

K450 OWNER'S MANUAL

**Electrostatic Spraying Systems, Inc.
62 Morrison Street Watkinsville, GA 30677
(706) 769-0025**

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I. Introduction

Congratulations!

You have just purchased the most advanced spraying system on the market today. Electrostatic Spraying Systems, Inc. is committed to providing you with the most effective sprayer for delivery of today's chemicals that is as easy to operate and maintain, as it is easy on the environment.

Here at ESS, we work continuously to improve all of our products and their systems. To achieve this goal, **we would like your comments.** If you have any concerns, questions or suggestions, please contact us at the address or phone number below.

Electrostatic Spraying Systems, Inc.
62 Morrison Street
Watkinsville, GA 30677
Phone: 800-213-0518
Fax: 706-769-8072
Email: essparts@kaibab.com

Important!

Please take the time to study this manual before operating the K-450 Row Crop Sprayer™. It contains important instructions on the safe setup and operation of this equipment. You will also find SAFETY PRECAUTIONS as well as helpful suggestions to maximize your productivity.

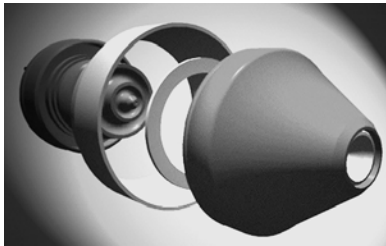
Thank you!

We appreciate your business and are proud that you have selected an ESS sprayer for your operation.

*ESS K-450 Row crop Sprayer™, K-450 Row crop™, Maxcharge™, and the ESS logo are copyrights or registered trademarks of Electrostatic Spraying Systems, Inc.

Overview of the ESS model K-450 Air-Assisted Electrostatic Sprayer

Air-assisted electrostatic sprayers produce electrically charged spray drops that are carried in the plant canopy in a low pressure, gentle, medium speed air stream. The heart of the K-450 sprayer is the patented *Maxcharge*TM Maxcharge nozzle. Air and spray liquid enter separately at the rear of the nozzle. Just



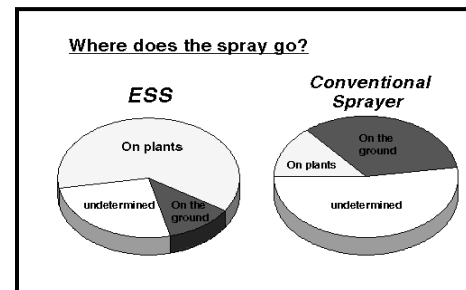
The *Maxcharge*TM spray nozzle is what makes ESS the industry leader in the production of electrostatic spraying equipment.

before leaving the nozzle, the air hits the liquid stream to make many thousands of small spray drops that pass through the charging ring without touching it. A charge is transferred to the spray drops by induction, a process similar to the way a magnet can move metal filings or electric motors are powered. This charge is about 80 times greater than gravity. The air pushes these thousands of charged spray drops out of the nozzle and into the plant canopy. There, the charged spray drops can move in any direction to deposit on all plant surfaces.

The *Maxcharge*TM nozzle offers double the spraying power of our competitors with none of their electrical arcing or safety hazards. It is easier to clean and also corrosion proof. The interior ceramic outlet resists wear three times better than stainless steel outlets. All of these characteristics combine to give the best spray coverage on the market today. As a result, you can be assured of savings in the application of chemical in a quality package that is virtually maintenance-free.

As you can see below, results of air-assisted electrostatic spraying as opposed to conventional sprayers are dramatic.

The University of California completed a series of tests to investigate what happens to spray liquid after it leaves the nozzle. **Conclusion:** ESS technology places over 4 times the amount of spray onto the plant surface using 1/2 the amount of chemicals. Furthermore, they also reported that ESS sprayers send 2/3 less chemicals to the ground and into the air. Less chemical used overall, less waste and less drift than conventional equipment. Imagine the environmental consequences!



II. Warranty

Electrostatic Spraying Systems, Inc. warrants to the original purchaser of this equipment that the equipment is free from any defects in material and workmanship for a period of one year after delivery. The attached warranty form must be returned within 30 days of delivery of the equipment for verification of delivery date and purchase or this warranty is void. Under this warranty, Electrostatic Spraying Systems, Inc. will repair or replace any defective items found within the one-year period. Electrostatic Spraying Systems, Inc. reserves its exclusive right to determine if the defective part is covered under this warranty and its choice of repairing or replacing the part. **Parts must be returned for inspection in order to determine warranty.**

DISCLAIMER OF IMPLIED WARRANTIES AND CONSEQUENTIAL DAMAGES

Electrostatic Spraying Systems, Inc. obligation under this warranty, to the extent allowed by law, is in lieu of all warranties, expressed or implied, including implied warranties of merchantability and fitness for a particular purpose and any liability for incidental or consequential damages with respect to the sale or use of the items warranted. Such incidental or consequential damages shall include but not be limited to: transportation charges, cost of installation, duty, taxes, charges for normal service or adjustments, loss of profits, use, income, crops, or production, or increased cost of operation, or spoilage or damage to material, or other commercial loss arising in connection with the sale, installation, use, repair or replacement of ESS products, or detention or delay in the delivery of equipment or parts.

THIS WARRANTY SHALL NOT APPLY:

1. To ESS vendor items that carry their own warranties such as, but not limited to, air compressors or blowers, liquid pumps, pop off valves or air switches, etc.
2. If, in the sole discretion of Electrostatic Spraying Systems, Inc., the unit has been subject to misapplication, abuse, misuse, negligence, fire or other accident.
3. From damage resulting from corrosive action of any gases, liquids, or powders handled by the equipment or improper installation of warrantable parts, or failure to properly follow maintenance procedures as outlined in this manual.
4. If the unit has been altered or repaired in a manner which, in the sole judgment of Electrostatic Spraying Systems, Inc., such alteration or repair affects the unit's performance, stability, or reliability.
5. If parts not made, specified, or supplied by Electrostatic Spraying Systems, Inc. have been used in connection with or substituted on the unit, if in the sole judgment of Electrostatic Spraying Systems, Inc. such parts affect the unit's performance, stability or reliability.
6. To normal maintenance and service or replacement items such as, but not limited to lubricants, filters, drive belts, or to normal deterioration of such

things as exterior finish due to use and exposure in various climates. Furthermore, it shall be the responsibility of the purchaser to follow all operation checks listed in this manual to ensure that the unit is in good working order.

NO EMPLOYEE OR REPRESENTATIVE OF ELECTROSTATIC SPRAYING SYSTEMS, INC. IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY UNLESS SUCH CHANGE IS MADE IN WRITING AND SIGNED BY A CORPORATE OFFICER OF ELECTROSTATIC SPRAYING SYSTEMS, INC.

Product Warranty Registration Form

Electrostatic Spraying Systems, Inc.

Model Number _____

Serial Number _____

Purchase Date _____

Owner's Name _____

Company Name _____

Address _____

City _____ State _____ Zip _____

Phone Number _____ Fax Number _____

Email Address _____

Owner's Signature **X** _____

*Your signature indicates acceptance of equipment, a clear understanding of the warranty and receipt of instructions on safe and proper operating procedures.

Instructions to validate your warranty:

- 1. Fill out this form.**
- 2. Sign your name.**
- 3. Make a copy for yourself.**
- 4. Fax or mail this form to ESS, Inc.**
Fax# 706-769-8072
Electrostatic Spraying Systems, Inc.
62 Morrison Street
Watkinsville, GA 30677
- 5. If you have purchased several ESS products, please fill out a separate form for each one.**

**Proper completion of these steps within 30 days insures the validity of your warranty.*

Instructions for a warranty claim:

1. Contact us first by fax/phone with a description of the problem. Include the product type, serial number, and your phone and fax numbers.
2. Return the defective part to ESS, Inc.
3. In the package with the returned part, please include the model and serial numbers and your written description of the problem.
4. If you need the part immediately, we recommend that you order it, and we will credit your account upon determination of coverage by warranty.

III. Safety Precautions

OWNER'S/OPERATOR'S RESPONSIBILITY

Study the owner's manual. The owner is responsible for ensuring that all persons using this equipment are properly trained to do so. It is the responsibility of the operator to become familiar with all safe and correct operating procedures of this product.

It is the owner's responsibility to maintain this product in accordance with the guidelines described in the Owner's Manual. Proper inspection of the equipment, repair or replacement of parts when continued use of the product would cause personal harm or damage or excessive wear to other parts is the responsibility of

Chemical Precautions

Read and follow all instructions on the chemical or pesticide manufacturer's label for the following:

1. Protective clothing, including, but not limited to:
 - Eye protection
 - Rubber boots
 - Rubber gloves
 - Rubber apron
 - Hat
 - Cartridge respirator (when handling, mixing and applying the chemical)
2. Handling:
 - Mixing
 - Storing
 - Disposing methods
3. Decontamination methods for chemical removal from persons, clothing and equipment.
4. Avoiding potential health and environmental hazards.
5. Medical treatment for poisoning symptoms.
6. Length of time before reentry into the sprayed area.
7. Proper posting or notification of sprayed areas.

