<td>UNICELL ASSEMBLY</td>
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<td>36-0068</td>
<td>IONIZER CONTACT SPRING</td>
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<td>3</td>
<td>30-0452</td>
<td>CONTACT WELD NUT</td>
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<td>4A</td>
<td>18-0674</td>
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<td>4B</td>
<td>18-0670</td>
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<td>WIDE PLATE (GND.)</td>
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<td>10-0157</td>
<td>NARROW PLATE (+/-)</td>
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<td>16</td>
<td>36-0142</td>
<td>SCREW 8-32 x 1/2&quot;</td>
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</tbody>
</table>

**Figure 6**

Unicell Electrical Alignment and Parts List
4. OPERATION

4.1 Start-up Checks

4.1.1 INSTALLING COMPONENTS
If unicells and filter media were removed for shipment or installation, refer to Figure 6 for proper installation and electrical contact alignment. Filter media is installed as after filters (after the unicell) with In Place Cleaning. Do not install filter media as pre filters (before the unicell) with In Place Cleaning. This will reduce the effectiveness of the wash cycle by 50 percent. The filter media is utilized as pre and after filters if the PSG is not equipped with In Place cleaning. The PSG inlet plenum, if supplied by UAS, will have baffle filters or aluminum media. The inlet plenum should be inspected that all baffle filters or aluminum filters are installed.

4.1.2 DUCTING CONNECTIONS
Blower speeds are factory set by the blower manufacturer to compensate for static pressure losses in ducting as specified by others. Starting the blower before ducting is complete or before debris is removed can result in motor overload or other system damage.

4.1.3 BLOWER ROTATION
For proper airflow, the blower should be operating in the correct direction. If the blower is operating in the reverse direction, air will move in the proper direction, but at significantly reduced rates. To check rotation:

1. Place PSG unit off line.
2. Remove blower housing from the blower to observe the pulley rotation.
3. Place the PSG unit on line for approximately one minute.
4. Place PSG unit off line.
5. As the blower pulley slows down, observe the direction of rotation.
6. Note directional arrow located on the blower housing.

7. If blower wheel was not rotating in the correct direction, disengage main three-phase fused disconnect switch.

8. Open power panel and reverse any two of the three wires at the terminal strip (L1, L2, and L3).
9. Engage the main three phase fused disconnect switch and place the PSG on line, checking blower rotation.

4.1.4 BLOWER BELT TENSION
The drive belt tension adjustment is critical within the first 24 hours of the system exhaust blower operation. During this 24 hour period, the initial stretch of the belt occurs which requires a belt tension adjustment. If this tension adjustment is not completed the belt will wear prematurely, requiring a replacement. A drive belt tension gage should be used for adjusting belt tension. If fan belt tension is improper, set tension by adjusting the motor slide base. Loosen four bolts holding the motor to the base and turn the adjustment bolt(s) on the base. Check with a steel straight edge to make sure that motor pulley and blower pulley is still aligned. Tighten motor mounting bolts. Figure 7 illustrates a typical motor/blower arrangement (motor/blower configurations will vary).

4.1.5 BLOWER CURRENT MEASUREMENT
Using an ammeter measure the current amperage of the blower motor. The measurement should not exceed the full load ampere (FLA) rating identified on the blower motor nameplate. If the overload relay is tripping perform the following: check overload relay for proper setting per motor FLA, measure blower rpm and design static pressure to determine that actual conditions are per blower specifications. Blower rpm can be measured with a tachometer. Design or total static pressure (TSP) is the summation in static pressure between the blower
inlet and outlet. This summation is best checked with a manometer and pitot tube measuring readings from (a) the exhaust transition near the blower inlet and (b) the exhaust stack after the blower outlet. If the actual static pressure is higher than the blower specifications, and or the blower rpm is higher than the blower specifications, reduce the blower speed by opening the variable pitch pulley as described in the next procedure. Blower specifications or blower curve refers to the established operating conditions set by the blower manufacturer, rpm, cfm (air volume), and TSP. A reduction in blower rpm will decrease the TSP. A new pulley set may be required to reduce the blower rpm and amperage. The blower can be supplied either by UAS or by others. A blower curve can be requested through the blower manufacturer with the serial number.

4.1.6 ADJUSTING MOTOR VARIABLE PITCH PULLEY
Increasing blower speed (RPM) will increase airflow (CFM) and current amperage. Refer to Figure 8. To increase speed, close the variable pitch pulley (from “normal,” as in Figure 8A, toward “full closed,” as in Figure 8B). Decreasing blower speed will decrease airflow (CFM) and current amperage. To decrease speed, open the variable pitch pulley (from “normal,” as in Figure 8A, toward “full open,” as in Figure 8C). To adjust the variable pitch pulley:

1. Loosen motor base nuts, adjust motor slide base and remove the drive belt.
2. Loosen set screw “A” to clear the drive key between pulley halves.
3. Remove the key.
4. Adjust pulley in increments of one turn to the desired setting.
5. Install key and tighten set screw “A.”
6. Install drive belt.
7. Loosen set screw “B.”
8. Align belt centerlines of motor and blower pulleys using straight edge and square.
9. Set belt tension using a belt tension gage.

Some system exhaust blowers will not have an adjustable motor pulley.

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**CAUTION**

Improper blower speeds adversely affect system performance. Contact United Air Specialists before adjusting motor variable pulley settings.

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4.1.7 POWER PACK OPERATION
The power pack voltage range is 90 to 130 AC, 60 Hz, supplied by UAS Main Electrical Panel or electrical panel supplied by others. If the electrical panel is supplied by others the power pack circuit should be electrically interlocked with the blower circuit. The PSG will be operating in an unsafe mode if an electrical interlock is not installed. The power pack indicator light on the unit is illuminated when high voltage output is within specifications. If the indicator light is flashing or fails to illuminate refer to Section 10 Troubleshooting.

4.1.8 REMOTE STATUS PANEL
The remote status panel (a remote amber light to each power pack enclosure indicator light circuit identified by a letter/number) will display the following conditions.

Amber light(s) will be illuminated under normal conditions, high voltages within specifications.

Amber light(s) are in the flashing condition, high voltages are not within specifications. The PSG system is on line.