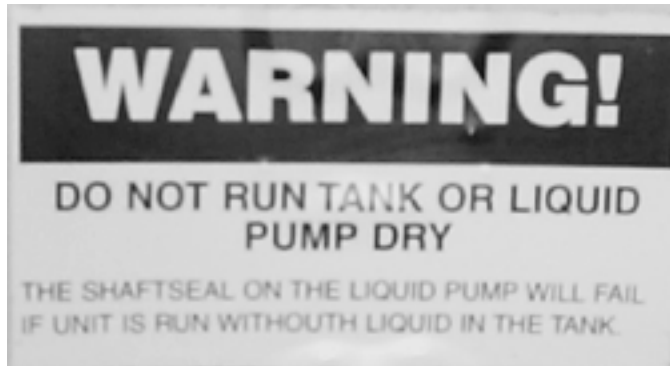
Safety Precautions

Lack of attention to safety can result in **REDUCTION OF EFFICIENCY, ACCIDENT, PERSONAL INJURY OR DEATH.** Watch for safety hazards and correct deficiencies promptly. Use the following safety precautions as a general guide when using this machine. Additional safety precautions are mentioned throughout this manual for specific operating and maintenance procedures.

1. Study and become familiar with the owner's manual. Failure to do so is considered a misuse of this equipment.
2. Before operating equipment, become familiar with all caution and warning decals affixed to the machine.
3. Do not allow children to operate the sprayer. Do not allow adults to operate the sprayer without proper instruction.
4. Keep the area of operation clear of all persons and animals.
5. Do not apply chemicals when weather conditions favor drift from treated areas.
6. Turn off the sprayer when leaving it unattended.

DECALS

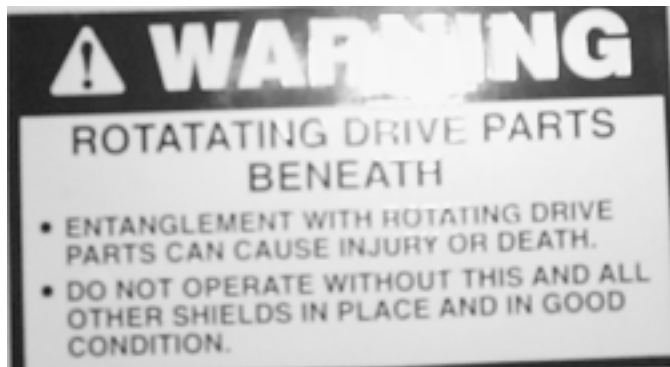
ESS places several decals on the K450 sprayer to remind the operators of safety and proper techniques. Always follow good, safe practice when operating this machinery. Note the locations on the equipment where these decals may be found. Replace them if they become worn or damaged and can no longer be read.



This warning is repeated several times in this manual. The decal is found on the front and rear of the spray tank.



This caution is found on the 10 gallon stainless steel tank. The blower pressurizes this tank and caution should be used when opening the lid or removing the quick connects. Lifting the gray knob up that is located on the tank lid will relieve tank pressure.



This warning decal is located near all the shield locations under which the belt drive components are located. **Do not operate the K450 without proper shielding in place.**



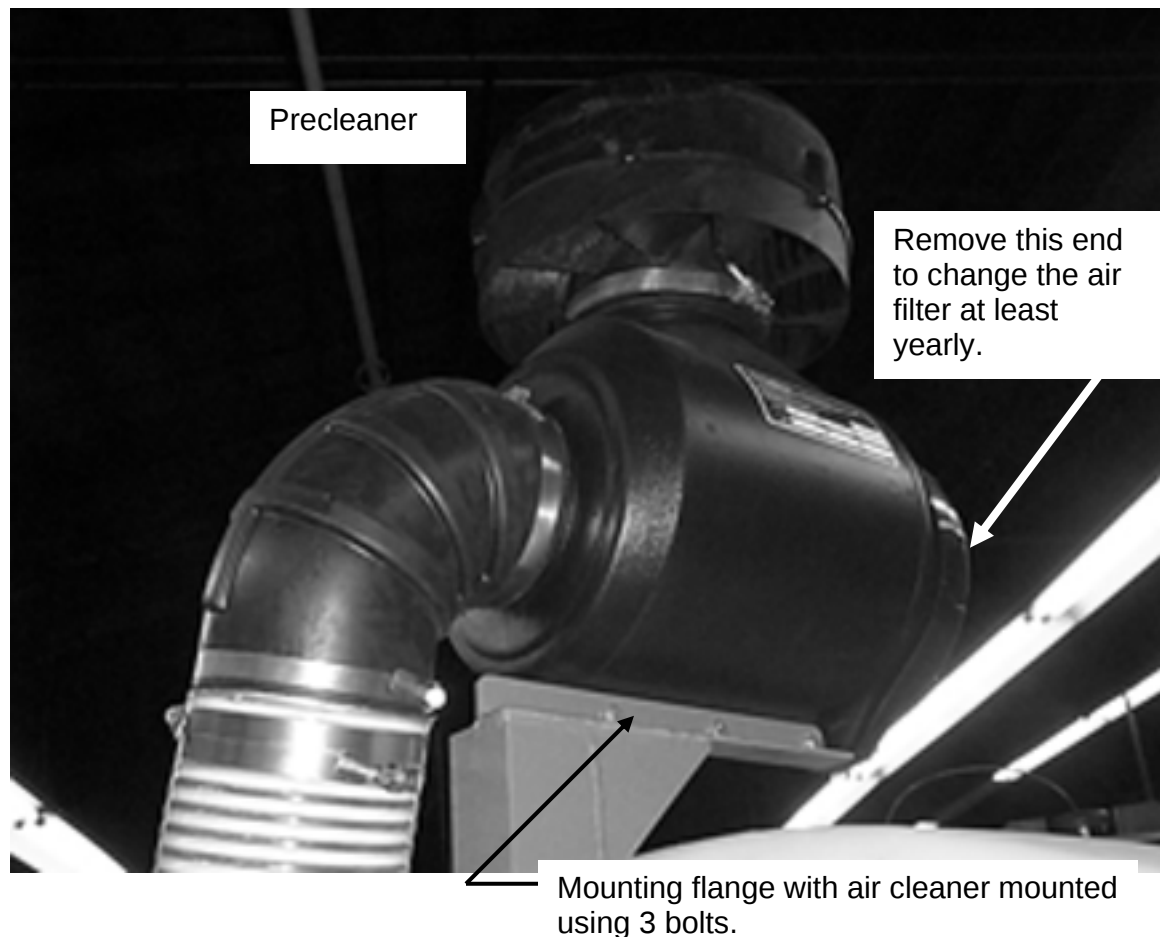
This danger decal is located on the front of the K450 sprayer. The K450 could tip forward when the wings are in the folded position when the base is resting on uneven ground. Exercise caution when connecting the sprayer to the tractor.

IV. Initial Installation

The K-450 sprayer is fully assembled and tested at Electrostatic Spraying Systems before shipment. After testing, the unit is partially disassembled for shipment. After you have unloaded the sprayer, there are several parts that must be reassembled before operation.

- Air Filter Assembly

Reinstall the air filter assembly on the sprayer.

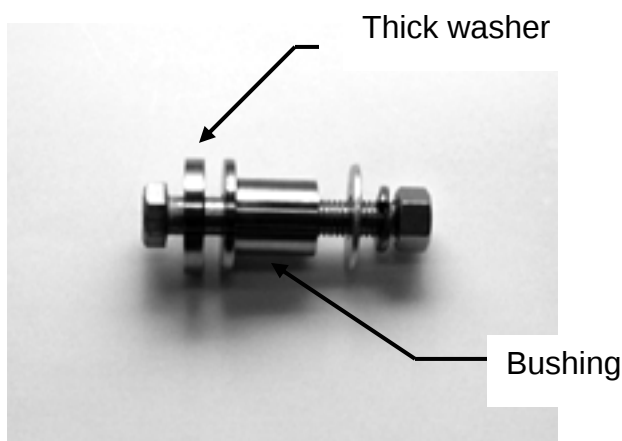


It consists of a 5" aluminum nipple in a rubber elbow, black plastic air filter body with element, and pre-cleaner. Three 5/16" bolts with washers and nuts are included as well as two hose clamps. Mount the air cleaner assembly on the mounting flange weldment using the three bolts. Slide the hose clamps over the 5" ID hose. Place them in opposite directions. Insert the 5" aluminum nipple into the 5" ID hose and tighten the hose clamps.

- ## Wing Assembly

In some instances, the K-450 sprayer will be shipped with the wings detached. They will be marked "L" or "R" indicating a left or right wing assembly. **In this manual, all references to left and right are with the viewer standing at the rear of the sprayer looking forward over the sprayer, as it would be mounted on the tractor.** Left and right wings are virtually identical, but an inspection of the wiring harness connections that are different on the left and right wings can identify them.

To install a wing assembly, remove the two ½" mounting bolts installed in the lower section of the swing arm assemblies on the rear frame of the sprayer. A bolt is shown below with the thick, machined washer, the stainless steel bushing, and the zinc washer.