Amber light(s) are not illuminated, PSG system is off line, or amber light/flasher module has failed, refer to troubleshooting section.
Maintenance procedures and the majority of the troubleshooting section refer to the power pack enclosure indicator light.

Check operation of each amber light by placing the power pack toggle switch in the off position, one at a time, amber light should be flashing corresponding to module identification on remote status panel.

The remote status can be in the configuration of a beacon light instead of individual amber lights. The beacon light is common to all the modules. The beacon light is illuminated when a failure occurs to one or more modules.

4.1.9 POWER PACK ENCLOSURE PUSH ROD AND GROUNDING BAR

Each power pack enclosure has a captive, spring loaded "push rod" extending into the module.

Factory-set, the push rod serves the following purposes:

1. High voltage DC power is automatically shut down with the unicells removed from the module.

2. Whenever a module door or power pack enclosure lid cover is opened, the limit switch is disengaged, placing 115 VAC off line to the power pack.

3. Opening either of the module door or the power pack enclosure lid cover also releases the spring loaded push-rod, placing the grounding bar in contact with the cell door feed through insulator acorn nut, removing residual cell voltage.

**CAUTION**

The opening of only the module door is such that the grounding bar may not completely short out the cell circuit. As a precaution, perform the grounding procedure, refer to Figures 12 and 13.

During normal operation, with unicells in place, the component door (10) and the power pack door closed (3), the push rod (5) is in contact with unicell endplate (6). Push rod extension (1) is in contact with the ground bar (2) and bends to contact the limit switch (4). Refer to Figure 9. Upon opening the component door (10), the push rod (5) is released from the unicell endplate (6) and spring (7) compression is relieved, breaking the contact of the push rod extension (1) from the ground bar (2), placing AC voltage off line to the power pack and causing the grounding bar to contact the acorn nut (8). Refer to Figure 10. When opening the power pack door (3), the spring (7) remains compressed but the grounding bar (2) is pulled from the push rod extension (1) as the power pack door (3) is opened. AC voltage is placed off line to the power pack by opening the limit switch (4) which the unicells are grounded through the acorn nut (8), but with the contact spring (12) fully compressed. Refer to Figure 11.
4.1.10 ODOR CONTROL

Odor filtration removes the troublesome gases from the air stream as a post treatment to the PSG unicell components. The media can consist of carbon (18 to 20 pounds per filter) or potassium permanganate (28 to 30 pounds per filter) a Class 1 rated media which does not support combustion. PSG systems requiring an ETL listing will have potassium permanganate.

The odor control cabinet consists of a number of odor filters as dictated by size of the PSG system. The odor filter dimension is 22" x 22" x 2" at a designed velocity of 50 – 100 fpm. The life of the media is generally three to six months with a proper primary filtration (unicell components) maintenance program. Contaminant collection to the odor filters will decrease the service interval. The original filter frames should be retained. There is a slide gate to the filter frame for dumping the spent media and installing new media. A service company should be selected which is familiar with installing new media into the original filter frames.

The odor filters should be installed one to two days prior to placing the system on line. The odor filter service life will decrease if the odor filters are installed before the one to two days recommendation.

- Remove plastic sleeves
- Slide odor filters into the cabinet tracks with gaskets parallel to the back of the cabinet, and such that gaskets on adjacent filters seal against each other.
- Odor filters are installed in a “V” bank configuration.
- Do not slide the filters with the gasket(s) in the filter tracks.

4.1.11 IN-PLACE CLEANING.

The spray nozzles to the wash headers can become clogged or otherwise obstructed due to debris within the field piping. At initial start-up, water should be purged before final pipe connection at the PSG. The Y strainer to the detergent injector tee assembly should also be checked for debris. A wash cycle should be initiated before placing the PSG on line, refer to the In-Place Cleaning Owner’s Manual for the start up operational procedure.

4.1.12 PLACING PSG ONLINE

Depending upon job specifications or other requirements, the PSG may be placed on line by a customer-supplied switch, or a time clock, or through a building maintenance system (BMS), refer to UAS Electrical Drawings. Upon PSG start-up, the system blower is placed on line and the power packs are placed on line after a 45 second delay. The indicator light on each power pack enclosure should be illuminated. The power pack enclosure toggle switch should be checked if the indicator light is not illuminated. If the indicator light is not illuminated after checking the toggle switch or the indicator light is flashing. Refer to Section 10 Troubleshooting. The UAS Main Electrical Panel has a 40 second time delay at start-up for the power pack circuit. This represents a standard precaution since PSG operates in applications where combustible gases could be present in process enclosures or process duct at start-up. The time delay of 40 seconds purges the duct before activating the power pack circuit to assure safe operation. For operation of auxiliary system equipment, refer manufacturer’s owner’s instructions for proper operating procedures.

4.1.13 UAS ON SITE START UP

The PSG system may include on site start up by a UAS Field Service Technician. Usually this is listed on the order acknowledgment. As installation nears completion, allow at least two weeks for scheduling a UAS Field Service Technician. Contact UAS Customer Service for a start-up request form. The completion of the request form is required before scheduling a UAS Field Service Technician. The on site start up consist of a complete mechanical and electrical inspection including the operation of all supplied UAS equipment. UAS Field Service Technician is available for on site service at a daily rate plus travel and expenses.

5. MAINTENANCE AND MANUAL CLEANING

5.1 Recommended Maintenance

Once the system is operational, periodic maintenance is necessary to assure proper performance. Follow a regular pattern of system observation and log abnormal conditions. Since systems reflect the process under control, maintenance patterns will vary accordingly.

5.1.1 CHECK POWER PACK ENCLOSURE INDICATOR LIGHTS

The PSG should be monitored daily by observing that the indicator light is illuminated to each power pack enclosure or by the remote status panel or remote beacon or BMS. Occasional arcing (flashing of an indicator light) is normal. An established arcing condition or dead short condition (continuous flashing of an indicator light) or the indicator light is not illuminated is not normal should be corrected. Refer to Section 10 Troubleshooting.