Cut away all tape, strapping material and transportation coverings on all hoses, cylinders and wire assemblies. Dismantle all wood packing material from the wing being careful of pinch points on the breakaway of the wing. Unfold the breakaway. Mount the wing on the swing arm with the two ½" bolts. Make sure a stainless steel bushing is in each ear of the swing arm. Mount the bushing with the flange on the inside of the swing arm ear. Put a large zinc washer on a bolt, lift the wing so that it fits inside the ears of the swing arm, and install the bolt with the head on the inside with the threads sticking out so that they will not rub on the main air delivery hose when it is installed. Use the thick, machined washer on the outside and the ½" nylon lock nut. Repeat for the other bolt. Lift the wing tip up and pin the hydraulic cylinder in place. Reinstall the hydraulic hoses to the cylinder.

Connect the wire harness. Match each harness to its corresponding mate using the identifying letters marked on each housing. Additional single wire connectors need to be attached also; however, the order is not important. Reattach the liquid line and attach the 3" main air hose to the boom using the T-clamp connectors supplied.



View of correctly assembled wing, with mounting bolts correctly placed and the main air hose installed.

- ## Installing the Driveline

Mount the sprayer on the tractor and cut the driveline to fit. Follow the directions from the Bondioli and Pavesi manual paying particular attention to the length guideline on page 6. Also, one end of the driveline shield tube is marked with a tractor symbol to indicate that end attaches to the tractor PTO.

- ## Making the Hydraulic Connection

The tractor, through its auxiliary ports, supplies hydraulic power for the sprayer. The hydraulic hoses are marked 'P' and 'T' to indicate pressure side and tank return. Remove the caps and install the correct quick fittings for the tractor. Push the hose marked 'P' into the auxiliary pressure port and the hose marked 'T' into the auxiliary tank return port. Oftentimes, the tractor hydraulic flow control can be shifted in either direction to change the direction of flow through the ports. Make sure that hydraulic flow is from the tractor into the hose marked 'P' and returns from the hydraulic block through the hose marked 'T'. **Failure to do so will cause the sprayer hydraulics to operate erratically and may cause damage to the equipment or injury to bystanders.** K450 sprayers manufactured after February 2001 have a check valve installed in line to prevent flow through the hydraulic block in the wrong direction. If this type block is hooked up backwards, no hydraulic functions will operate.

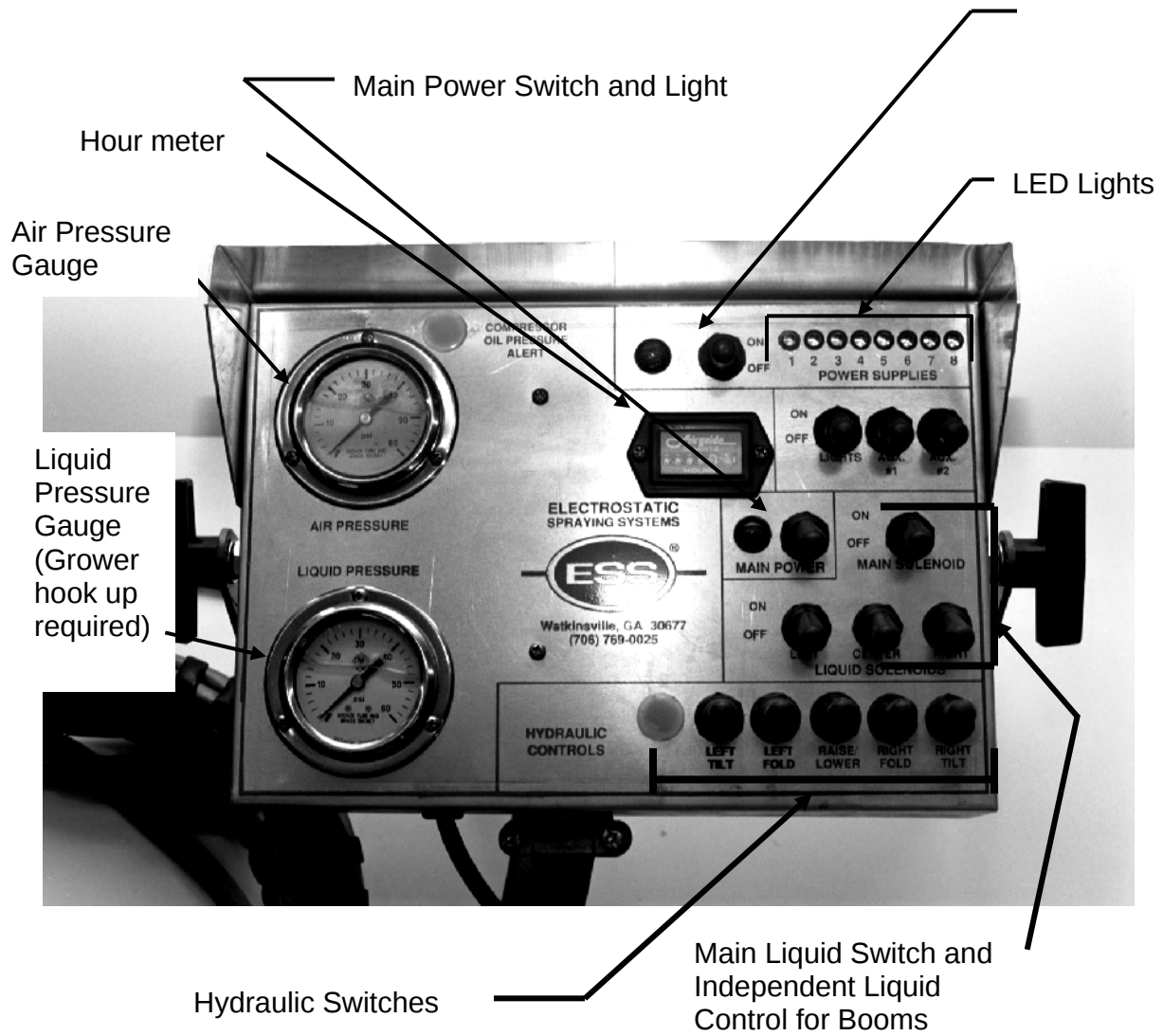
- Installing the Control Box

The control box mounts in the tractor cab at any location within easy reach of the operator. Some common positions are overhead or to the right. Attach the red wire directly to the tractor battery 12-volt terminal post and the green wire directly to the tractor ground post. Failure to ground the system properly can cause premature failure of the power supplies. Make sure that you are not operating on a 24-volt tractor system. Contact the ESS service representative for instructions in this case.

Attach the two bundled electrical cables to the front of the K450 sprayer as shown in the photograph below. Also, attach the gray air hose to the hose barb on the front of the sprayer. This allows the operator to see the air pressure of the sprayer during operation without turning around to observe the front of the sprayer during field operation. In those cases where it is allowable, there is a liquid pressure gauge available in the control box that can be attached to the sprayer liquid system to observe the liquid spraying pressure in the tractor cab.



This photograph also shows the gate valve on the right that adjusts the liquid pressure to control the flow rate of the sprayer. The liquid pressure is shown on the liquid pressure gauge (right one). The left gauge is the air pressure.



The photograph above details the features of the control box discussed in the next section.

V. Operating Instructions

ESS recommends that the sprayer be operated with only water the first time after initial installation. This will allow the operator to get comfortable with all controls and operation of the sprayer.

Fill the main liquid tank and the 10-gallon stainless steel rinse tank with water. Make sure the liquid direction control located in front of the rinse tank is in the spray position. **Operating the sprayer without water in the tank will cause damage to the centrifugal pump seals!**

- ### Hydraulic Cylinder Control

With the tractor running, PTO disengaged, and the sprayer attached as described in section 4, initial installation, operate the boom hydraulics to test the correct attachment of the hydraulic hoses. The hydraulic control switches located at the bottom, right side of the control box will activate the hydraulic cylinders even if the control box main switch is off. All hydraulic switches are momentary contact switches and will return to the center position when released. The center hydraulic switch should move the spray boom up or down when pressed in the up or down position. The tilt switches should move the wing tips up or down and the fold switches should fold the wings in or out when the listed switches are moved up or down. If the boom operates opposite from the direction chosen, the hydraulic hoses are not installed correctly or the tractor hydraulic lever is in the wrong position. If the hydraulics do not function at all, reverse the main hydraulic hoses or move the tractor hydraulic lever in the opposite direction. Correct and retest. Adjust the tractor hydraulic speed control to adjust the fold speed of the wings. Refer to your tractor manual.

- ### Setting the Air Pressure

With the tractor just above idle speed, engage the PTO and increase the tractor speed until the air pressure reading is around 15 PSI. The blower is equipped with a pop off valve that protects the blower from overpressure. The noise created by the pop off valve will alert the operator to slow the tractor PTO speed until the pop off shuts. At this point, the blower will be operating at its maximum potential for correct spraying. Sometimes, there is minimal leaking of air from the pop off valve during operation. This is normal.

- ## Setting the Liquid Pressure

Turn on the main power switch and verify that the hour meter is working. Now, turn on the main solenoid switch and next, in turn, the left, center, and right liquid solenoid switches. Each wing and center section will begin to spray.

At the front of the sprayer is a gate valve next to the liquid pressure gauge. See the photograph above on page 14. Opening this valve will decrease pressure and closing the valve will increase pressure. This valve restricts the return flow of liquid to the tank. There is a hole in the valve so that when it is fully closed, some liquid always returns to the tank to maintain tank agitation. Also, this keeps the gauge from failing in an overpressure situation. Liquid pressure will be factory between 20 & 30 psi in order to achieve a nominal 180-ml/minute flow $\pm$ 10% out of each nozzle.

Use the graduated cylinder found in the parts kit to check all nozzle flows before spraying. Any flash or small piece of material that has broken loose after ESS' own testing or in transportation can be cleaned at this time following the procedure outlined in the maintenance section. Average the readings over the entire sprayer to determine the nozzle flow rate to use when applying chemicals.

- ## Turning on Charging

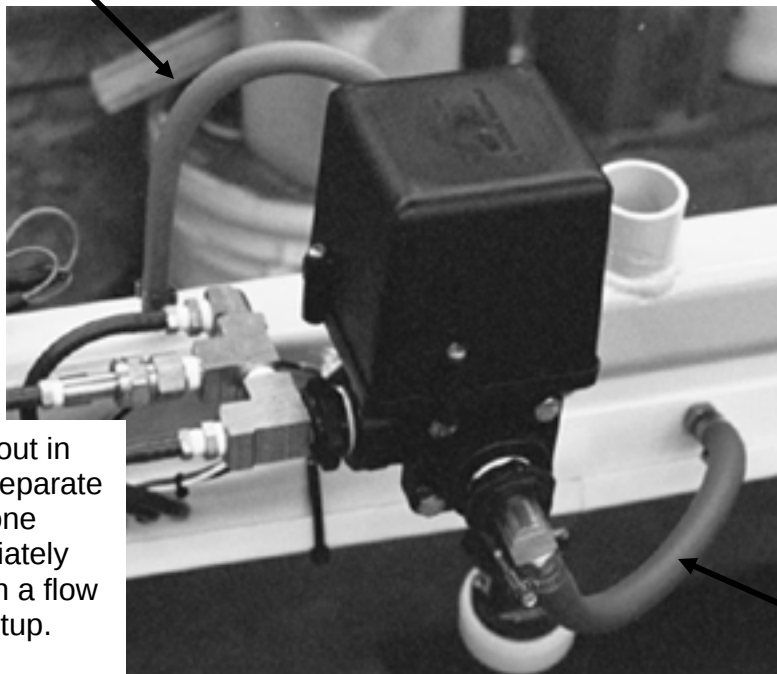
When the power supply switch was turned on, the power supplies activate to charge the spray. There is a bank of LED lights to the right of the power supply switch that will glow for each power supply operating on the boom. Depending upon the number of power supplies that are on the unit, any number from 5 to 8 lights will glow. To verify, you can count the small black power supplies in the boom wire way shielding to determine the number of lights that should be on. For example, if there are 5 power supplies on the sprayer, lights 2,3,4,6 and 7 will be on. Lights 1 through 3 are reserved for the left boom, 4 and 5 for the center section and 6 through 8 for the right boom.

Using the meter supplied by ESS, check the charge level of all nozzles. Follow the procedure in the maintenance section to correctly set the meter for measuring current. Readings will vary from 9 to 18 depending upon various conditions. Any reading of 0.00 indicates a nozzle that is not receiving voltage. Any low readings from 2 to 6 indicate that the nozzle has some flash present and needs to be clean. If all the nozzles read low, the sprayer is not grounded properly. Please see the maintenance section for troubleshooting guidelines.

- ## Shutting Down the Sprayer

It is important to shut the sprayer down correctly so that the liquid lines will be purged of chemical. Turn off the main solenoid switch or the three independent liquid solenoid switches to shut off the three way ball valves so that air will purge the liquid lines in the boom. Wait a few seconds until the nozzles quit spraying. They may spit intermittently, but at this time, turn off the power supply switch, then the main power switch.

Air purge line



Liquid out in three separate lines, one immediately through a flow disk setup.

View of a ball valve assembly on the K450 sprayer. The valve is fed through the hose in front and liquid is feed to the nozzles through the small 1/8" lines. The hose at the rear of the ball valve allows air to enter the 1/8" liquid lines when the ball valve is shut off so that the liquid lines and nozzles will purge spray material. This feature eliminates clogging of the lines and nozzles.

Liquid in

VI. Calibration and Field Operation

The model K450 is a low volume sprayer. Tank mixes must be adjusted accordingly. The average nozzle flow rate can be adjusted and operated from 100 to 200 ml/min. Outside this range, nozzle charging is poor and spray deposition is low. Optimum performance is achieved by setting the liquid flow in the nozzles around 180 ml/min. Adjust the liquid pressure with the gate valve. Adjust the boom height so that the nozzles are about 18 inches over the crop. At this height, the nozzle air will push the charged spray into the plant canopy and provide adequate overlap of the spray cloud from each nozzle. If the boom is too close to the crop, then the air will push the spray into the crop before it has time to be attracted to the top leaf surfaces. This is known as striping. If the boom is too far away, then spray may not reach the bottom of tall canopies or spray drift will occur. In windy conditions, the nozzles can be angled forward and the boom lowered some. Take care to observe that there is overlap of the spray before it enters the plant canopy. Adjust accordingly. The figure below show a sprayer correctly setup over a crop.



When mixing chemicals for a low volume sprayer, it is good practice to conduct a jar test to determine if the chemicals to be mixed are compatible. If they are not, then investigate alternative chemicals or use a compatibility agent to maintain the chemicals in suspension. It is also a good idea to treat the water with a pH agent. **ESS does not recommend the use of wetting agents or spreader-stickers.**

Calibration Guide

Use the following formula to determine the total gallons per acre (GPA):

$$\text{GPA} = \frac{0.13 \times (\text{Average nozzle flow rate}) \times (\text{Number of nozzles})}{(\text{Tractor speed}) \times (\text{Boom Length})}$$

- Average nozzle flow rate is the calculated average flow from the nozzles in ml/min. Use the graduated cylinder to measure all the nozzles on initial setup.
- Tractor speed is ground speed in miles/hour.
- Boom length is the ESS boom length in feet.

Example

A K450 with 49 nozzles on a 38-foot boom has been tested following the initial operating setup and found to have an average liquid flow rate from the nozzles of 175 ml/min. The operator wishes to travel at 5 miles/hour. What is the GPA?

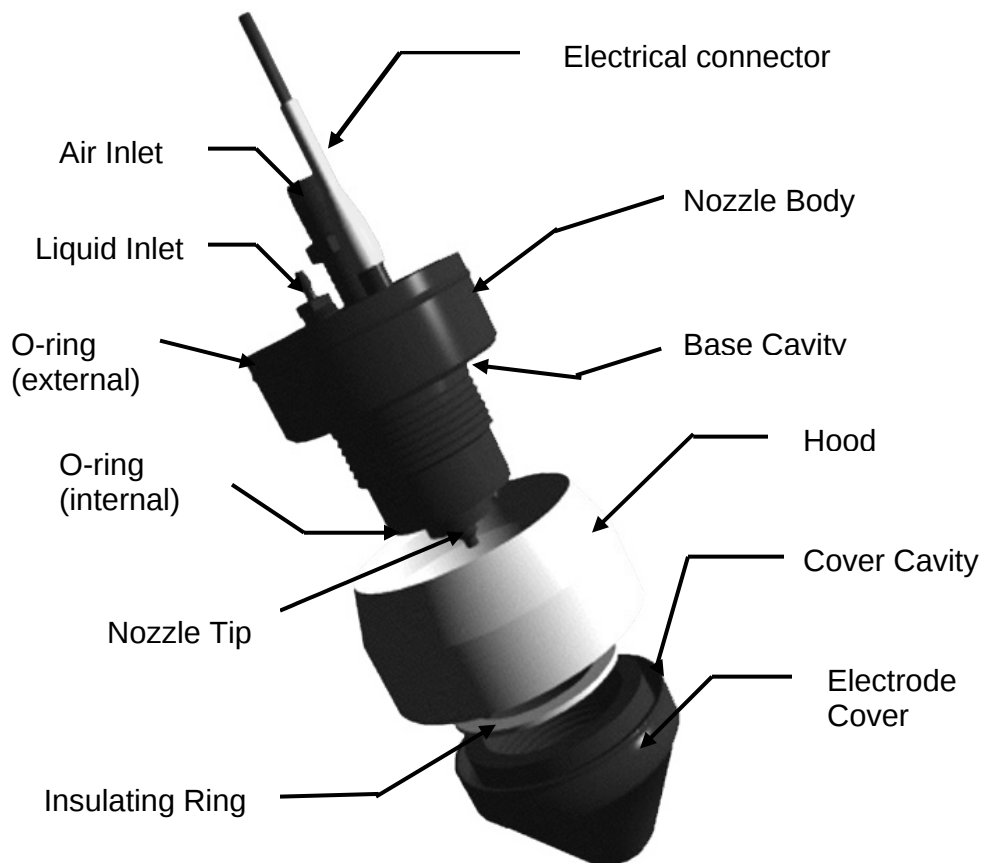
$$\text{GPA} = 0.13 \frac{175 \times 49}{5 \times 38} = 5.87 \text{ GPA}$$

VII. Cleaning and Maintenance

It is very important to follow all the maintenance and cleaning procedures to ensure that the electrostatic sprayer will function its best. While the Maxcharge nozzles outperform all electrostatic spray technology on the market today, occasional, regular cleaning will result in peak operating performance. The sprayer can be washed down prior to any individual component cleaning. Pressure washers will not damage the electrical components or the nozzles; however, use Silglyde electrical grease in all connections exposed to pressure washing.