5.1.2 UNICELL(S) WEEKLY VISUAL INSPECTION

A visual inspection of a few modules could identify problems such as moderate to extreme contaminant build up to the unicells even though the indicator lights are illuminated. This will be helpful in scheduling a manual cleaning of the components, refer to Section 6 and 7. To check the condition of the unicells, place the PSG off line. Open the module door and perform...
the grounding procedure, refer to Figures 12 and 13, inspect the condition of the unicells, filters, door feed-thru insulators and interior of the cabinet. Experience will dictate whether contaminant build-up is excessive. Contaminant build up will decrease high voltage to the ionizer and collector cell circuits and also system efficiency. When accessing a module, always clean the two door feed-thru insulators. Inspect the ionizer section of each unicell, noting the condition of the contact spring (distorted?, bent? missing?), ionizer weld nut (missing?), ionizer standoff insulators (contaminant build up) and ionizer wires (contaminant build up?, missing?), repair or replace. Ionizer wires should be taut and centered between ground plates. Ground plates between each ionizer wire should be straight and parallel. Unicell module support tracks should be free of contaminant build-up for ground contact.

Inspect the collector cell section of each unicell, noting the condition of the contact spring (distorted? bent? missing?) cell contact screw (missing?), cell plates (bent? warped?) should be parallel and straight, repair or replace. Cell hot plates (smaller dimensional plates) should be centered between ground plates (larger dimensional plate). Cell plates should not have contaminant bridging between the cell plates or at support structure corners or the triangular insulators. Unicell module support tracks should be free of contaminant build-up for ground contacts.

5.1.3 FILTERS, DRAIN SUMPS, AND ACCESS DOOR GASKET INSPECTION
Inspect filters, noting the condition (contaminant build up? media separation? bent frames?) should not have contaminant build up restricting airflow, repair or replace.

Module drain sumps should not have moderate to extreme contaminant build up or an accumulation of wash water if equipped with In Place Cleaning, clean module sumps as required. Component access doors gaskets should be in-place and in good condition.

5.1.4 PERFORM AN IN-PLACE CLEANING WASH CYCLE
If the PSG is equipped with In Place Cleaning a daily wash cycle is required refer to In Place Cleaning Owner's Manual and Sequence of Operation Instructions. A typical seven day wash cycle would be six day waterwash without detergent with the seven day a detergent wash. The “Detergent Frequency Selection” can be increased up to everyday. The auto wash cycle is initiated by a UAS time clock, with the wash cycle sequencing, wash cycle times, and detergent frequency through the UAS PLC. A wash cycle can be manually initiated, identical operation as the auto wash cycle, at the UAS Main Electrical Panel for an additional wash cycle. A wash cycle whether a manual or by time clock can only be initiated with the PSG off line. The wash cycle frequency could be increased or decreased depending on visual inspection of the components and high voltage measurements. When the PSG is placed on line after a wash cycle, the power pack enclosure(s) indicator light(s) may intermittently or continuously flash for approximately 60 minutes. If this condition exceeds 60 minutes refer to Section 10 Troubleshooting.

5.1.5 MANUALLY CLEANING SYSTEM COMPONENTS
The system components could require manual cleaning, weekly, bi weekly, monthly, one to three months interval, every six months, or yearly depending upon application/ high voltage measurements. Refer to Sections 6, 7, and 8. Manual cleaning should not exceed yearly.

6. MANUAL CLEANING OF SMOG-HOG® COMPONENTS
There are a number of methods for manual cleaning, certain key cleaning criteria contribute to the effectiveness of every method. These include the type of detergent, detergent strength, water temperature, agitation/impingement, duration, rinse procedure and dry-out time.

6.1 Type of Detergent
In general the detergent used on most hydrocarbons (e.g., oily residues) will be alkaline in nature. It is extremely important that the detergent have a built-in buffering agent to reduce aluminum deterioration.
6.2 Detergent Strength

Detergent concentration in a mixture with water varies with the application from 1:1 to 25:1 parts water to parts detergent. For any contaminant condition, the best course is to use a cleaning solution per the detergent manufacturer's directions. More or less detergent may eventually be required for effective cleaning at reasonable detergent cost. The standard factory detergent concentration setting is 5% (20:1).

**CAUTION**

Never mix caustic and alkaline detergents for any manual or in-place cleaning. Detergent mixing could cause rapid heat release, gel formation or some other undesirable condition. Complete purging of system piping and soak tanks is required when changing detergents.

6.3 Water Temperature

Detergents can be up to twice as effective in hot water. Hot water alone is very effective in softening built-up residue. Water temperature should be 140°F to 170°F, not to exceed 180°F.

6.4 Agitation/Impingement

These methods are virtually the same, with impingement being the most extreme form of agitation. Any liquid movement over built-up residue will remove a layer, allowing detergent to work on the next layer. A reduction in cleaning time duration usually results.

6.5 Cleaning Cycle Duration

In most cleaning methods, adequate time should be allowed for the detergent to remove the contaminant thoroughly. Reaction time will vary depending on detergent strength, temperature and agitation. Guidelines for mixing, heating and expected results are included on specification sheets for most detergents. Time is necessary for effective cleaning. Soaking may seem slower and less effective than high impingement and/or hot water above 180°F. Personnel should be forewarned about using excessive pressure or temperature to shortcut the cleaning process. High pressure or stream spray cleaning at point blank range until cell plates edges are shiny is not effective. Not only will penetration to the cell core not occur, but warping and bending of the plates may result as well. Patience and thoroughness of cleaning best preserve the integrity of the components in the long term. Soaking and gentle rinsing provides for best results.

6.6 Rinse Procedure

Cleaned components should be rinsed off quickly and thoroughly to remove remaining contaminants. If the components appear to be clean, some detergent residue may remain. This should be removed because the residue may contribute to voltage bleed-down when the unicell is placed in operation. Also, even though the detergent is “buffered” prolonged contact could cause oxidation. As with cleaning, hot water should be used for rinsing.

6.7 Dry-Out Time

Unicells and filter media should be dry before the PSG is placed into operation. Startup of a wet system will cause dead short conditions to the ionizer and collector cell circuits. Wet unicells and filter media should be placed in a warm room for drying. Techniques such as hand wiping insulators and blowing dry unicells and filter media with compressed air will decrease drying time. Another method for drying cleaned components is installing the unicells and filter media in the PSG and placing on the system blower on line, with all power pack enclosure toggle switches placed in the “off” position for 30 minutes.

7. MANUAL CLEANING METHODS

The manual cleaning method selected will depend on the type of contaminant, rate of deposit, facility limitations such as cleaning time windows (process downtime) and available utilities. All cleaning methods listed in this section are acceptable.

7.1 Soak Tank

This is the most effective method which involves placing unicells and filter media in an agitated solution of hot water and detergent. With proper detergent selection and concentration, this procedure will quickly remove most contaminants. Unicells and filter media should not be placed in highly concentrated detergent solutions or allowed to soak for extended periods, (e.g., overnight), especially at elevated temperatures. Extended period of soaking in solvent or detergent solution will degrade components (oxidation) over time and should be avoided.

7.2 Portable Pressure Washer

A self-contained pressure washer with a spray wand can be an effective cleaning method, providing it is used with caution. Care should be taken not to expose the unicells to close-up and prolonged blasts of high pressure/temperature, causing cell plate deformity, requiring a replacement set of unicells and filter media.

7.3 Automatic Parts Washers

Certain commercially available units which are effective combine and automate the features necessary for effective cleaning, including water heating, detergent injection, agitation, rinsing and drying.
7.4 Other Cleaning Considerations

The previous methods address the cleaning of unicells and filter media. The PSG cabinet should also be periodically cleaned (i.e., during normal planned downtimes) to reduce contaminant build up. High voltage output of the power packs should also be checked when manual cleaning is performed.

8. APPEARANCE OF COMPONENTS AFTER CLEANING

Components should have a clean, not necessarily “new,” aluminum appearance. Discoloration will not affect system efficiency. The following are acceptable conditions for the system components. Parts should be replaced as required.

8.1 Unicell

1. Frame, end plates and cell plates are free of contaminant build-up (residual contaminant has been removed between cell plates, and ionizer wire support bars).
2. The frame is square, cell plates are parallel, cell hot plates (small dimensional plates) are centered between ground plates (large dimensional plates).
3. Ionizer standoff insulators and cell triangular insulators (front and rear) are cleaned (no residual coating). Cracked or carbon-tracked insulators have been replaced.
4. Ionizing wires and springs are intact and taut, centered between ground plates with no contaminant build up or coating.
5. Contact springs and contact screws are properly located and not deformed replace missing or deformed contact hardware.
6. Bent or broken parts have been repaired or replaced.

8.2 Prefilters/Afterfilters

1. Aluminum media and frame are free of contaminant.
2. Frame is square and media is intact.
3. Filters are always installed with drain holes down and arrow on each frame pointing in the direction of airflow.

8.3 Cabinet

1. Door feed-thru insulators are cleaned and white.
2. Door gaskets are cleaned and intact.
3. Component tracks are free of contaminant build up (for unicell grounding).
4. Module drain sumps are cleaned and free-flowing.
5. Interior is free of extreme contaminant build-up.
6. Blower wheel and housing is free of extreme contaminant build-up.
7. Preconditioning equipment (inlet plenum with baffle filters, cooling coils, etc.) has been checked for excessive pressure drop, cleaned if necessary.
8. Nozzles on all in-place cleaning system headers are not plugged.

9. PART REPLACEMENT PROCEDURES AND ADJUSTMENTS

9.1 Ionizer Wire(s) Replacement

Refer to Figure 14.
1. Remove damaged wire from each spring.
2. Replace spring if damaged or missing.
3. Loop one end of new wire over bottom spring. Pull top wire loop with pliers over top spring.
4. Wire should now be taut and centered.

⚠️ NOTICE

If replacement parts are not available, remove broken wires and tension springs from the ionizer section until parts are available. The unicell can be placed in service with missing ionizer wires.
9.2 Door Feed-Thru Insulator(s) Replacement

1. Place system off line.
2. Open power pack enclosure lid cover.
3. Remove high voltage wire by removing #10-32 hex nut.
4. Remove insulator retaining nut.
5. Open module door and remove the long screw from the insulator.
6. Remove the insulator from the interior of the module door.
7. Clean silicone sealant from module door surface.
8. Install replacement insulator, reversing the procedure, and applying a thin coat of silicone sealant to base of insulator.

9.3 Indicator Light Replacement

1. Open the power pack enclosure lid cover.
2. Disconnect the red and black wires from the indicator light which is connected to wires “9” and “2”.
   The indicator light located on each power pack enclosure is polarity sensitive. For proper operation, the two wires from the indicator light should be connected as follows, red wire connected to “9” wire from the power pack, black wire connected to “2” wire from the power pack.
   If the wires are reversed, the indicator light will not illuminate. The power pack indicator light circuit is DC voltage.
4. Install the replacement indicator light reversing the procedure.

9.4 COMPONENT ACCESS DOOR(S) GASKET REPLACEMENT

Should leakage occur an adjustment of the latch paws on the back of the door handles may solve the problem. Extreme care should be exercised in compressing door gasket beyond the design limits. Before adjusting for gasket deflection, check for the following:

1. Door or cabinet damage.
2. Deformed or torn gasket.
3. Leakage from some other source. Unicell components should be removed and replaced with great care to preserve gasket integrity. Should damaged gasket require replacement, contact United Air Specialists for the correct gasket material, BUNA-N (42-0168) or EPDM (42-1503).

9.5 Power Pack Enclosure Push Rod Adjustment

Tools required:
- 6" adjustable or 5/16" open-end Wrench. Refer to Figure 9.
1. Close module door (10) with unicells installed.
2. Open power pack enclosure lid cover (3).
3. Loosen 5/16" hex jam nut (9), then back off push rod extension (1) to end of threads.
4. Close power pack enclosure lid cover, listening for point where limit switch (4) is engaged.
5. Adjust rod extension (1) inward until limit switch (4) engages approximately one inch before the power pack enclosure lid cover closes (3).
6. Tightened hex jam nut.
7. Close power pack enclosure pack lid cover (3) and latch.
9.6 Blower Lubrication

The blower bearings require lubrication at a 2 to 3 month interval (petroleum lubricant lithium NLGI grade 2 grease). The bearings should be lubricated with the blower in operation. A hand operated grease gun is required performing one to two injections slowly, do not exceed two injections. Excessive injections/grease will cause bearing seal failure, contributing to bearing failure.

10. TROUBLESHOOTING

⚠️ CAUTION

Troubleshooting should only be completed by qualified and trained personnel.