- The Nozzle

Disassemble the nozzle by unthreading the electrode cover. Pull the hood off, The nozzle consists of four main components, the body, the electrode cover, hood and insulating ring. The nozzles are mounted under the air tube using two hose assemblies and a swivel connector. This allows the operator to aim the nozzles in directions that are appropriate for travel speeds and wind conditions. In addition, the wiring harnesses and liquid lines are mounted inside a Lexan protective covering that keeps chemical off these components and protects the parts from physical damage. The diagram below identifies the nozzle components and the air, liquid and electrical connections, if required.



Simple cleaning of the nozzle interior and exterior with soap and water after each day of use is the most important thing you can do to ensure trouble free operation. Cleaning each day avoids long-term chemical buildup that eventually causes clogs, poor spray patterns and shortens nozzle

life. Each day after following the procedures below, remove the electrode cover and clean any debris from around the nozzle tip. Clean the ceramic outlet and all interior and exterior surfaces. It is important to clean inside the hood and the two cavities shown in the above diagram. Wipe clean the exterior of the wire and all hoses and fittings connected to the nozzle. Put Silglyde silicon grease inside the nozzle electrical connections whenever you have disconnected the nozzle.



Silglyde will keep all the electrical connections free from corrosion.



Apply enough Silglyde to coat the metal pin and socket connections of the nozzles and also the low voltage wire connectors.

After cleaning, make sure the internal and external o-rings are still in place. Put the insulating ring back on the nozzle and screw the electrode cover back. Replace the hood, pushing it up against the external o-ring. **The electrode cover should be hand tight. Never use pliers or other tools to tighten it. The insulating ring should be loose.**

- Flushing the Sprayer

After spraying and proper disposal of any remaining spray solution, flush the K450 sprayer with a mixture of water and a cleaning agent. **ESS recommends the use of NUTRA-SOL cleaner which can be purchased from ESS.**



Nutrasol cleaner is an excellent neutralizer of chemical deposits in your tank and liquid lines. Recommended use of this product will keep your equipment operating at peak performance. The recommended mixing ratio is 4 ounces in 12.5 gallons of water.

Mix the cleaner with water in the 10-gallon stainless steel rinse tank. Move the handle on the three way ball valve mounted on the front, left side of the center section to the rinse position. Disassemble the main bowl filter and clean the screen. If heavy wettable powders have been sprayed, disassemble the flow disk assemblies and clean the enclosed screens.



The photo above left shows the disassembled flow disk setup with the flow disk and screen found inside the body. The photo to the right is an assembled flow disk found on a wing section. They are also located on the outlet side of ball valves.

Be careful not to lose the flow disks or mix them up from one assembly to another (they can be different across a boom). With all ball valves on, operate the sprayer to thoroughly flush all lines. **Do not perform this procedure without at least 5 gallons of water in the main tank. The centrifugal pump is operating during this procedure and damage to the seal will occur if the pump is operated dry for even a short time.**

- Cleaning the Main Tank

The main tank can be flushed and cleaned with Nutra-sol also. This prevents any chemical buildup on the inside of the tank, hoses or the liquid pump. For thorough mixing, move the handle of the three-way ball valve to the rinse position and operate the sprayer with about 5 or 10 gallons of Nutra-sol solution for about 5 minutes. Turn the handle to the spray position to empty the tank by spraying through the nozzles or open the tank dump valve and dispose of the solution properly.



- Repairing Power Supply Wires

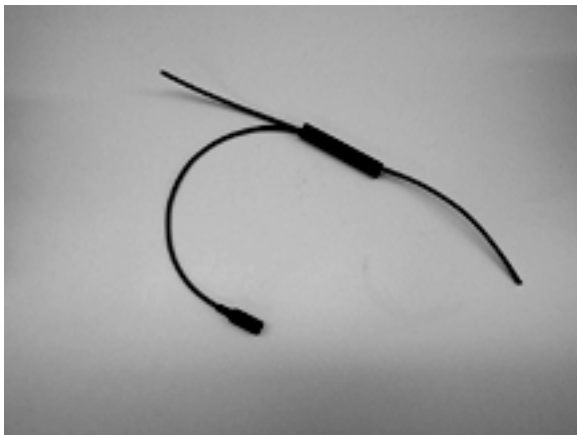
Occasionally, the red power supply wiring harnesses will be damaged or break during field operation. These can be easily repaired in the field; however, only use the heavy wall heat shrink supplied for the repair. Never use thin wall heat shrink or electrical tape because the electrical connection will break down or “leak current” during operation which will lower charging and degrade performance.



Wire assembly for nozzle, P/N 3609 can be used in repairs. Also, red electrostatic wire, P/N 1512 is supplied in the parts kit. To strip back the wire, cut the red outer casing first, then carefully cut the inner casing to expose the wire itself.



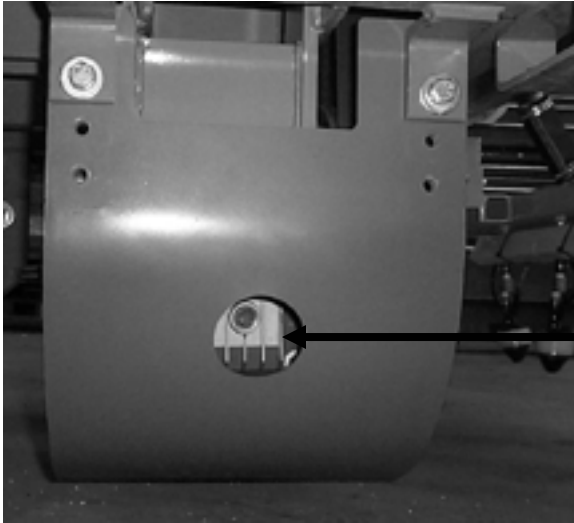
Simply twist the wires together in order to make a joint wherever it is needed.



Cut a 3 inch piece of heavy wall heat shrink, P/N 6601, slip it over the wires and position it over the joint. Use a heat gun or small propane lighter to shrink the material down. Start in the middle and apply heat evenly around the shrink tubing. Work out toward one end and then the other. Glue inside the tubing will provide the sealing capability.

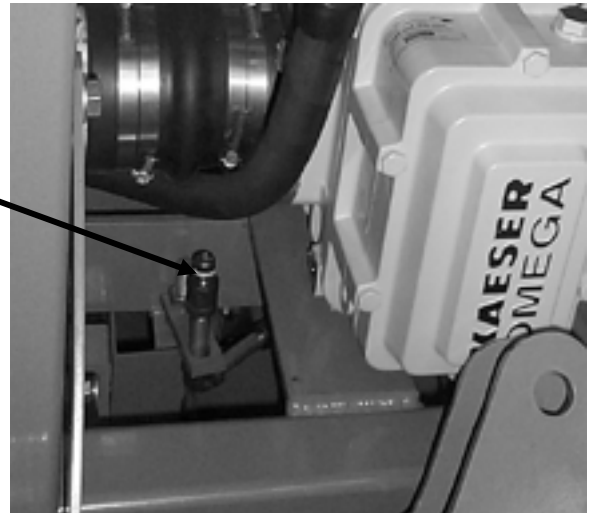
- Before Operation

- Check oil in gearbox. Add 90-weight gear oil through the oil fill inlet piping until oil is centered in the inspection port shown below.



Gearbox oil level inspection port.

Oil fill port for the gearbox located next to the K450 blower just under the 5" air inlet. Use 90-weight gear oil



- Check oil in blower. Maintain at port inspection level. Use either mineral oil or synthetic oil as specified in the Kaeser operator's manual. OmegaSB-220 oil is recommended.

Oil fill location for the gear end of blower. The oil fill location for the drive end is on top, under the liquid pump mount plate.

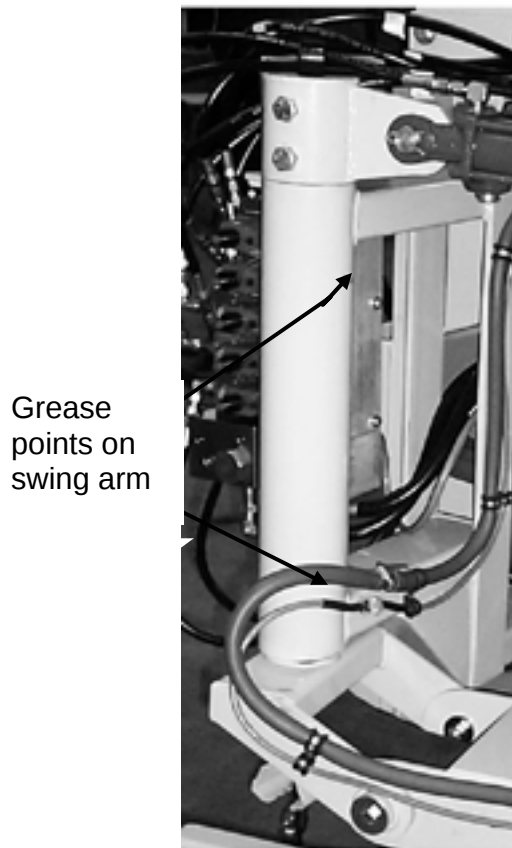


Oil drain, front. Rear oil drain is on opposite end.

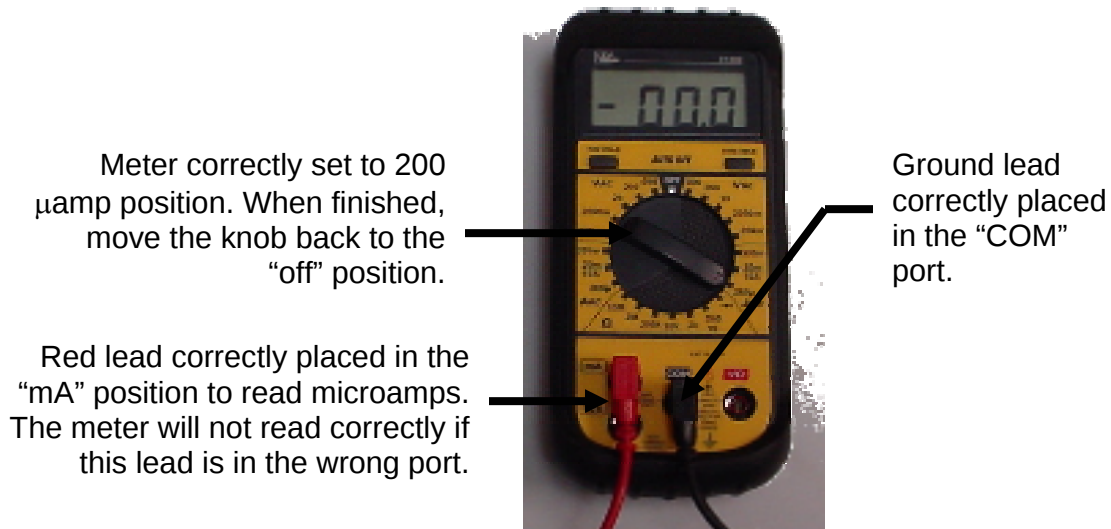
Inspection port for gear-end of blower. Oil capacity is 6.1 ounces. There is another on the drive end of the blower toward the rear on this same side. Oil capacity is 6.7 ounces

- Lubricate u-joints with a lithium-based grease every 8 hours of operation.

- Lubricate boom hinge points and shock linkage pivot points.



- Test the nozzle for charging using the photo below to ensure that the meter is set correctly to measure micro-current.

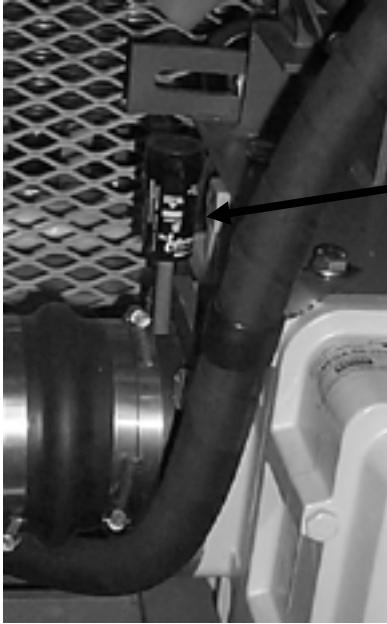


To test the nozzles, turn the meter on to the 200 micro amp setting (200 μ A). Ground the black lead against the spray boom or pinch the metal probe between the forefinger and thumb of your hand. Insert the paddle on the red lead into the spray stream about 1 inch from the outlet of the nozzle. Read the charge on the meter. Clean any nozzles that are below 6 micro amps by following the procedure that was outlined above.



View of correctly positioned paddle in spray stream and ground probe held between fingers. Spray charge is measuring 7.2 μ A.

- While the unit is running, inspect the vacuum restriction gauge on the inlet side of the blower. Clean or replace the air filter if the gauge shows red.



This vacuum restrictor gauge will show red if the air filter becomes blocked. Clean or replace the filter immediately if this condition occurs. This must be checked while the blower is operating.

- Check the blower drive belts and the pump drive belt for any signs of wear and correct tightness.

This nut must be loosened up to $\frac{1}{2}$ " before tightening or loosening the lower nut.



View of one belt-tensioning rod on the gearbox weldment located under the K450 frame. The other is directly behind it. In order to tension the drive belt, loosen the nut on top of the plate and then turn the nut on the bottom of the plate up against the plate. This pivots the gearbox weldment down and results in tightening of the drive belts. Tighten the front and rear adjustment in equal increments alternating between them so that the gearbox weldment is not twisted.

Turn this nut so that it moves up to tension the belt. Down to loosen the belt.



View of the pump belt assembly. Loosen the nut on the belt tensioner, pull it back to loosen belt. The main drive belts must be removed to replace a liquid pump belt.

Liquid Pump

Fan, P/N 7865 and Fan Hub
Spacer P/N 7918

Belt tensioner P/N 7887

- ## Yearly Maintenance

- Apply Silglyde electrical grease to all wiring harness pin assemblies and all nozzle electrical connections.
- Drain and replace the main gearbox oil.
- Verify hours of operation of the sprayer to determine if the blower oil should be changed. For mineral oil, change every 1500 to 2000 hours. For synthetic oil, change every 6000 to 8000 hours.
- Thoroughly clean all nozzles by following the procedure outlined above. Clean these in Nutrasol thoroughly. Use a soft bristle toothbrush and pipe cleaners to remove any chemical deposits. These parts may have to soak in the cleaning solution. Using the soft bristle brush or a soft cloth, clean the interior and exterior of the nozzle base. Make sure the o-ring is replaced before reassembly of the cover on the nozzle.
- Thoroughly inspect all wiring harnesses and red high voltage wiring for cuts or abrasions that show black streaks. This is electrical arcing. Any cuts, abrasions or joints that show this arcing should be repaired with thick wall heat shrink following the procedure outlined above.
- In critical applications, replace the centrifugal pump seal following the exact instructions found in the Hypro operator's manual.

VIII. TROUBLESHOOTING GUIDE

SYMPTOM	Possible Problem(s)	Corrective Action
Air pressure is low	PTO Speed too low Air fittings are loose Hoses cut or unattached Pop off valve may be open	Increase tractor RPM Spray fittings with soapy water - tighten ones that bubble Inspect for loose hoses or failed air lines - replace Inspect pop off valve for trash in inlet
Spray from nozzle is erratic or spits	Debris in the nozzle Liquid filters are clogged Low liquid level in the tank Loose liquid fitting near nozzle Ball valves not open	Clean nozzle according to instructions Clean liquid filters in the flow setups and main filter Increase liquid level in tank above 2 or 3 gallons Inspect for black hose pulled from back of nozzle Verify that power supply switch is on
Liquid will not turn off	Main power switch turned off before liquid control switches Fuse blown on liquid control	Verify that power supply switch is on so that ball valve will turn off correctly Replace fuses found inside back of control box
Charging indicator (LED) light is out	Dirty nozzles Bad or loose ground Bad power supply Cut wire	Clean nozzle according to instructions Inspect that green ground wires are connected to battery and sprayer Inspect power supply for output Inspect for cut or damaged wires
Nozzle charging is low or zero on ALL nozzles	Bad or loose ground Blown fuse No input power Bad meter or leads	Inspect that the green ground wires are connected to battery and sprayer Replace power supply fuse inside rear of control box Inspect for 12 volt DC current to power supplies Inspect meter for blown fuse or leads cut or short
Nozzles drip when the sprayer is off	Turned off sprayer without following correct procedure	Restart unit and turn off liquid control then turn off main power switch
Liquid pressure too high	Gate valve setting wrong Blocked liquid return line	Adjust pressure down by opening gate valve Inspect for blocked return line to tank

IX. Parts

- Spare Parts Kit

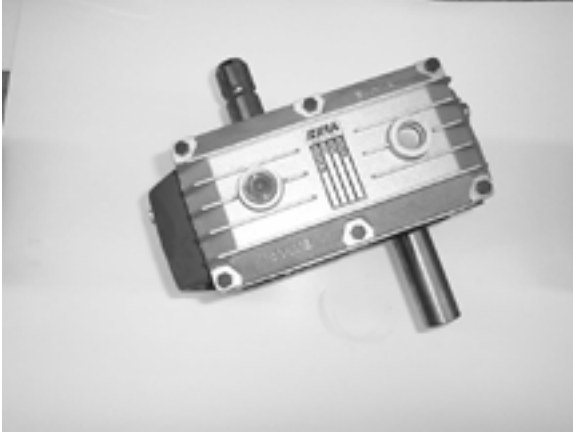
Every K450 sprayer is shipped with a spare parts kit that contains an assortment of small parts that may be needed during initial setup and operation. These parts are ones that may be broken during normal operation and would need immediate replacement to continue spraying. The kit also contains the owner's manuals, charging meter and graduated cylinder for calibration of the sprayer.

Part Number	Quantity	Description
1292	2	Connector, ring, male, 12-10 ga., 3/8" stud
959	2	Connector, tab, female, 22-18 ga., 0.250 series
960	2	Connector, tab, male, 22-18 ga., 0.250 series
3250	2	Fuse, 15 amp, AGC, 1-1/4" - 1/4"
3379	2	Fuse, 20 amp, AGC, 1-1/4" x 1/4"
2578	2	Fuse, 5 amp, AGC, 1-1/4" x 1/4"
3380	2	Fuse, 8 amp, AGC, 1-1/4" x 1/4"
5771	5	O-ring, Buna-N, #209
396	15	Hose, 1/4" ID, gray
209	20	Hose, 1/8" ID, vinyl, black
148	5	Mender, 1/8" hose barb
7857	5	Tee, 3/16" x 3/16" x 1/8" hose barb, nylon or polypropylene
7858	5	Reducing barb, 3/16" x 1/8", nylon or polypropylene
685	3	Ell adapter, 1/8" hose barb x 1/8" MPT, nylon, black
797	3	Straight adapter, 1/8" hose barb x 1/8" MPT, nylon
7853	5	Reducing adapter, 3/16" hose barb x 1/8" MPT, brass
1875	1	Spray bottle, plastic
4890	2	Body, 1/4"-18 MPT
763	3	Strainer, 100 mesh
764	3	Strainer, 24 mesh
6270	1	Attached lid container
830	2	Heat shrink, 0.375", black
944	2	Heat shrink, 0.5", black
6601	1	Heat shrink, 0.400 to 0.150 w/ adhesive, black
1662	5	Hose clamp, worm gear, size 4, SS
663	10	Hose clamp, two ear, 1/2", SS
1464	1	Box for small parts
1285	1	Graduated cylinder
1391	3	Hose assembly, row crop
2572	1	Multimeter assembly

Part Number	Quantity	Description
5794.180	2	Nozzle assembly, ported 0.180
3609	5	Wire assembly, high voltage, female
3174	1	Silicon grease, 4 oz tube
1566	1	Tank cleaner, Nutra-sol
5694	5	Insulator ring
8246	1	Seal kit, 9203 polypro pump
7859	5	Tee, 3/16" hose barb, nylon or polypropylene
8253	5	Mender, 3/16" hose barb

- Service Parts

- Power Train Parts



P/N 6811 Gearbox



P/N 5834 Driveline



P/N 7872 Drive Belt (2 required)



P/N 7871 Pump Belt

- Air System Parts



Air filter assembly P/N 7870
With pre-cleaner P/N 8244



P/N 8671, Replacement air filter



P/N 7869 Vacuum Indicator



P/N 7850 Pop-off Valve



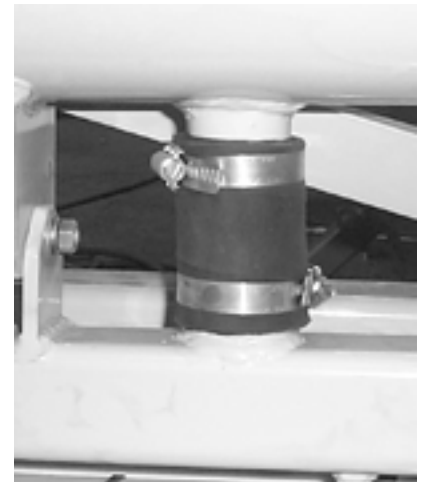
P/N 7892 Pressure Switch



P/N 7884 Hot Air Blower Hose, 3"
with P/N 7861 T-bolt Clamp



P/N 7885 Flexible Hot Air Hose, 3"
with P/N 7861 T-bolt Clamp



P/N 7886 1-5/8" ID
Exhaust Air Hose with
P/N 813 Worm Clamp

- Liquid System Parts



P/N 7862 Dump Ball Valve, 1"



P/N 7863 Tank Outlet Ball Valve, 1-1/2"



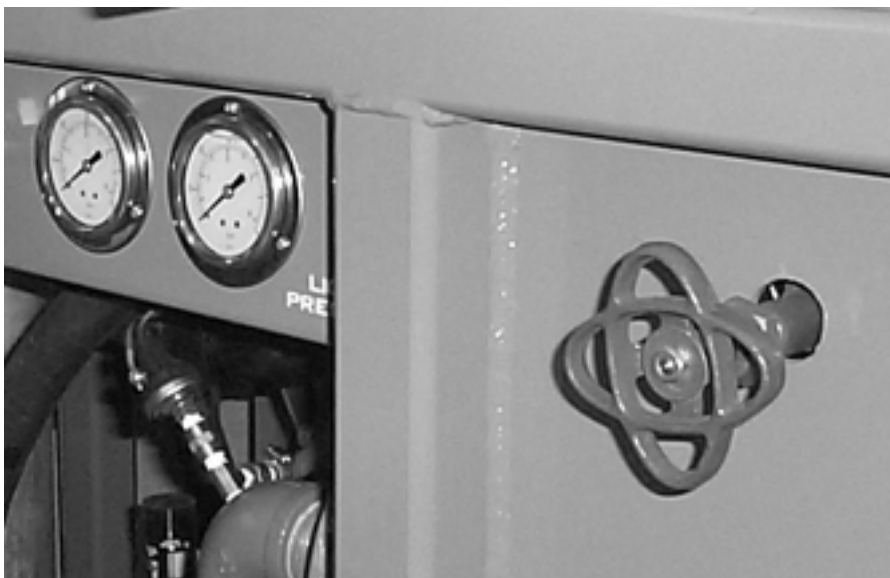
P/N 5068 Line Strainer with Parts

Replacement
screen for filter
P/N 6600

Replacement
o-ring for filter
P/N 6599



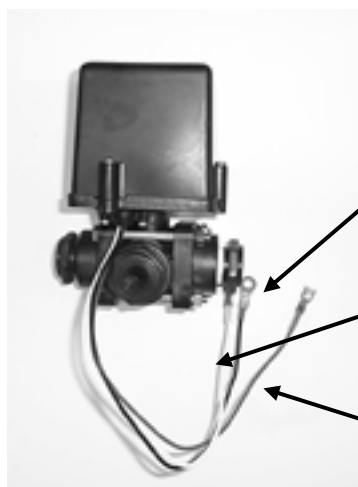
P/N 7873 Liquid Centrifugal Pump



P/N 1039 Gauge, 2-1/2", 0-60 PSI and P/N 7851 Gate Valve



P/N 7906 Ball valve, manual
Three way



P/N 8432 Ball valve assembly
12 volt electric

Black ground lead

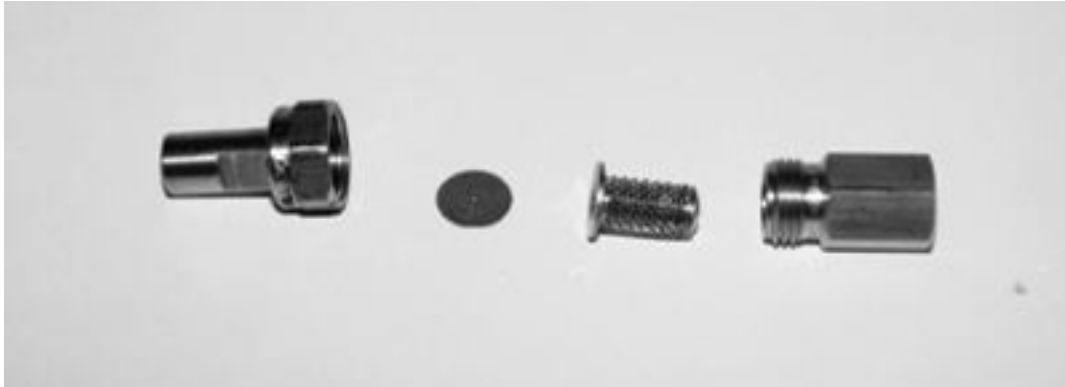
White 12 volt power
lead

Red "return" power lead

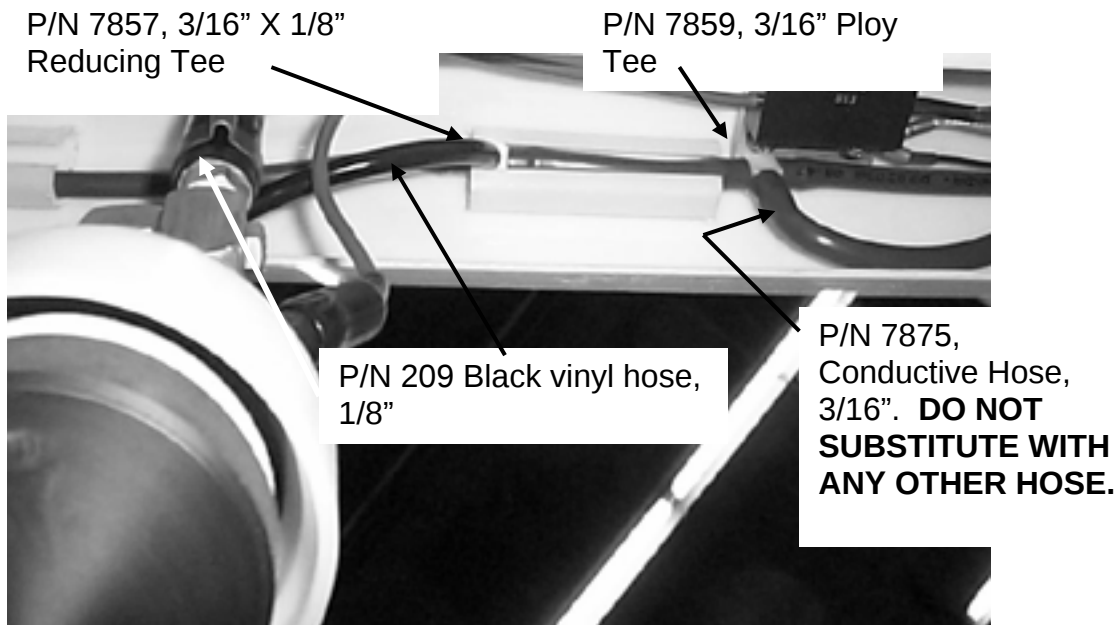
Flow disks are several
sizes:

P/N 1293 - # 51

P/N 4350 - #59



From the left, P/N 768, Adapter with P/N 767, Cap; P/N “several”, Flow Disk; P/N 764, 24 mesh strainer; P/N 770, Body, ¼” NPT. Flow disks are matched to the number of nozzles. P/N 1293 - #51 for 5 to 6 nozzles and P/N 4350 - #59 for 7 to 8 nozzles.



View into the Lexan raceway on the boom showing detail of wiring and hose.



P/N 8235 Jet Agitator Nozzle
with insert



P/N 7864 Anti-vortex Fitting

P/N 3375, Gauge, 2" 0-60 PSI

P/N 3249 Hour meter

P/N 129 LED light in P/N 716 LED Holder

P/N 895 SPST Switch w/ P/N 3252 Rubber Boot. Total of nine switches.

P/N 896 DPDT switch w/ P/N 3252 Rubber boot. Total of 5 switches.

P/N 1103 Lamp, 12 volt, Snap-in, blue

Remove screws on back to access fuses.

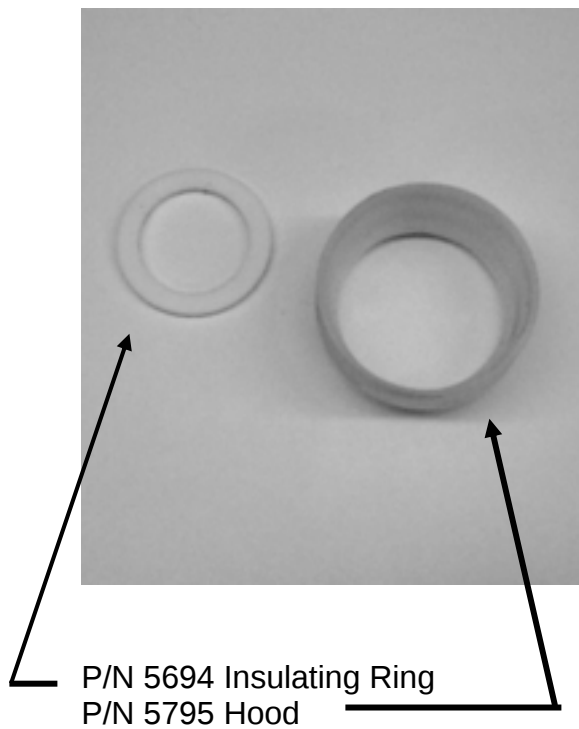
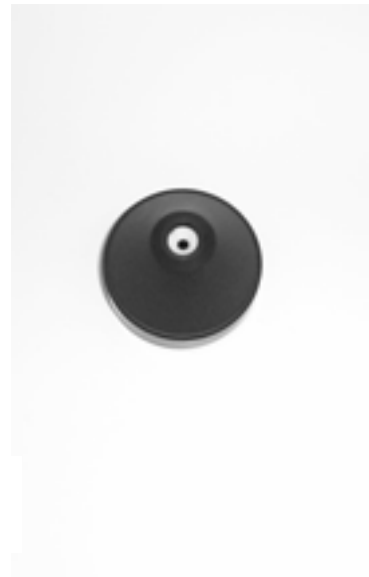
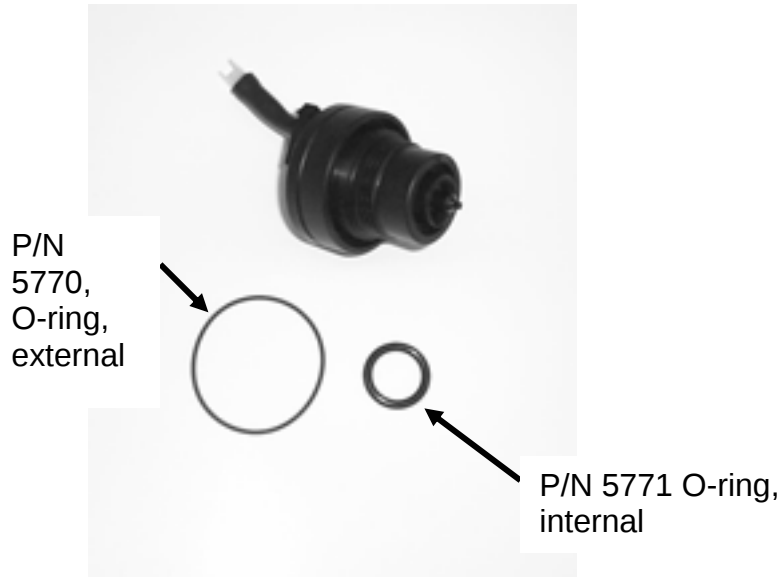
P/N 3380, 8 amps

P/N 2578, 5 amps

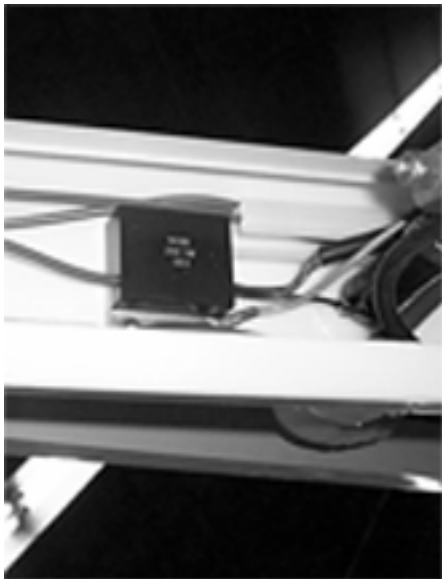
P/N 3379, 20 amps

P/N 3250, 15 amps

- Nozzle Parts



- Wiring Parts



P/N 1071A Rowcrop Power Supply



P/N 3609 Wire assembly for
Nozzle repair. Order P/N 1512
bare wire for wiring repair.



P/N 6601 Heavy Wall Heat
Shrink Tubing

- Miscellaneous Parts



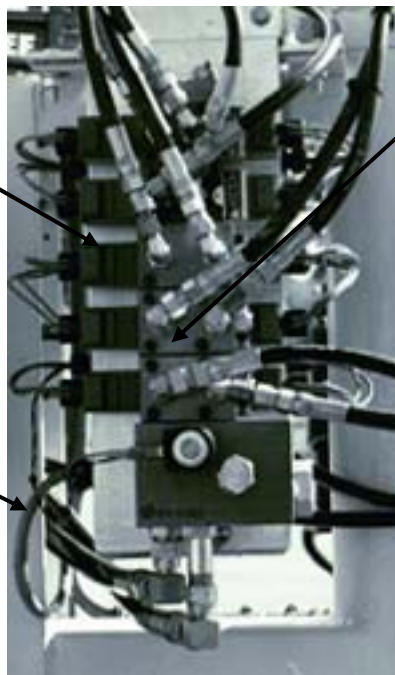
P/N 7303 Breakaway Hinge Assy



P/N 4132 Spring Assist Shock

P/N 6732 Stack Valve. Order (2) P/N 8285 O-ring and (1) P/N 8284 O-ring plate when replacing valve.

P/N 7942 Hydraulic Valve Wiring Control Harness



P/N 7930 Lock Valve. Order (2) P/N 8285 O-ring when replacing valve.

P/N 7943 Hydraulic Block Assembly