⚠️ CAUTION

Hazardous live and moving parts are exposed during the troubleshooting procedures.

⚠️ WARNING

Power pack enclosure(s) service voltage is 120VAC. This can be lethal. Voltage (120 VAC) is present within the power pack enclosure even though the toggle switch is placed in the off position.

⚠️ CAUTION

RISK OF ELECTRICAL SHOCK.

The high voltage circuits to the ionizer and collector should be grounded before removing the power pack, high voltage wires, door feed through insulators and unicell(s). The grounding procedure can be accomplished by waiting one minute after placing the toggle switch in off position to the power pack enclosure or refer to Figures 12 and 13. The power pack total current output is limited to a maximum of 5 milliamps to assure personnel safety.

The PSG system can consist of one or more modules. Each module represents an independent collection system, 1, 2 or 3 unicells in series with a power pack enclosure. The power pack enclosure indicator light is the reference in determining the module status. The indicator light illuminated represents a working module, usually within high voltage specifications. An indicator light flashing or not illuminated exhibits an abnormal condition.
10.1 Tools Required

- Multimeter
- High voltage probe accessory for the multimeter
- High voltage test cables (2), 3’ in length with test clips at each end
- Basic hand tools
- *One power pack (UAS Part Number 21-1216)
- AC cable with three prone plug (for the wall receptacle), opposing end of cable should have two connectors for the power pack and a test clip for the ground wire. The ground wire should be secured to the ground stud on the power pack.

* A power pack can be utilized from one of the modules.

10.2 Perform Before Troubleshooting

The following should be checked to the module(s) in which the indicator light(s) is flashing or is not illuminated. Corrections should be completed and parts replaced.

- Toggle switch is in the on position to the power pack enclosure.
- Check adjustment of the push rod which engages the interlock switch refer to Section 9.5 “Adjusting Push Rods”.
- Proper electrical alignment to the unicell components, refer Figure 6, correct if necessary.
- The proper numbers of unicells are installed to the module.
- Unicell components have a moderate to extreme contaminant build up, manually clean the unicell components.
- Ionizer wires and tension springs missing or broken, remove broken wires/springs from the drain sump and or the unicell components
- Ionizer standoffs, cell triangular and or door feed through insulators display moderate to extreme contaminant build up, broken or carbon tracked insulators, clean or replaced (imbedded black streak which cannot be removed by cleaning, replace insulator).

10.3 Troubleshooting Procedure

Each power pack enclosure is equipped with an interlock switch for the power pack 120 VAC circuit. Since the power pack enclosure lid cover is open for troubleshooting the interlock switch should be engaged (manually or by other means) after placing the toggle switch in the on position and disengaged when placing the toggle switch in the off position. All connectors on the power pack are identified with name and wire number with the exception of the ground connector (green wire to this connection). Refer to Figure 16, Step 1 and Step 2 does not require a high voltage probe.

Figure 16
Power Pack Input and Output Connections

If there is a dead short condition or arcing condition usually the problem is within the collector cell. The power pack should be confirmed that the power pack is operational, start with step (1), before proceeding to the step (2). In the event of a dead short condition the power pack is designed to “shut down” the high voltage to the ionizer and collector cell circuits causing the indicator light to flash. When the dead short condition is removed possibly by the exhaust blower or In Place Cleaning System (if so equipped) or manual cleaning the high voltage output will return to normal. The indicator light will be illuminated. The power pack is self protecting from dead short conditions. The ionizer section supports 10 mil tungsten wires which apply a high voltage positive charge to the contaminant particles.

The cell section contains plates alternately charged collecting the contaminant particles from the ionizer section.

High voltage problems can generally be isolated by reference to the indicator light. If the indicator light(s) are illuminated and the unit is moving air but efficiency is below normal (unicells not dirty, smoke discharging from the exhaust blower) check for properly aligned unicells. Refer to Figure 6.

A high voltage probe is required to measure high voltages to the ionizer and collector circuits to the unit and performing the “Bench Test Procedure”. As an accessory, a high voltage probe can be purchased for a multimeter.

**High Voltage Specifications:**

**Ionizer Circuit Operating Range:** 10.0 to 11.8 KVDC

**Collector Cell Circuit Operating Range:** 5.0 to 7.5 KVDC

There are two factors which will elevate ionizer voltages above 12.0 KVDC.

1. The ionizer wires are heavily coated with contaminant (two to three times or greater, the diameter of the wire). This will decrease collection efficiency.
2. There are "run away" voltages to the power pack requiring power pack replacement, above 12.0 KVDC to the ionizer circuit, and 7.5 KVDC to the collector cell circuit.

There will be continuous cell arcing if cell voltages exceed 7.5 KVDC. This is also caused by "run away"
10.4 STEP 1 — Checking the Power Pack

Indicator light is flashing or not illuminated

The toggle switch should be placed in the off position to the power pack enclosure, open power pack enclosure lid door, and disconnect both high voltage wires (Ionizer #8 and Collector #7) from the power pack. The high voltage wires should carefully be placed away from the ionizer and collector cell power pack connectors, eliminating the high voltage wires from contacting the power pack connectors. Place the toggle switch in the on position and engage interlock switch; the indicator light should be illuminated. If the indicator light is illuminated the power pack is operational, proceed to step (2). If the indicator light is flashing (high voltage wires #8 and #7 disconnected from the power pack), the power pack requires replacement. If the indicator light is not illuminated proceed with following until the problem is located and corrected.

The following steps refer to the wiring diagram within the power pack enclosure or Figure 17.

Verify there is 120 VAC to the power pack, place the toggle switch in the off position and remove the 120 VAC wires from the power pack terminals 5 and 6. Connect the multimeter to the two 120 VAC wires and place the toggle switch in the on position and engage the interlock switch.

Confirm 120 VAC to the power pack enclosure terminals, not the power pack terminals 5 and 6.

Verify the interlock switch operation (120 VAC) to the power pack enclosure (measure voltage to the primary side of the interlock switch and engage interlock switch before measuring voltage to the secondary side. The mechanical engagement of the limit switch should be checked refer to Section 9.5.

Place system off line and check the tightness of all wire terminal screws and inspect for disconnected wires at the power pack enclosure or remote electrical panel terminal blocks.

Inspect the fuses or circuit breaker to the power pack circuit.

Indicator light and circuit should be checked. Check wire connections (#9 and #2) to the power pack, and to the indicator light assembly. The LED requires correct wiring polarity. The LED will not illuminate if the wiring polarity is incorrect.

The power pack has two terminals for the indicator light, identified as #9 (+), and #2 (-). The factory wiring numbers are identical.

LED has two wires (red and black) from the assembly, wire #9 to the red wire, wire #2 to the black wire.

VDC measurement with wires #9 and #2 disconnected from the power pack: 7.9 to 10.0 VDC, with #9 and #2 connected 3.8 to 6.0 VDC.

Place toggle switch in the off position and connect all wires which have been disconnected.

Parts should be replaced as required.

---

**Figure 17**

Power Pack Enclosure Wiring Diagram
10.5 STEP 2 — Checking the Unicell
Components Indicator Light is Flashing

Do not proceed with step (2) until step (1) is completed. The following steps are the process of elimination in identifying the problems to the ionizer/collector cell circuits. There are four conditions which could occur with a flashing indicator light.

1. The high voltages are below specifications to the ionizer and or the collector cell circuit(s).
2. There is an arcing condition to the ionizer and or collector cell circuit(s).
3. There is a dead short condition.
4. The power pack has failed. Refer to Step 1.

(a) Place the toggle switch in the off position, and open power pack lid door. Disconnect high voltage wire #8 to the ionizer connector with high voltage wire #7 (Collector) connected to the power pack and place the toggle switch in the on position, and engage interlock switch.

The indicator light should be illuminated. If so, the cell circuit is operational proceed to (b). If indicator light is flashing perform the following.

• Place toggle switch in the off position, open component door, and remove the unicell(s).

• Place toggle switch in the on position, and engage interlock switch. The indicator light should be illuminated. If the indicator light is illuminated the problem is within the collector cell section. If the indicator light is flashing the problem is the high voltage feed through insulator (dirty, cracked, carbon tracking) and or the high voltage wire (broken wire or wire insulation has deteriorated causing a dead short condition).

Parts should be replaced as required.

Remove the unicells and inspect for the following:

COLLECTOR CELL CONDITIONS CAUSING FAILURE

• Dirty collector cell(s) (contaminant build up bridging the cell plates and or on cell triangular insulators front/rear) requiring manual cleaning.
• “Wet” collector cell(s), not properly dried after a wash cycle or manual cleaning procedure, use compressed air to accelerate the drying time.
• Deformed collector cell contact springs contacting a “grounded surface”.
• Misaligned contact springs (contacting a grounded surface) between the outer and inner most cells if module is equipped with two unicells and or at high voltage feed through insulators. Refer to Figure 6.
• Bent cell plate(s) contacting the opposing cell plate(s).
• Warped cell plate(s) which could be due to high duct operating temperature, consult UAS.
• Carbon tracking to the cell high voltage feed through insulator and or cell triangular insulators, imbedded black streak which cannot be removed by cleaning (replace insulator).
• Surface oxidation to unicell component requiring a replacement.
• Unicell is structurally weak, loose steel rivets, deterioration to cell plate spacers or paper thin cell plates due to utilizing the improper detergent.

Parts should be replaced as required or replacement of unicell.

Sometimes a flashing indicator light will clear itself by removing the unicell(s) from the module and then installing the unicell(s) back into the module.

The Bench Test Procedure will determine which unicell(s) are causing a flashing indicator light. Refer to Section 10.7.

Place toggle switch in the off position; connect all wires which have been disconnected and install unicell(s).

(b) Indicator light is illuminated with the high voltage wire #7 connected to the collector cell connector on the power pack. Place toggle switch in the off position and connect high voltage wire #8 to the ionizer connector on the power pack. Place the toggle switch to the on position and engage the interlock switch.

The indicator light should be illuminated? If so, the unicell(s) are operational. If the indicator light is flashing perform the following.

• Place power in the off position, open the component door, and remove unicell(s).

• Place toggle switch in the on position and engage interlock switch. If the indicator light is illuminated the problem is within the ionizer section. If the indicator light is flashing the problem is the high voltage feed through insulator (dirty, cracked, carbon tracking) and or the high voltage wire (broken wire or wire insulation has deteriorated causing a dead short condition).

Parts should be replaced as required.

Remove the unicell(s) and inspect for the following:

IONIZER CONDITIONS CAUSING FAILURE

• Dirty ionizer(s) (contaminant build up) requiring manual cleaning.
• “Wet” ionizer(s), not properly dried after a wash cycle or manual cleaning procedure, use compressed air to accelerate the drying time.
• Deformed ionizer contact springs contacting a “grounded surface”.
• Misaligned contact springs (contacting a grounded surface) between the outer and inner most ionizer, if module is equipped with two unicells, or at the ionizer high voltage feed through insulator. Refer to Figure 6.
• Broken ionizer wires.
• Contaminant build up and or cracked ionizer stand off insulators and or high voltage feed through insulators.
• Carbon tracking (black streak) to the ionizer stand off insulators and or high voltage feed through insulator (replace insulator)
• Ionizer wires not “taut” contacting the ground plates.
• Bent ionizer wire support bar contacting a “grounded surface.”
• Bent ground plates contacting the ionizer wires.
• Surface oxidation to unicell component requiring a replacement.
• Unicell is structurally weak, loose steel rivets, deterioration to cell plate spacers or paper thin cell plates due to utilizing the improper detergent.

Parts should be replaced as required.

Sometimes a flashing indicator light will clear itself by removing the unicell(s) from the module and then installing the unicell(s) back into the unit.

The Bench Test Procedure will determine which unicell(s) are causing a flashing indicator light, refer to Section 10.7.

Place toggle switch in the off position; connect all wires which have been disconnected and install unicell(s).

10.6 High Voltage Probe Measurements

A high voltage probe (refer to manufacturers instructions) is required to measure high voltage output from the power pack. Refer to Figure 18. The component door should be closed with the indicator light illuminated. If the indicator light is flashing or not illuminated perform step 1 and if required step 2.

1. Place toggle switch to the power pack enclosure in the on position.

2. Open the lid door to the power pack enclosure and connect the ground wire from the high voltage probe to the bare metal push rod.

3. Engage the interlock switch and place the tip of the high voltage probe to the ionizer door feed through insulator. The high voltage measurement should be 10.0 to 11.8 KVDC. If the ionizer voltage is below specifications refer step 2, “Ionizer Conditions Causing Failure”. Bench Testing may also be required. Low ionizer voltage will decrease the collector cell voltage, but low cell voltage will not affect the ionizer voltage...

4. Engage the interlock switch and place the tip of the high voltage probe to the collector cell door feed through insulator. The high voltage measurement should be 5.0 to 7.5 KVDC. If the collector cell voltage is below specifications refer step 2, “Collector Cell Conditions Causing Failure.” Bench Testing may also be required. Low ionizer voltage will decrease the collector cell voltage.

10.7 BENCH TEST PROCEDURE

**CAUTION**

RISK OF ELECTRICAL SHOCK.

The high voltage circuits to the ionizer and collector should be grounded before removing the power pack, high voltage wires, door feed through insulators and unicell(s). The grounding procedure can be accomplished by waiting one minute after placing the toggle switch in off position or refer to Figures 12 and 13. The grounding procedure statement is not identified within the bench test procedure but should be performed. The power pack total current output is limited to a maximum of 5 milliamps to assure personnel safety.

This procedure can be utilized to determine an electrical problem with the unicell(s) or a power pack or testing the unicell(s) after manual cleaning.

Do not use a power pack that is not within the high voltage specifications, refer to “Testing the Power Pack”.

---

Figure 18

High Voltage Measurements at the Power Pack

The high voltage probe can be used to determine which circuit is arcing by isolating each circuit ionizer or collector cell.

1. Disconnect high voltage wire #7 (collector cell) and measured high voltage to the ionizer circuit (high voltage wire #8).
2. Connect high voltage wire #7 and disconnect high voltage wire # 8.
3. Measure high voltage to the collector cell circuit (high voltage wire #7) Fluctuating high voltage during a measurement will indicate an arcing circuit.
High Voltage Specifications:
Ionizer Circuit Operating Range: 10.0 to 11.8 KVdC
Collector Cell Circuit Operating Range: 5.0 to 7.5 KVdC

PROCEDURE
TESTING THE IONIZER
1. Select one unicell to be tested.
2. Connect one high voltage wire to the ionizer contact spring and to the power pack connector identified as “Ionizer #8”.
3. Connect the other high voltage wire (use as a ground wire) to the metal frame of the unicell and to the ground stud on the power pack.
4. AC cable should be connected to the power pack connectors 5 and 6 with ground wire secured to the ground stud on the power pack.
5. Connect AC cable plug to the wall outlet.
6. Measure high voltage with the high voltage probe, ionizer voltage should be 10.0 to 11.8 kVdC, not to exceed 12.0 kVdC. If ionizer voltage exceeds 12.0 kVdC, the ionizer wires are moderately to extremely coated with contaminant (clean ionizer wires), or the power pack is not within specifications.
7. If there is an arcing condition, determine the problem and repair.
8. Disconnect AC cable plug from the wall outlet.

Refer to “Ionizer Conditions Causing Failure” in Section 10.5.

Ionizer may not be within high voltage specifications, even though manually cleaned, due to the service “age” of the unicell. The unicell should be replaced.

Parts or unicell should be replaced as required.

TESTING THE POWER PACK
1. Connect AC cable to the power pack connectors 5 and 6 with the ground wire secured to the ground stud on the power pack.
2. Connect AC cable plug to wall outlet.
3. Measure high voltage with high voltage probe at the connectors “Ionizer #8” and “Collector #7”, refer to high voltage specifications.
4. Disconnect AC cable plug from the wall outlet.
5. Replace power pack if high voltage measurements are above or below high voltage specifications.
## 10.8 Troubleshooting Guide

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSES</th>
<th>RECOMMENDED SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>System will not start or only operate a short duration</td>
<td>Main electrical disconnect switch in the off position.</td>
<td>Place disconnect switch in the on position.</td>
</tr>
<tr>
<td></td>
<td>The unit start/stop switch is in the off position.</td>
<td>Press the unit start switch in the on position.</td>
</tr>
<tr>
<td></td>
<td>Fused have failed.</td>
<td>Replace the fuses.</td>
</tr>
<tr>
<td></td>
<td>Overload relay has tripped.</td>
<td>Compare FLA rating of the motor to the overload relay setting, adjust as required and measure amperage.</td>
</tr>
<tr>
<td></td>
<td>Poor wire connections.</td>
<td>Check wire connections at motor and all wire terminations.</td>
</tr>
<tr>
<td>Insufficient airflow</td>
<td>Blower rotation is incorrect.</td>
<td>Check blower rotation per directional arrow on the blower housing. Refer to Section 4.1.3.</td>
</tr>
<tr>
<td></td>
<td>Blower/motor drive belts have failed.</td>
<td>Check drive belts and motor condition.</td>
</tr>
<tr>
<td></td>
<td>PSG access door(s) are open.</td>
<td>Close PSG access door(s).</td>
</tr>
<tr>
<td></td>
<td>PSG has extreme internal contaminant build up due to poor maintenance.</td>
<td>Manually clean the PSG unit. Refer to Sections 6, 7 and 8.</td>
</tr>
<tr>
<td></td>
<td>Internal debris within the duct and or PSG cabinet.</td>
<td>Remove debris.</td>
</tr>
<tr>
<td>The power pack enclosure indicator light is not illuminated</td>
<td>Power pack enclosure toggle switch is in the off position.</td>
<td>Check toggle switch position.</td>
</tr>
<tr>
<td></td>
<td>Power pack enclosure(s) push rod assembly is not properly adjusted.</td>
<td>Refer to Section 9.5.</td>
</tr>
<tr>
<td></td>
<td>Power pack has failed.</td>
<td>Refer to Section 10.4.</td>
</tr>
<tr>
<td>The power pack enclosure indicator light is flashing.</td>
<td>Unicells are not properly electrically aligned.</td>
<td>Refer to Figure 6.</td>
</tr>
<tr>
<td></td>
<td>Unicell(s) have a moderate to extreme contaminant build up.</td>
<td>Refer to Sections 6, 7 and 8.</td>
</tr>
<tr>
<td></td>
<td>High voltage measurements are not within specifications.</td>
<td>Refer to Section 10.3.</td>
</tr>
<tr>
<td></td>
<td>Power pack has failed.</td>
<td>Refer to Section 10.4.</td>
</tr>
<tr>
<td>System efficiency is poor. Smoke is discharging to the atmosphere.</td>
<td>Power pack enclosure(s) toggle switch are in the off position.</td>
<td>Check power pack enclosure(s) toggle switch position.</td>
</tr>
<tr>
<td></td>
<td>Unicells are not properly electrically aligned.</td>
<td>Refer to Figure 6.</td>
</tr>
<tr>
<td></td>
<td>Unicell(s) have a moderate to extreme contaminant build up.</td>
<td>Refer to Sections 6, 7 and 8.</td>
</tr>
<tr>
<td></td>
<td>Power Pack has failed.</td>
<td>Refer to Section 10.4.</td>
</tr>
<tr>
<td></td>
<td>Power pack enclosure(s) push rod assembly is not properly adjusted.</td>
<td>Refer to Section 9.5.</td>
</tr>
<tr>
<td></td>
<td>Fuses have failed to the power pack circuit.</td>
<td>Replace fuses.</td>
</tr>
<tr>
<td></td>
<td>Air volume (ACFM) is not within specifications.</td>
<td>Measure air volume, call UAS Customer Service for specifications.</td>
</tr>
</tbody>
</table>
11. ORDERING PARTS

11.1 Replacement Parts

Common replacement parts are illustrated within this manual. For further assistance call United Air Specialists Customer Service.

United Air Specialists, Inc.
4440 Creek Road
Cincinnati, Ohio 45242
Tel. 1-800-252-4647

For prompt service, please specify:
1. Unit Model Number (nameplate)
2. Unit Serial Number
3. Part Number or Part Description (see illustrated parts)

11.2 Returning Parts

When returning parts directly to UAS, call Customer Service at 800-252-4647 for a return authorization number (RMA). Mark it prominently on the returned package to assure prompt handling and service.

11.3 Freight Cost

Freight cost on returned parts must be prepaid by the sender. Freight cost on parts shipped from UAS is prepaid by UAS and added to the cost of the parts.
12. POWER PACK ENCLOSURE ASSEMBLY

POWER PACK ENCLOSURE ILLUSTRATION
### 12.1 POWER PACK ENCLOSURE ASSEMBLY PARTS LIST

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QUANTITY REQUIRED</th>
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<tbody>
<tr>
<td>1</td>
<td>20-1396</td>
<td>Power Pack enclosure</td>
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<tr>
<td>2*</td>
<td>21-1216</td>
<td>Power Pack</td>
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<tr>
<td>3</td>
<td>02-1651</td>
<td>Shorting Out Assembly</td>
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<td>4</td>
<td>42-10063-0001</td>
<td>Gasket For Lid Cover</td>
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<td>5</td>
<td>20-2835</td>
<td>Terminal Block</td>
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<td>6</td>
<td>10-11034-0002</td>
<td>Terminal Bracket</td>
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<td>41-2435-5</td>
<td>Terminal Label</td>
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<td>9</td>
<td>30-0065</td>
<td>Flat Washer #10</td>
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<td>Lock Washer #10</td>
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<td>30-0003</td>
<td>Hex Nut 10 x 32</td>
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<td>20-0326</td>
<td>Toggle Switch SPST</td>
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<td>30-0045</td>
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<td>Label “Off/On”</td>
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<td>20-0035</td>
<td>Hex Cap Switch Seal</td>
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<td>02-10561-G</td>
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<td>37-0026</td>
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<td>30-0398</td>
<td>Round Head Screw, #10-32 x 4” SST</td>
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<td>30-0412</td>
<td>Lock Washer, #10 EXT. Tooth, SST</td>
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<td>30-0367</td>
<td>Fender Washer, ¼” x 1 1/2”, SST</td>
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<td>Spacer</td>
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<td>Hex Nut, #10-32 x 1”</td>
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<td>20-1239</td>
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<td>Switch Insulator</td>
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<td>30-0016</td>
<td>Screw 6-32 x 1”</td>
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<td>Nut Plate</td>
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<td>30-0118</td>
<td>Screw 6-32 x 1½”</td>
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<td>30-0038</td>
<td>Lock Washer #6</td>
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<td>30-0001</td>
<td>Hex Nut 6-32</td>
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<td>10-0961</td>
<td>Interlock Switch Arm Ground Bar</td>
<td>1</td>
</tr>
<tr>
<td>37</td>
<td>39-10008-0006</td>
<td>Hex Latch</td>
<td>1</td>
</tr>
</tbody>
</table>

* Standard power pack part number. System could have a special power pack, refer to part number on the power pack (21-XXXX) before ordering replacements.

** L/R left to right airflow unit, R/L right to left airflow unit, as viewing from the component door side.
UNITED AIR SPECIALISTS, INC.
LIMITED WARRANTY

UAS warrants to the original purchaser that all equipment will be free from defects in materials and workmanship for one year from the date of shipment from UAS (three years for Smokeeter® and VisionAir™ models other than CC and DC series) and that major structural components on SFC and MCB series will be free from defects in materials and workmanship for ten years from the date of shipment from UAS. This warranty applies only if equipment is properly installed, maintained, and operated under normal conditions and does not apply to damage caused by corrosion, abrasion, abnormal use or misuse, misapplication, or normal wear and tear. This warranty will be void with respect to equipment that is subject to unauthorized repairs or modifications. UAS makes no warranty as to goods manufactured or supplied by others. This warranty is subject to any limitations in UAS’ quotation and may not be modified except by a written instrument signed by the President or Vice President of Sales of UAS.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT.

As Purchaser’s exclusive remedy for any defects in the equipment, UAS will exchange or repair any defective parts during the warranty period, provided such parts are returned, prepaid, to UAS’ factory. The obligation of UAS is limited to furnishing replacement parts F.O.B. UAS’ factory or making repairs at UAS’ factory of any parts that are determined, upon inspection by UAS, to be defective. In no event will UAS be responsible for labor or transportation charges for the removal, reshipment or reinstallation of the parts. IN NO EVENT WILL UAS BE RESPONSIBLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES.