



# Operator's Manual 450RC




**Electrostatic**  
Spraying Systems

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# OPERATOR'S MANUAL

## 450RC ROW CROP SPRAYER



Electrostatic Spraying Systems, Inc.  
62 Morrison St. · Watkinsville, GA 30677-2749  
U.S.A.

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## CONGRATULATIONS!

You have just purchased one of the most advanced spraying systems on the market today. Electrostatic Spraying Systems, Inc.<sup>1</sup> (ESS) is committed to providing you with powerful spraying systems that are easy to operate and maintain.

The products of ESS are the result of the efforts and creativity of many people. In addition to input from engineering, marketing and manufacturing personnel, suggestions from our customers have been implemented into the design of our equipment. We would like to hear your ideas also! If you have any suggestions or comments regarding the products or service of ESS write or call us at:

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support@maxcharge.com

Please take time to read this manual before operating the 450RC Row Crop Sprayer™. The manual contains important instructions for the operation of this equipment. It includes helpful suggestions to maximize productive use. Several safety precautions are listed for your protection.

Thank you!

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

Your new sprayer has been thoroughly tested and calibrated at the factory. If you have any problems with it, please get in touch with us immediately. We will be glad to answer any questions you have concerning our equipment or service. ESS intends to support its customers with efficient, helpful and friendly service. We appreciate your business and sincerely hope that Electrostatic Spraying Systems can meet your present and future spraying equipment needs.



<sup>1</sup> ESS 450RC Row Crop Sprayer™, 450RC™, MaxCharge™, and the ESS logo are copyrights or registered trademarks of Electrostatic Spraying Systems, Inc.

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## Overview of the 450RC Air-Assisted Electrostatic Sprayer

The heart of the 450RB sprayer is the patented MaxCharge™ nozzle. ESS air-assisted electrostatic sprayers produce 35 to 40 micron electronically charged spray droplets that are carried to the plant canopy in a 5.5 to 7 cfm air stream through each nozzle.

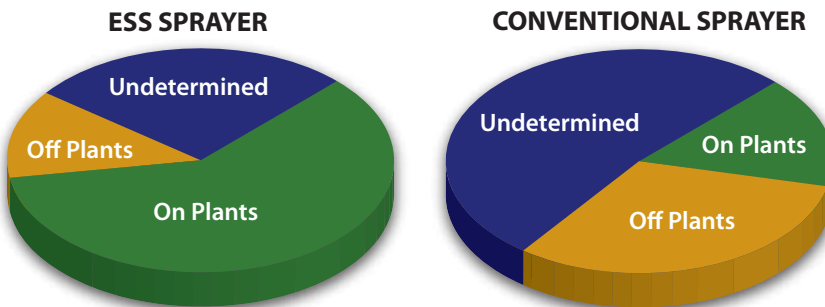
Air, liquid, and electricity enter separately at the rear of the nozzle. A positive charge is applied to the electrode in the tip of the nozzle inducing a negatively charged liquid flow. Just before leaving the nozzle, the liquid is sheared by the air atomizing the liquid into many thousands of 35 to 40 micron droplets trapping the negative charge. The charged droplets leave the nozzle and are carried by the 5.5 to 7 cfm air flow to the plant canopy.

The charged droplets are attracted to the plant material by electrostatic forces, up to 75 times the pull of gravity, evenly coat all the plant surfaces, front, back, underside of leaves and stems. The results is uniform spray coverage on hidden areas deep inside the plant canopy where other sprayers miss.

The MaxCharge™ nozzle is easy to clean and corrosion-proof. The interior ceramic outlet resists wear three times better than stainless steel outlets. These features combine to give the best spray coverage on the market.

The comparison of air-assisted electrostatic spraying versus conventional spraying is dramatic.

### Where Does the Spray Go?

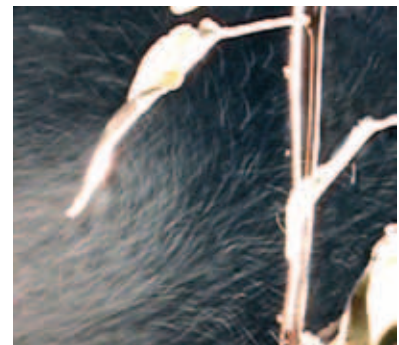


The University of California completed a series of tests to investigate what happens to spray liquid after it leaves the nozzle.

**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 benefit!**



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






*Electrostatically charged droplets are attracted to plant surfaces.*

## Safety Information

---

### OPERATOR RESPONSIBILITY AND SAFETY

-  Lack of attention to safety can result in accidents, personal injury or death.
-  Always watch for safety hazards and correct problems promptly.
-  When using any equipment, obey all manufacturers' safety information and labeling.

### IMPORTANT!













***Read the Operator's Manual!*** Failure to do so is considered a misuse of the equipment.

It is the responsibility of the user to read the Operator's Manual to understand the safe and correct operating procedures for the sprayer and to maintain the sprayer according to the manufacturer's recommendations. It is the operator's responsibility to ensure that all who are using this equipment read this manual.

The operator is responsible for inspecting the equipment and for repairing and replacing damaged or worn parts to prevent damage or excessive wear to other parts. It is also the operator's responsibility to deliver the machine for service or to replace defective parts which are covered by the standard warranty.

### EQUIPMENT SAFETY







***Use the following safety tips as a general guide when using the 450RC sprayer:***

-  Before operating any equipment, become familiar with all safety guidelines, cautions and warnings including those provided by the tractor manufacturer.
-  Do not allow children to operate the sprayer. Do not allow adults to operate the sprayer without providing them proper instruction.
-  Do not allow riders on the sprayer or tractor during operation or transport.
-  Keep the area of operation clear of all persons and animals.
-  Sprayer is equipped with a Power Take Off (PTO) driveline. Failure to take proper safety precautions could result in serious injury or death.
-  Keep hands, feet, hair and clothing away from PTO driveline and other moving parts.
-  Do not operate machinery without all guards and shields in place.
-  Always disengage the PTO, stop tractor engine and wait for all moving parts to stop before servicing, adjusting or repairing the sprayer.
-  Do not apply chemicals when weather conditions favor drift from intended treatment area.
-  Never pump flammable or explosive liquids such as gasoline, fuel oil, kerosene, etc. through the ESS sprayer.
-  Turn off the sprayer whenever leaving it unattended.
-  Only unhitch the sprayer from the tractor on firm and level ground.



## CHEMICAL SAFETY

**Read and follow all instructions on the chemical manufacturer's label. Make note of the following requirements for:**

-  **Personal Protective Equipment (PPE)** to be worn when handling, mixing and applying the chemical, including: protective clothing such as boots, gloves, apron or hat; eye protection such safety glasses, goggles or a face shield; and respiratory protection such as a mask, cartridge or respirator.
  -  **Directions for use.** This includes handling, mixing and applying as well as storage and disposal of the chemical.
  -  Environmental and physical or chemical **hazards**.
  -  **First aid** in case of chemical exposure.
  -  **Mandatory waiting periods** between application time and worker reentry (i.e. 'Re-entry Interval' - REI) and crop harvest (i.e. 'Pre-harvest Interval' - PHI).
  -  Proper visual and/or verbal **notification** to workers and/or the public regarding areas sprayed.
- Always follow the prevailing laws of the area in which chemicals will be used.

### PLEASE NOTE:



**Additional safety guidelines associated with specific operating and maintenance procedures are mentioned throughout this manual.**

## SAFETY DECALS

ESS places several decals<sup>1</sup> on the 450RC to remind equipment operators of proper equipment use and possible safety hazards. Even if these decals are missing or hidden from view always follow safe practices when operating ESS machinery. Replace them if they become worn or damaged and can no longer be read.

Please make sure to:

1. Note the original locations of the decals on the equipment.
2. Replace decals if they become worn or damaged and can no longer be read. Extra decals may be ordered from ESS or an authorized ESS dealer.

 <b>WARNING!</b>	 <b>¡PRECAUCIÓN!</b>
<ul style="list-style-type: none"><li>• DO NOT REMOVE TANK LID OR RELEASE TANK PRESSURE WHILE COMPRESSOR IS RUNNING.</li><li>• RELEASE TANK PRESSURE BEFORE REMOVING LID OR TANK HOSE CONNECTIONS.</li><li>• KEEP FACE AWAY WHEN RELEASING PRESSURE AND WHILE REMOVING TANK LID.</li><li>• DO NOT OVERFILL TANK.</li><li>• FILL TO 4 INCHES (10 CM) FROM TOP OF TANK WHEN USING TANK AGITATOR SYSTEM.</li></ul>	<ul style="list-style-type: none"><li>• NO RETIRE LA TAPA DEL TANQUE NI LIBERE LA PRESIÓN DEL TANQUE MIENTRAS LA COMPRESORA ESTÉ FUNCIONANDO.</li><li>• LIBERE LA PRESIÓN DEL TANQUE ANTES DE RETIRAR LA TAPA O LAS CONEXIONES DE LA MANGUERA DEL TANQUE.</li><li>• MANTENGA EL ROSTRO ALEJADO CUANDO LIBERE LA PRESIÓN Y MIENTRAS RETIRA LA TAPA DEL TANQUE.</li><li>• NO SOBRELLENE EL TANQUE.</li><li>• LLÉNELO HASTA 10 CENTÍMETROS (4 PULGADAS) DE LA PARTE SUPERIOR DEL TANQUE CUANDO USE EL SISTEMA AGITADOR DEL TANQUE.</li></ul>

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.

<sup>1</sup> ESS is currently redesigning the warning labels for the sprayers. There may be minor changes in the layout and/or wording of the warning decals on your sprayer.

<b>! WARNING!</b>	<b>! ¡PRECAUCIÓN!</b>
<p>AGRICULTURAL CHEMICALS CAN BE DANGEROUS. IMPROPER SELECTION OR USE CAN SERIOUSLY INJURE PERSONS, ANIMALS, PLANTS, SOIL OR OTHER PROPERTY.</p> <p><b>BE SAFE:</b></p> <ul style="list-style-type: none"> <li>• SELECT THE RIGHT CHEMICAL FOR THE JOB.</li> <li>• HANDLE IT WITH CARE.</li> <li>• FOLLOW THE INSTRUCTIONS ON THE CHEMICAL MANUFACTURER'S LABEL.</li> </ul>	<p>LOS PRODUCTOS QUÍMICOS AGRÍCOLAS PUEDEN SER PELIGROSOS. LA SELECCIÓN O EL USO INAPROPIADOS PUEDEN LESIONAR SERIAMENTE A LAS PERSONAS, LOS ANIMALES, LAS PLANTAS, LA TIERRA U OTRA PROPIEDAD.</p> <p><b>TENGA CUIDADO:</b></p> <ul style="list-style-type: none"> <li>• SELECCIONE EL PRODUCTO QUÍMICO CORRECTO PARA EL TRABAJO.</li> <li>• MANÉJELO CON CUIDADO.</li> <li>• SIGA LAS INSTRUCCIONES DE LA ETIQUETA DEL FABRICANTE DEL PRODUCTO QUÍMICO.</li> </ul>

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

<b>! DANGER!</b>		<b>! ¡PELIGRO!</b>
<p><b>ROTATING DRIVE PARTS BENEATH</b></p> <p>Entanglement with rotating drive parts can cause injury or death. Do not operate without this and all other shields in place and in good condition.</p>		<p><b>EQUIPO EN ROTACION DETRAS DE LAS PROTECCIONES</b></p> <p>No óperar el equipo sin todas sus protecciones. El contacto con equipo en rotacion puede causar heridas ó la muerte.</p>


This warning decal is located near all the shield locations under which the belt drive components are located.

**Do not operate the 450RC without proper shielding in place.**

<b>! DANGER!</b>	<b>! ¡PELIGRO!</b>	<b>! DANGER!</b>
<p><b>MOVING PARTS CAN CRUSH AND CUT</b></p> <p>Do NOT operate with guard removed. Do NOT place hands or fingers under guard.</p>		<p><b>MANTENGASE ALEJADO</b></p> <p>Zona sin proteccion para evitar riesgos, no opere este equipo sin todas sus protecciones instalados.</p>

**DO NOT OPERATE THE SPRAYER IF YOU CAN SEE THIS WARNING DECAL!**

This warning is visible only when an essential shield is missing.

<b>! DANGER!</b>	<b>! ¡PELIGRO!</b>	<b>! DANGER!</b>
<p><b>TIPPING HAZARD DEATH OR INJURY CAN OCCUR</b></p> <p>BOOMS ARE IN THE FOLDED POSITION. SUPPORT BOTH SPRAY BOOMS WITH THE LEGS PROVIDED, OR BY OTHER MEANS. THE GREATEST HAZARD IS DURING CONNECTION OR DISCONNECTION FROM THE TRACTOR.</p>		<p><b>RIESGO DE VOLTEO PUEDE OCURRIR UNA MUERTE O LESIÓN</b></p> <p>LOS BRAZOS ESTÁN EN LA POSICIÓN DE PLEGADO. SOSTENGA AMBOS BRAZOS CON LAS PATAS PROVISTAS O CON OTRO MEDIO. EL MAYOR PELIGRO SE PRESENTA DURANTE LA CONEXIÓN O DESCONEXIÓN DEL TRACTOR.</p>

This danger decal is located on the front of the 450RC sprayer. The 450RC 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.

<b>! WARNING!</b>	<b>! ¡ADVERTENCIA!</b>
<p><b>DO NOT RUN TANK OR LIQUID PUMP DRY</b></p> <p>The shaft seal on the liquid pump will fail if the unit is run without liquid in the tank.</p>	<p><b>NO TRABAJE SIN LIQUIDO EN EL TANQUE O LA BOMBA</b></p> <p>El sello de la bomba se dañara si el equipo funciona sin liquido.</p>

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

**PLEASE NOTE:**

**Running the pump without liquid voids the pump warranty.**

**This is an expensive repair.**



## Installing The Sprayer For The First Time

The 450RC sprayer is fully assembled and tested at Electrostatic Spraying Systems before it is shipped. After testing, the unit is partially disassembled for shipment. When you have unloaded the sprayer, some components will require reassembly before the initial operation. **Make sure to remove all parts that may have been stored inside or on the surrounding pallet of the unit for shipping.** Your sprayer is shipped with the necessary fasteners for assembly.

### Air Filter Assembly

Reinstall the air filter assembly on the sprayer. The assembly consists of a 5" aluminum nipple in a rubber elbow, black plastic air filter body assembly and upright filter mount. Four 3/8" bolts with washers are included as well as two hose clamps. Mount the entire assembly on the right side of the unit using the four bolts already threaded into the frame. Locate the 5" aluminum intake mounted to the unit, position the hose around the intake and tighten the clamps.

### Wing Assembly

In some instances, the 450RC sprayer will be shipped with the wings detached. They will be marked "L" or "R" indicating a left or right wing assembly. Left and right wings are virtually identical, but have different ball valve locations. For proper installation, position the wings so that the ball valve is on the side farthest from the tractor.

Cut away all tape, strapping material and transportation coverings on all hoses, cylinders and wire assemblies. Dismantle all wood packing material from the wing. If your unit has a breakaway-style wing, be careful of pinch points during unpacking, then unfold the breakaway.



Mount the wing assembly on the swing arm with the two 1/2" bolts provided. Remove the two 1/2" mounting bolts installed in the lower section of the swing arm assemblies on the rear frame of the sprayer. A bolt and bushing are shown at right. Make sure a stainless steel bushing is in each ear of the swing arms, and that the bushing is inserted with its flange on the outside of the swing arm ear. Place the provided sleeve bearing (bronze washer) inside each ear in preparation for wing installation.

Which is the left side? Which is front?

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.

The front is the part closest to the sprayer's PTO

 **NOTE**



*Upright filter mount location.*



Lift the wing so that it fits inside the ears of the swing arm, paying attention to keep the sleeve bearing in place. Once positioned install the remaining two bushings in the boom with the flanges towards the outside. Lastly, install the bolts with the head on the outside of the swing arm. **Take care to ensure that the threads will not rub on the main air delivery hose when it is installed.** Secure the bolt with the 1/2" nylon lock nut provided. Verify that the boom tilts easily by lifting up on the ends.

Lift the wing tip up and pin the hydraulic cylinder in place. Reinstall the liquid line and wiring harness through the provided loop straps attached to the swing arm. Match each harness to its corresponding mate using the identifying letters marked. Also attach the additional single wire grounding straps to the welded H-frame. Reattach the liquid line to the manifold on the H-frame and attach the 3" main air hose to the boom using the T-clamp supplied.



## Installing the ESS Supplied Driveline

Your sprayer comes with an ESS supplied Bondioli & Pavesi driveline. This driveline connects the tractor PTO shaft to the sprayer input shaft. To prevent damaging the sprayer it is necessary to follow specific installation steps. In addition to reading the instructions below in this ESS 450RC operator manual, please make sure to read the Bondioli & Pavesi manual supplied with the driveline prior to beginning installation.



**WARNING! DO NOT STAND BETWEEN TRACTOR AND SPRAYER WHILE TRACTOR IS BEING BACKED TO HITCH.**



**WARNING! ADDITIONAL BALLAST MAY BE NEEDED ON THE FRONT OF THE TRACTOR FOR STABLE OPERATION AND TRANSPORT OF THE SPRAYER. SEE TRACTOR OPERATOR'S MANUAL FOR RECOMMENDED WEIGHTS.**



**READ THE MANUAL SUPPLIED WITH YOUR BONDIOLI & PAVESI DRIVELINE BEFORE INSTALLING.**

### INSTALLATION STEPS:

#### FIRST: Determine proper driveline length

First, determine if the driveline is the correct length. Begin by mounting the sprayer on the tractor's 3-point hitch per the tractor operator manual, but **DO NOT** install the driveline at this time. Due to normal tractor equipment and implement variations the driveline may need to be shortened per the following steps:

#### NEXT: Shorten the driveline (if needed)

1. **Determine shortest distance the driveline will span:** Raise the sprayer until the tractor PTO shaft and the sprayer shaft are level. This represents the shortest distance the driveline will span
2. **Determine tractor to sprayer distance:** Measure the distance from the groove on the tractor PTO shaft to the groove on the sprayer input shaft. Record this number.
3. **Determine driveline length:** Lay the fully collapsed driveline out on a flat, even surface and measure the distance from the center of the implement yoke retaining pin to the retaining ring (i.e. groove to groove). Record this number.

## NOTICE

**If the measurement taken in Step 3 is less than that of Step 2, the driveline WILL NOT HAVE TO BE CUT. Otherwise, proceed to Step 4.**

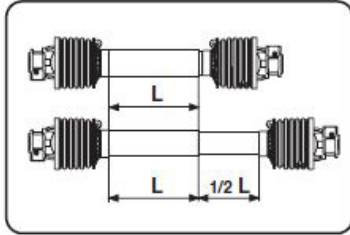
## NOTICE

**FAILURE TO USE THE ESS SUPPLIED DRIVELINE WILL VOID THE WARRANTY**



*Your Bondioli and Pavesi manual is fastened to the sprayer's driveline.*

- Determine length to cut:** Subtract the measurement from #2 (*tractor to sprayer distance*) from the measurement from #3 (*length of driveline*) and add 1 inch (25 mm) to insure there is adequate driveline movement allowance. This is the length of the driveline that will need to be cut. PLEASE NOTE: this length must be cut from BOTH sides of the driveline to shorten it for proper use.



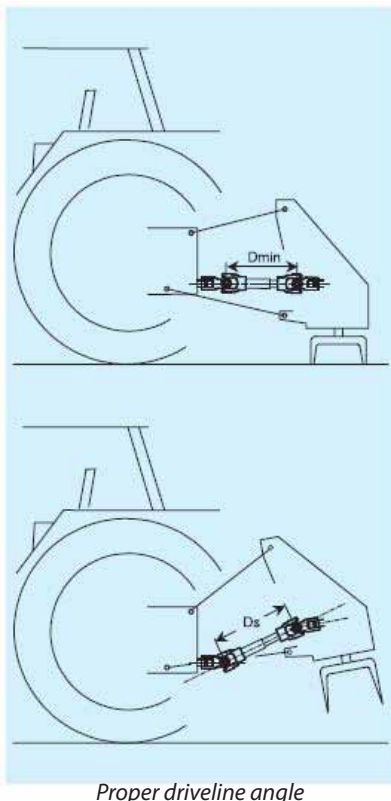
## NOTICE

Telescoping tubes must always overlap by at least 1/2 of their length in normal operation and at least 1/3 of their length in all working conditions. VERIFY THIS BEFORE CUTTING DRIVELINE.

- Shorten the driveline:** Refer to the Bondioli & Pavesi manual (which comes fastened to the driveline) for instructions on the proper technique for cutting the driveline.
- Attach reassembled driveline** to tractor PTO shaft and sprayer input shaft and check fit. Note one end of the driveline shield tube is marked with a tractor symbol to indicate the end that attaches to the tractor.
- Install the driveline shield restraint chains** per the manual supplied with your Bondioli & Pavesi driveline.

## NOTICE

Driveline angles should not exceed 25 degrees.



*Driveline shield restraint chain installed*



*Driveline holding cable*



## Hydraulic Connections

The tractor, through its auxiliary ports, supplies hydraulic power for the sprayer's boom controls. The hydraulic lines provided will be capped off for shipping purposes. This threading is 1/2-14 MPT. **It is the owner's responsibility to source the correct quick connects needed to work with their tractor model.** Remove the caps and install the quick connects. The 450RC unit has a check valve installed in line to prevent flow through the hydraulic block in the wrong direction. If the lines are connected backwards, the hydraulics will not function. If the tractor hydraulic flow can be shifted, change the direction before swapping lines.

Before operating hydraulic functions, make sure the unit is in an open area and clear of any possible obstructions. Refer to [Operating Instructions \(page 8\)](#) for further hydraulic control information.

## Installing the Control Box

Mount the control box in the tractor cab at a location within easy reach of the operator. Some examples are shown below.



In order to supply electricity to the unit harness 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. To complete installation, connect the control box to the unit using the appropriate harness ends. It may be necessary to rotate connectors until proper alignment is achieved. Do not use force. Once aligned, twist coupling ring gently until a click is felt.



## NOTICE

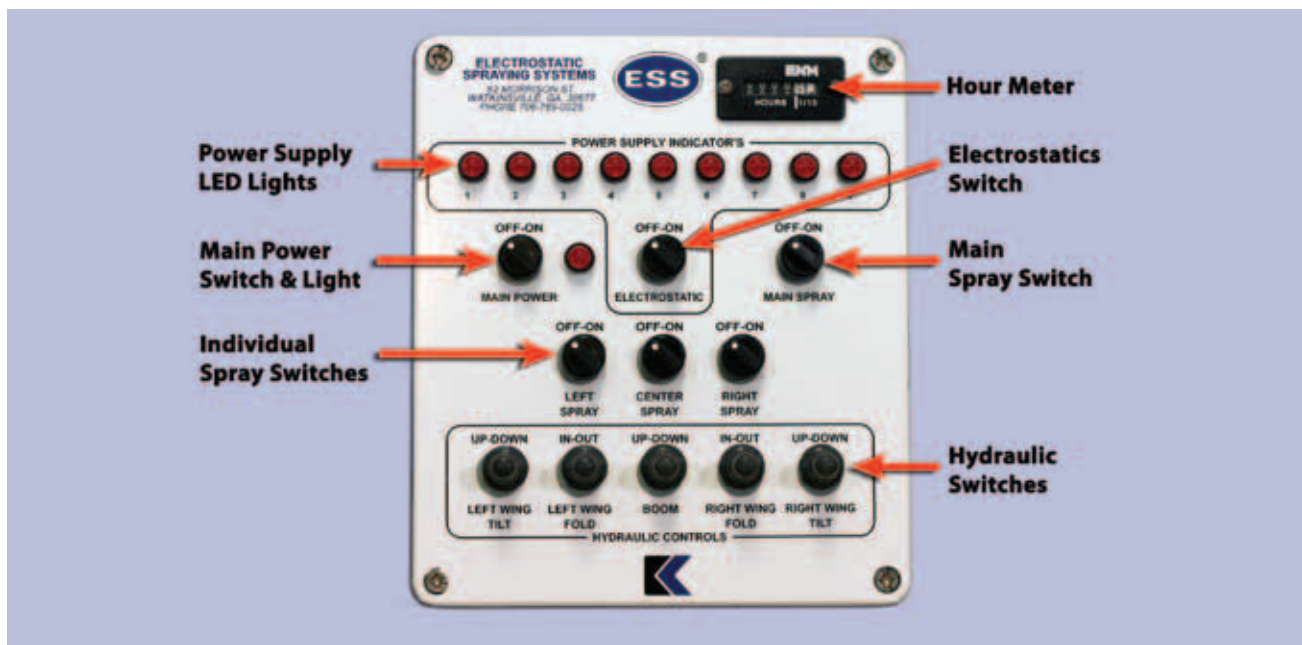
Do not use undue force when attaching electrical harness to avoid damage to the connector.



Photograph shows the location of the connections for the Control Box Harness. Remove the caps and attach the harness to the unit.

## NOTICE

Please note, the ESS control box and sprayer is a 12-volt system. Using a 24-volt system will damage electronics.



ESS Control Box

## Operating Instructions

ESS recommends first running only water the first time after initial assembly. This will allow the operator to become familiar 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.

### Hydraulic Cylinder Control

With the tractor running, PTO disengaged, and the sprayer attached as described in the Hydraulic Connections section (page 8), operate the boom hydraulics to test the correct attachment of the hydraulic hoses. The hydraulic control switches located at the bottom of the control box will activate the hydraulic cylinders once the main power switch has been activated. All hydraulic switches are momentary contact switches and will return to the center position when released. The center hydraulic switch will move the H-frame up or down when toggled. The tilt switches will move the wing tips up or down and the fold switches will fold the wings in or out when the corresponding switches are toggled. If the hydraulics do not function at all, reverse the hydraulic hoses or move the tractor hydraulic flow direction lever in the opposite position. Correct and retest. Adjust the tractor hydraulic speed control to adjust the fold speed of the wings. Refer to your tractor manual for more information about your hydraulic system.

## NOTICE

Operating the sprayer without water in the tank will cause damage to the centrifugal pump seals! This type of damage is not covered by your warranty. electronics.

## Setting the Air Pressure

The sprayer should be operated at an air pressure of 15 PSI. With the tractor running just above idle speed, engage the PTO and increase the tractor RPM until the air pressure reading is around 15 PSI. The blower is equipped with a pressure relief valve that is calibrated at 16 PSI—its job is to protect the blower from overpressurizing. The noise created by the pressure relief valve will alert the operator to slow the tractor PTO speed until the relief valve closes.

Many operators reach the proper operating air pressure by increasing the tractor RPM until the relief valve is audible. Then reduce the RPM until the valve closes again; this is especially effective at night when the gauge is difficult to read.

It is normal for a small amount of air to leak from the pressure relief valve during routine operation.

## Setting the Liquid Pressure

Turn on the “MAIN POWER” switch and verify that the hour meter is working. Now, turn on the “MAIN SPRAY” switch, which allows operation of individual spray switches. Turn on the left, center and right spray switches, which activate the motorized ball valves, to control the liquid. The nozzles will begin to spray.

At the front of the sprayer, right of the liquid pressure gauge, is a gate valve labeled “LIQUID PRESSURE VALVE.” This valve restricts the return flow of liquid to the tank. Opening (turning counter-clockwise) the valve will decrease output pressure and closing (turning clockwise) will increase. Increasing liquid pressure decreases agitation. Excessively adjusting this valve will negatively effect proper tank agitation. Liquid pressure at the factory will be set between 20–30 PSI in order to achieve a nominal 180 ml/minute flow ( $\pm 10\%$ ) out of each nozzle. If additional flow rates are desired contact ESS before adjusting.



## Nozzle Adjustment

Use the graduated cylinder found in the sprayer parts kit to check the flow from each nozzle before spraying. Any flashing or small pieces of debris that have broken loose during testing or in transportation should be cleaned out at this time. Follow the procedure outlined in the Cleaning and Maintenance section to do so.

Determine the average of the liquid volume readings over the entire sprayer to determine the nozzle flow rate to use when applying chemicals. Refer to the Calibration and Field Operation section for determining gallons per acre (GPA) based on your measured nozzle flow.

Utilizing the double swivels on the nozzle assemblies, direct the spray pattern towards the target as desired. For normal spray applications, the nozzles should be at least 18 inches (50 cm) from the plant canopy. Nozzles should be angled slightly forward for maximum canopy penetration. In some conditions it may be necessary to lower the nozzles slightly to combat wind.



*In most applications, power supply number 9 is not used. Do not be alarmed if the light does not illuminate.*



## Operating Electrostatics

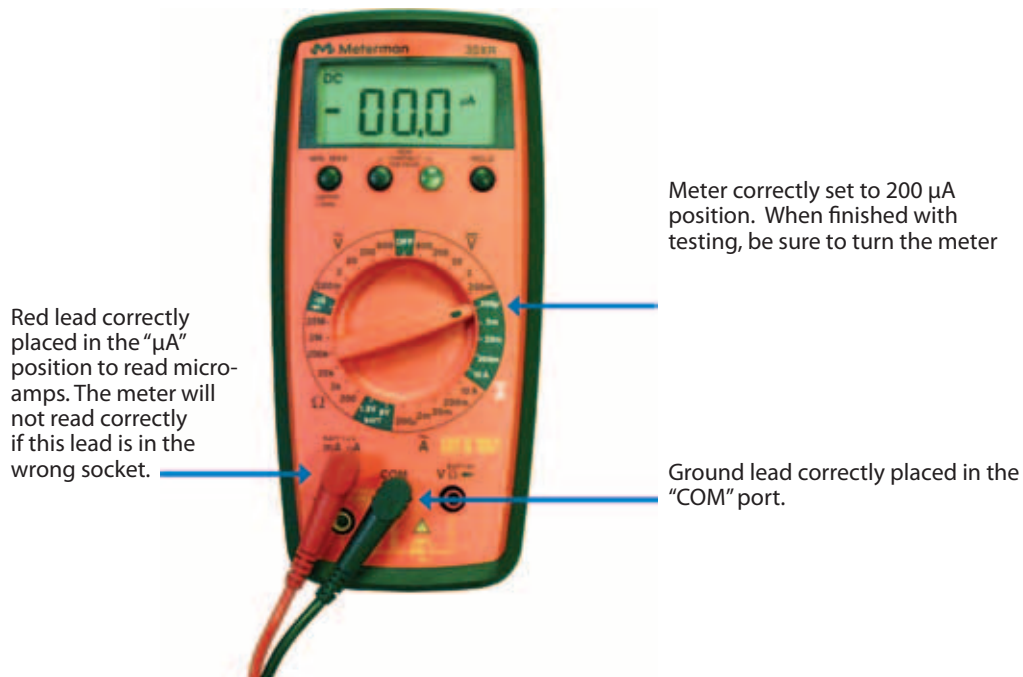
With the main power switch in the ON position, activate the "CHARGE" switch to supply electricity to the spray boom. Once air pressure is present, the bank of LED lights on the control panel will glow for each power supply operating on the spray bars. If a LED does not illuminate, it may be an indication that there is a fault with a power supply. If replacement is necessary refer to pages 14-15

Following the procedure in the Cleaning and Maintenance section (page 13), set the voltage meter (provided with your sprayer) to measure current in micro-amp ( $\mu\text{A}$ ) range. Check the charge level of all nozzles with air pressure reading 15 PSI and the liquid pressure reading 25-30 PSI.

Readings will vary from 9 to 18  $\mu\text{A}$  depending upon conditions. A reading of 0.00  $\mu\text{A}$  indicates a nozzle that is not receiving voltage. A low reading from 2 to 6  $\mu\text{A}$  indicates that the nozzle has some debris present or there is a blockage in the chemical supply line and needs to be cleaned. If all the nozzles read low, the sprayer may not be grounded properly.

### TESTING NOZZLE CHARGES

Test the nozzle for charging using the image below to ensure that the meter is properly set to measure the current of the spray cloud in micro-amps ( $\mu\text{A}$ ).





**NOTICE**

Make sure to test your nozzle liquid charges at standard operating liquid and air pressures.

To test your spray charge with the multimeter

1. Turn the meter on and set it to the 200  $\mu\text{A}$  range.
2. Ground the multimeter's black lead to the spray bar or by pinching the metal probe between the forefinger and thumb of your hand.
3. Hold paddle on the red lead about 1 inch (2.4 cm) from the tip of nozzle outlet while it is spraying and the electrostatics are turned on. Read the charge on the meter.

Ideally the spray charge will be above 10  $\mu\text{A}$ . In the image above the nozzle spray has an excellent reading of 26  $\mu\text{A}$ . If the charge is below 6  $\mu\text{A}$  you will not achieve good electrostatic 'wraparound'. For optimal performance, clean any nozzles that are below 9  $\mu\text{A}$  by following the procedures outlined in the Cleaning and Maintenance section.

## SHUTTING DOWN THE SPRAYER

It is important to shut the sprayer down correctly so that the liquid lines will be purged of chemical.



First turn off the electrostatic switch on the control box, then turn off the liquid flow by shutting off the main spray switch. Let the air flow purge the remaining liquid from the supply lines in the boom. Wait a few seconds until the nozzles quit spraying. They may spit intermittently, but this is normal. When the liquid has cleared from the boom supply lines, turn off the master switch and PTO drive.

**NOTE: Failure to disengage the PTO before shutting down the tractor can cause damage to the supercharger.**

◀ **NOTICE**

Follow the section on Draining and Flushing the Sprayer for additional post-use maintenance.

## Calibration and Field Operation

To be effective the 450RC nozzles need room for the spray to develop; set the nozzles at 18 inches (45.7 cm) above the top of the plant canopy with the nozzles directed slightly forward. If you have to spray in windy conditions you may lower the boom to the point where the spray breaks in the wind at the top of the canopy. This will use the wind to your advantage as much as possible. Take care not to spray when it is too windy; spray drift may occur and cause severe problems.

### Preventing striping

When the spray bars are set so that the nozzles are at least 18 inches from the crop, the spray has enough room to develop a cloud of charged particles. 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 spray will not have a chance to develop properly and it will paint the surface of the leaves unevenly. This is known as striping. If the spray bars are too far away from the target, then the spray may not reach into the plant canopies or spray drift will occur.

### Flow rate

The flow rate is controlled by the flow regulator assemblies located on the electric ball valves. 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 to the factory calibration of 180 ml/min ( $\pm 10\%$ ).

### Example

A ESS row crop sprayer has #59 flow disks installed; when operating at 30 PSI of liquid pressure, the sprayer's output is 170–180 mL per minute. This combined with a ground speed of 3.4 MPH yields a rate of about 10.8 gallons (40.9 liters) per acre. You can decrease the rate by increasing the ground speed or conversely increase the rate by lowering the ground speed.

### Mixing chemicals for a low-volume sprayer

The 450RC is a low volume sprayer. Tank mixes must be adjusted accordingly. Due to the increased coverage of the electrostatic units, start the first chemical mixture with the lowest listed rate on the chemical label. Adjust rates if necessary.

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.**



### How to conduct a jar test

Needed:

- Solutions of chemicals in approximate dilutions
- Jar with lid
- Gloves and Safety Glasses

After mixing solutions of the desired chemicals, place them in a large jar, cap it securely, and shake vigorously. Carefully observe the interaction between the chemical compounds. If the water becomes milky or cloudy, the combined solution may plug the nozzles. Let the jar sit for one to two hours. If there is precipitate on the bottom of the jar, then seek another combination of chemicals.

**NOTE**

## Calibration Guide

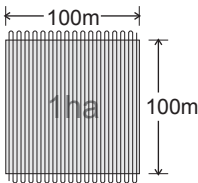
Q: How long will it take to spray 1 hectare?

Assuming the row spacing is 3 meters and the tractor speed is 5 km/h...

First, find the total length of the rows you have to cover.

$$1 \text{ hectare} = 10,000 \text{ m}^2$$

$$\frac{10,000 \text{ m}^2}{3\text{m}} = \frac{10,000 \text{ m} \times \cancel{m}}{3\cancel{m}}$$

$$= 3333.33 \text{ m}$$


If the tractor goes 5 km/h, how many minutes will it take to travel 3333.33 meters?

Set up the ratio:

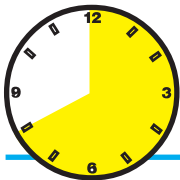
$$\frac{5000}{60} = \frac{3333.33}{x}$$

$$(5000)(x) = (3333.33)(60)$$

$$5000x = 200,000$$

(Well, actually it's 199,999.9, but let's round up to make the math easier...)

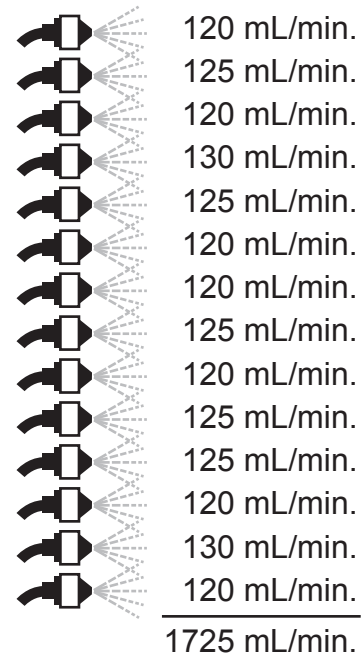
$$x = 40$$



It will take 40 minutes to spray 1 hectare at 5 km/h.

Q: How many liters will it take to spray 1 hectare?

Determine your sprayer's rate of liquid flow by measuring the output of all 14 nozzles.



Your sprayer's total output is 1725 mL/min.

If it takes 40 minutes to spray 1 hectare, then

$$40 \text{ min.} \times 1725 \text{ mL} = 69,000 \text{ milliliters}$$

$$= 69 \text{ liters}$$

It will take 69 liters to spray 1 hectare.

Q: How much can I spray in 8 hours?

In 8 hours of uninterrupted spraying, you could spray 12 hectares.

$$\frac{8 \text{ hours} \times 60 \text{ minutes}}{40 \text{ minutes}} = 12 \text{ hectares}$$

Q: How many hectares can I spray with one tank?

Your sprayer's main tank is 150 gallons (or 567.75 L) and it takes 69 liters to spray 1 hectare.

$$\frac{567.75 \text{ L}}{69 \text{ L/ha}} = 8.23$$

You can spray 8.23 hectares per tank.

Q: How long can I spray with one tank?

If it takes 40 minutes to spray 1 hectare, then

$$8.23 \text{ ha} \times 40 \text{ min.} = 329.2 \text{ minutes}$$

or, in hours

$$\frac{329.2}{60} = 5.49$$

five hours and 30 minutes

### Conversion Table

1 Gal = 3.785 L	1000 mL = 1 L
1 Acre = 43560 ft <sup>2</sup>	
1 mph = 1.61 km/h	

## Cleaning and Maintenance

It is very important to follow all the maintenance and cleaning procedures to ensure that the electrostatic sprayer will function properly. Although the MaxCharge™ nozzle will outperform all other electrostatic spray technology on the market, regular cleaning will ensure peak operating performance. The sprayer can be washed down with a pressure washer prior to any individual component being cleaned; take extreme caution around sensitive components. As a precaution, apply dielectrical silicone grease to all electrical connections. This will prevent water damage to the electrical system.

### Cleaning Nozzles

Disassemble the nozzle by unthreading the electrode cover. Pull the hood off. The nozzle consists of eight main components:

- |                    |                             |
|--------------------|-----------------------------|
| 1. Hood            | 5. Nozzle Base              |
| 2. External O-ring | 6. Liquid Inlet             |
| 3. Nozzle Cover    | 7. HV Electrical Connection |
| 4. Insulator Ring  | 8. Air Inlet Piping         |

The nozzles are mounted to the air tube using two brass nipples and two swivel connectors. This allows the operator to aim the nozzles in directions that are appropriate for travel speeds and wind conditions. The wiring harnesses and liquid lines are mounted inside PVC protective covering that protects parts from chemical and physical damage.

Disassemble the nozzle by unthreading the electrode cover. Pull the hood off. The nozzle consists of eight main components. The diagram on the right page identifies the nozzle components and the air, liquid, and electrical connections.

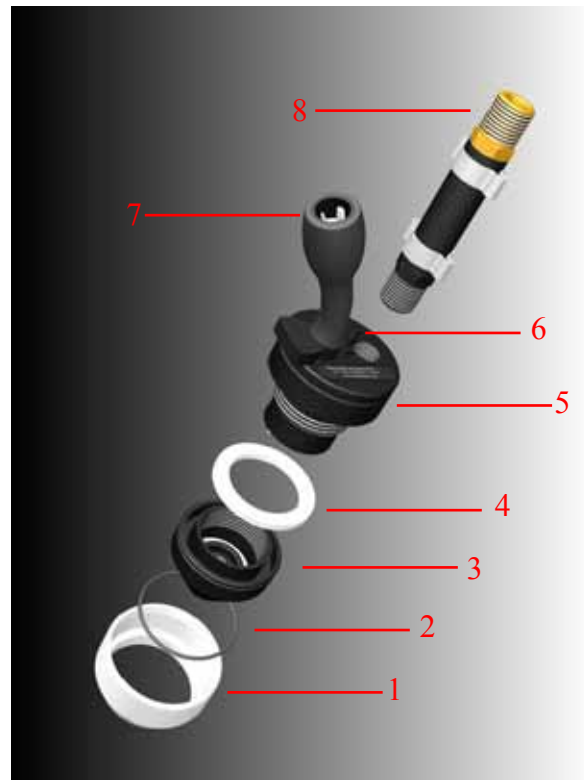
Simple cleaning of the nozzle interior and exterior with soap and water after each day of use is the most important thing you can do to ensure trouble free operation. Cleaning each day avoids long-term chemical buildup that eventually causes clogs, poor spray patterns and shortens nozzle life. After each day's use, remove the nozzle 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. Wipe clean the exterior of the wires and all hoses and fittings connected to the nozzle. Put dielectric silicon grease on any electrical components.

After cleaning, make sure the internal (located in the nozzle base) and external o-rings are still in place. Put the insulator ring back on the nozzle base and screw the nozzle cover back. Replace the hood, pushing it up against the external o-ring.

**The nozzle cover should be hand tight. Never use pliers or other tools to tighten it. The insulator ring should be loose.**



*Apply enough dielectric silicone greas to coat the metal pin and socket connections of the nozzles. Also use dielectric silicone grease to protect the low-voltage circular connectors.*



**NOTE**



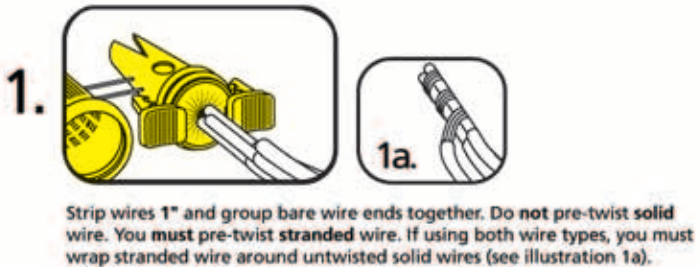
## Repairing Power Supply Wires

### Option 1: Using Blazing Wire Connectors

The red or black power supply wiring will occasionally break during normal field operation. The wiring can be repaired easily in the field. ESS recommends using Blazing Wire Connectors™; several are provided in your Spare Parts Kit. These connectors are waterproof and vibration-proof. Although you will need a pocketknife or wire stripper, no other tools are necessary to repair a broken wire.

Here are the instructions from [www.blazingproducts.com/products/connectors/LV9/instructions.html](http://www.blazingproducts.com/products/connectors/LV9/instructions.html).

### Instructions



Strip wires 1" and group bare wire ends together. Do **not** pre-twist **solid** wire. You **must** pre-twist **stranded** wire. If using both wire types, you must wrap stranded wire around untwisted solid wires (see illustration 1a).



Insert wires through flexible sealing fingers and bend bare wire ends together into one "V-Channel." When connecting heavy solid wires, use bending sleeve / depth gauge on outer sleeve of connector (see illustration 2a). For larger connections (e.g. three #12 wires, or equivalent, or more), bend wires into the V-Channel with round hole at bottom (see illustration 2b); pull folded group of wires downward into this hole at bottom of "V."



Separate connector, removing plastic "link" or "leg" from inner sleeve. Push inner sleeve into pre-filled outer sleeve until **double-locked**. Ensure that bending sleeve does not come down over either latch. Pre-filled silicone fully waterproofs the connection. Do not reuse.

### Instrucciones (también vea las ilustraciones)

**1.** Quitar la envoltura del cable hasta una altura de 2.5cm y juntar las extremidades despojadas de los cables. No es necesario de torcer los cables sólidos. Los cables retorcidos tienen que ser enredados. Si usa los dos tipos de cables juntos, necesita torcer el cable retorcido alrededor del cable sólido no retorcido (vea la ilustración 1A). **2.** Introduzca los cables a través de los dedos selladores flexibles y doble los cables en uno de los dos canales tipo "V". Conectando cables pesados y sólidos, utilice un manguito doblador/calibre de profundidad sobre el manguito exterior del conector (vea la ilustración 2A). Para conexiones mas grandes (ej: 3 cables del numero 12, o equivalente, o mas), doble los cables adentro del canal tipo V con el agujero redondo en el fondo (vea la ilustración 2B); jale el grupo de cables hacia abajo adentro de este agujero en el fondo del canal "V." **3.** Empuje el manguito interior adentro del manguito exterior llenado con silicona, hasta que se sean cerrados (bloqueados) doblemente. Verifique que el manguito doblador no quede encima de ninguna de las cerraduras. El silicona pre-llenado hará que la conexión sea completamente impermeable. No re-utilizar el conector.

Artwork reproduced courtesy of  
Blazing Products, Inc., [www.blazing-products.com](http://www.blazing-products.com)



## Option 2: Soldering

If you do not have one of the black high voltage connectors, you will need to repair the broken wiring harness with more traditional methods. Please note: It is important to use the heavy-walled heat shrink tubing (Part # 6601) for repairs. Do not use the thin-walled heat shrink tubing or electrical tape. These thinner insulating materials will break down under the harsh duty conditions your sprayer operates in. An imperfect repair will cause electrical current to “leak” and lower the performance of the nozzle-charging system.

First, strip back the ends of the broken wires by cutting the red outer casing, then carefully cut the inner casing to expose the wire itself.

Cross the wire ends in an “X” shape. Now, twist the right end away from you. Make sure you have good contact between the bare wires. Twist as tightly as you can.

Now, work with the left wire end. Twist it toward you. By reversing the twisting direction, you will make a stronger connection and the wire ends will be less likely to pull apart. Again, twist as tightly as you can.

If you have soldering equipment available, solder the wires together.

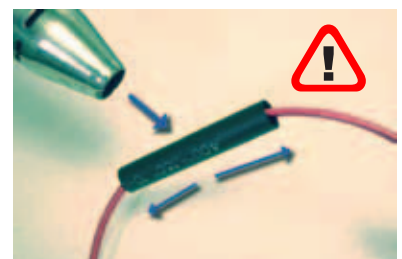
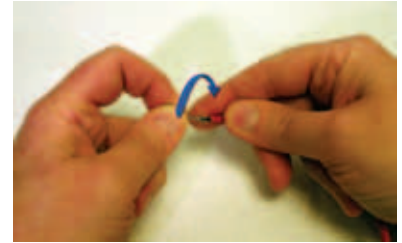
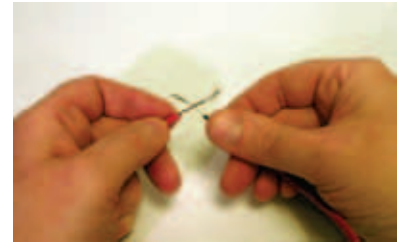
**Caution!** Always be careful with heated tools like soldering irons.

Remembering to use the thick-walled heat shrink tubing, slip the tubing over the open end of the wire and position it so that the bare wire is in the middle of the heat shrink tubing.

Use a heat gun or small butane torch to shrink the shrink tubing. Apply heat evenly, starting at the middle of the tube and working outward. Just before you finish shrinking the tubing, apply glue inside it to seal your repaired connection from moisture.

**Caution!** Always be careful with heated tools like heat guns.

# NOTE



## Draining and Flushing the Sprayer

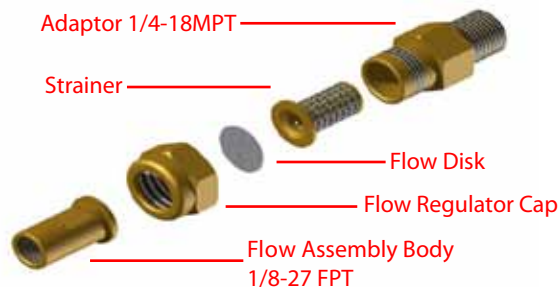
After spraying and after properly disposing of any remaining spray solution, flush the 450RC sprayer with a mixture of water and a cleaning agent. **ESS recommends the use of NUTRA-SOL cleaner which can be purchased from ESS.**

Nutra-Sol cleaner is an excellent neutralizer of chemical deposits in your tank and liquid lines. The 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 (113 grams in 47 liters of water). Mix the cleaner with water in the 10-gallon (37.9 liter) stainless steel rinse tank.

To flush the sprayer, first make sure the main tank has at least 5 gallons of water and that the rinse tank has been filled with either clean water or a Nutra-Sol solution. The brass rinse valve that controls the flow from the rinse tank is on the left side of the sprayer. Rotate the rinse handle down and open all spray switches. Operate the sprayer and run the entire contents of the rinse tank through the liquid system to thoroughly flush all lines. The main sprayer tank can be cleaned by rinsing it with clean water. Empty the rinse water through the dump valve on the left side of the sprayer.

**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.**

Disassemble the main bowl filter and clean the screen, located to the right of the pump on the base of the unit. Disassemble the flow disk assemblies and clean the enclosed screens.



### Flow Disks

The above drawing shows an exploded view of the disassembled flow disk assembly. Please take note of the correct order. The assembly is on each boom on the outlet side of the ball valve that controls the flow of liquid to the nozzles.

Be careful not to lose the flow disks or mix them up from one assembly to another (they can be different from spray bar to spray bar).

### Pump

The 450RC uses a Hypro pump. **DO NOT RUN THIS PUMP WITHOUT ADEQUATE LIQUID IN THE SPRAYER'S LIQUID SUPPLY SYSTEM. THE PUMP WILL BE DAMAGED.** The Hypro operator's manual is included in this binder.



Main tank dump valve

**NOTE**



Flow disk assembly location

## Gear Multiplier

The 450RC uses the BIMA M-7 1:4 gearbox. The parts list for the gearbox is included in this binder.

Check the oil in the gearbox regularly. Add SAE90EP (variable weights and synthetics are acceptable) gear oil through the oil fill inlet piping until the oil level reaches the middle of the sight glass (shown #1) or if gearbox does not include a sight glass, then until oil level reaches drain hole, located on side cover. (shown #2)

The first gear box oil change, at 20 hours of operation, has already been done at the factory; thereafter, change the oil every 500 hours or at the beginning of each season.

**ONLY EP (Extreme Pressure) oil should be used. The oil should be a GL-5.**

**Do not use a 140 weight oil as this will increase temperatures in the gearbox and decrease the service life.**

### #1 Gearbox oil level inspection port

Oil fill port for the gearbox is located next to the blower, just under the 5" air inlet. Remove spring-loaded breather in order to fill gearbox. Fill until oil reaches the middle of the inspection port. It is recommended to actuate the breather's spring valve with a small tool and a drop of oil, to ensure proper ventilation.



### #2 Gearbox oil level drain plug

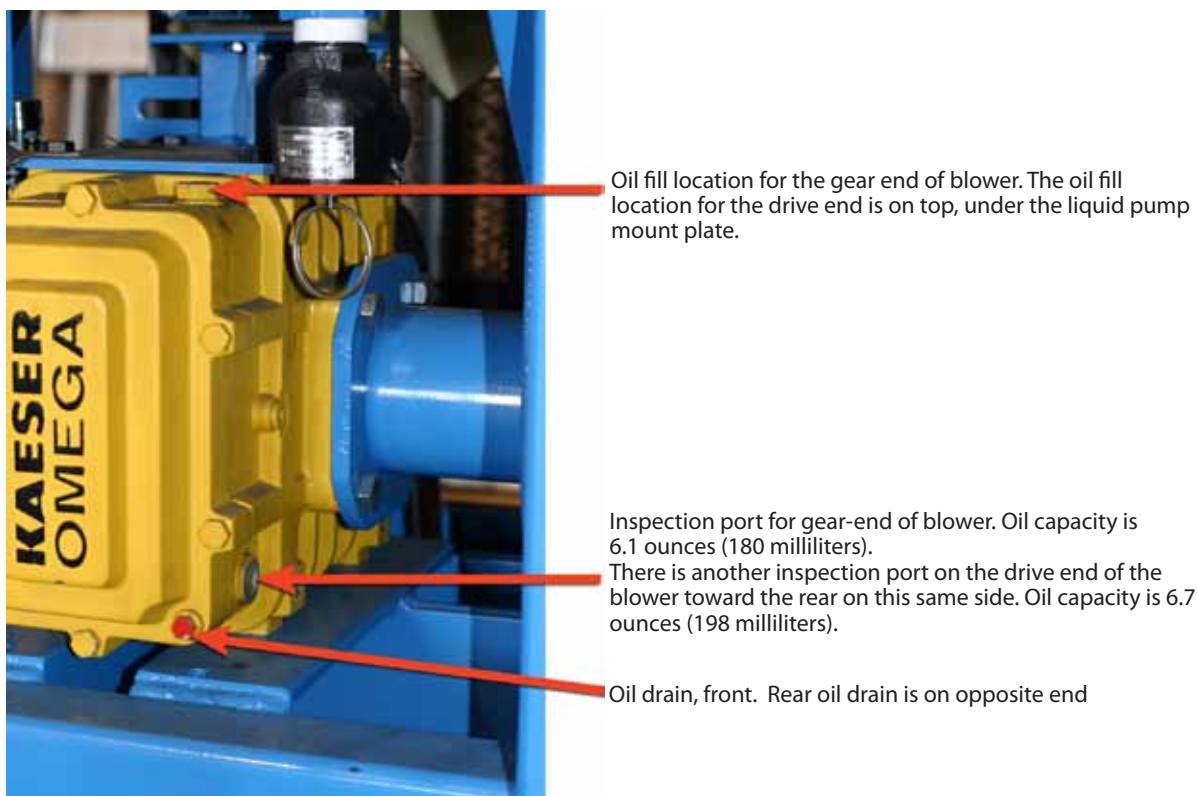
Drain plug must be removed before filling the gearbox. The fill port is located on the top of the gearbox underneath the blower. Remove the entire breather post assembly to fill. It is recommended to use a funnel with flexible hose to ease filling. Fill gearbox until oil begins to leak from the drain port. Replace the drain plug and breather post.



(Photos taken with shield off and/or gearbox detached for illustration purposes.)

## Blower

The 450RC uses the Kaeser Omega Rotary Blower. The Kaeser operator's manual is included in this binder. The first blower oil change should be done after initial break in at 100 hours; thereafter the change interval should be between 1500 and 2000 hours for mineral-based oils and 6000 to 8000 for synthecis (recommemnded at the beginning of each season). ESS uses OMEGA SB220 in the factory. Alternate oils made by Mobil, Shell, Texaco, and Exxon are acceptable. Consult the table below to determine the lubricant that best fits your needs.



### Fahrenheit

<i>Temperature</i>	<i>Recommended Lubricant</i>	<i>ISO Viscosity Grade</i>
Ambient temperature: 25° F to 140° F Oil temperature: up to 250° F	OMEGA SB-220*	220
Ambient temperature: 5° F to 105° F Oil temperature: 25° F to 140° F	Shell Morlina 100 (Mineral Lubricant)	100
Ambient temperature: 25° F to 140° F Oil temperature: 35° F to 230° F	Shell Morlina 220 (Mineral Lubricant)	220

### Celsius

<i>Temperature</i>	<i>Recommended Lubricant</i>	<i>ISO Viscosity Grade</i>
Ambient temperature: -3.98° C to 60° C Oil temperature: up to 121° C	OMEGA SB-220*	220
Ambient temperature: -15° C to 40.56° C Oil temperature: -3.89° F to 60° C	Shell Morlina 100 (Mineral Lubricant)	100
Ambient temperature: -3.89° C to 60° CF Oil temperature: 1.67° C to 110° C	Shell Morlina 220 (Mineral Lubricant)	220

\*Synthetic lubricant specially formulated for rotary lobe blowers.

\*Alternative to Shell Morlina oil would be Mobil DTE 220 (or 100 depending on climate)

\*Oil must be ISO 220 (or 100 depending on climate) and should contain an anti-foaming additive

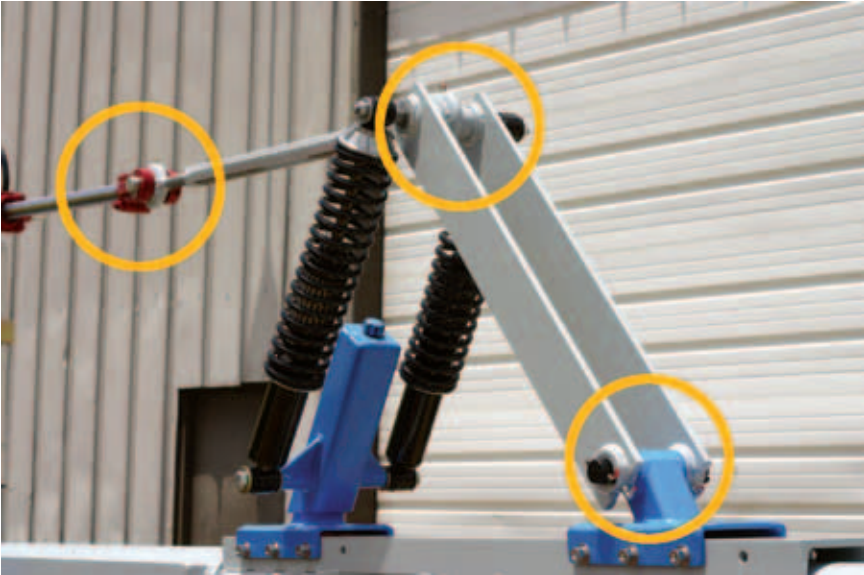


**Movable Parts**



*Lubricate swing-arm joints with a lithium-based grease every 8 hours of operation*

---



*Lubricate boom hinge points and shock linkage pivot points.*

---

## Filter

While the unit is running, inspect the restriction-service indicator on the filter housing. If indicator shows red reset while running to verify accuracy. If indicator continues to show red replace the primary filter. Before replacing filter, clean the inside of the housing thoroughly, making sure not introduce debris into the air system.



**NOTE**

**Once the filter is covered by dust, it reaches its maximum efficiency level.**

**Filters that appear very dirty may still contain a great amount of service life. Rely on the restriction-service indicator for the most efficient and economical use of the filter.**

*Location of the Restriction-service Indicator*

---



*Left: Filter housing*

---

*Above: Pre-cleaner and filter assembly*

---



## Drive belts

Drive belts wear-in and stretch. After the first 20 hours of operation, check for the correct tension and any signs of slippage or wear.



**CHECK BELTS** after the first 20 hours of operation.

*View of the interior of the sprayer from the right side.*

---

### **To adjust the gearbox to blower belt**

The two belt-tensioning rods for the blower are accessed from the underside of the sprayer (see the photograph above). To access the belt-tensioning rods it will be necessary to remove the lower gearbox guard by removing the four 1/2" hex head bolts. To increase the tension on the drive belt, first loosen the nut on top of the base plate. Now tighten the nut below the plate to increase the amount of threaded rod visible. Be cautious not to over-tighten the belts, as it will cause premature failure to the gearbox and blower bearings. Since measuring belt deflection is difficult, only tighten the belts just past an audible slip. While making adjustments, tighten the front and rear nuts in equal increments, alternating between them so that the gearbox weldment is not twisted. Once adjustments are made, tighten down the nuts above the base plate.

### **To replace the gearbox to blower belt**

Loosen both blower adjustment bolts until there is enough slack to remove the worn belt. Place the new belt on the drive pulley (sheave). Re-tension the new belt by tightening the front and rear adjustments in equal increments, alternating between them so that the gearbox weldment is not twisted



**Blower to Pump Belt**

**Gearbox to Blower Belts**

### **To adjust the blower to pump belt**

The Hypro pump used in the sprayer has a low power consumption, requires minimal belt tension and can be adjusted with the idler located on the backside of the belt (see the photograph below). To adjust the tension on the pump belt, loosen the 1/2" nut on the backside of the mount just enough to allow the idler to slide. Push the idler inward to tighten the belt; pull outward to loosen. When the belt is correctly tensioned, retighten the bolt.

NOTE: Tightening the idler in place will add tension to the belt. Be careful not to over-tighten the belt.

### **To replace the pump belt**

The main drive belts must be removed to replace a liquid pump belt (refer to page 21). Loosen the pump belt idler until there is enough slack to remove the worn belt. Place the new belt on the drive pulley (sheave). Re-tension the new belt by following the directions above. It may be necessary to remove the pump fans before attempting to replace the belts. You can easily remove the fan blades by removing the three inner bolts on the fan hub.

## Optional Raven Precision Rate Control System

The 450RC has the option of a Raven Precision Rate Control System. Below are reference images for the key features to locate on the 450RC sprayer. Please refer to the Raven manual in your parts kit for any further information



*Raven Control Panel*



*Radar Sensor  
\*as viewed from the rear, lower  
right side of the machine*



*Control Valve/Flow Meter Assembly  
\*as viewed from the rear of the machine  
with the back panel removed*

## **Sprayer Maintenance Warnings**

Please take special note of the following maintenance precautions as they could adversely affect your sprayer performance, sprayer parts life and warranty guarantees.

### **Failure to disengage PTO or failure to use ESS-supplied driveline:**

1. ALWAYS disengage the PTO before turning off the tractor.
2. ALWAYS use the driveline supplied with this sprayer.

### **Exposure to extreme heat:**

1. Unchecked constant sprayer usage in excess of eight (8) hours per day could result in issues that may damage the blower.
  - Operating the sprayer in temperatures over 100 °F (37 °C) will require more frequent attention to the maintenance listed above.

### **Water Contamination:**

1. ALWAYS replace the breather cap on the reservoir after checking the oil level.
2. When cleaning the unit, DO NOT spray water directly at the oil reservoir or into the air cleaner assembly.

### **Warranty Information:**

- PLEASE NOTE: You *must* return the warranty card at the back of this Operator's Manual in order for the equipment to be covered by the warranty.

# Maintenance Schedule

## Oil changes

GEARBOX	20 hrs	520 hrs	1020 hrs	1520 hrs	2020 hrs	2520 hrs	3020 hrs	...+500 hrs
BLOWER	100 hrs							
	Synthetic	6100 hrs	12100 hrs	18100 hrs	24100 hrs	30100 hrs	36100 hrs	...+6000 hrs
	Mineral	1600 hrs	3100 hrs	4600 hrs	6100 hrs	7600 hrs	9100 hrs	...+1500 hrs

### Before every work session:

- Check oil level
- Check belt tension
- Check restriction-service indicator

### After every work session:

- Clean sprayer and nozzles
- Properly dispose left-over spray solution
- Flush liquid system with rinse tank

### Daily

- Inspect and confirm that gearbox oil is at the middle of the sight glass.
- Inspect and confirm that blower oil is at the middle of both site glasses.
- Verify that the rinse tank is full of clean water, for post-use rinsing
- Check belts for wear or damage.
- Check restriction-service indicator at operating RPM.
- Check liquid filters in all flow assemblies and main tank strainer.
- Verify that all power supply indicators are illuminated while unit is running at operating RPM and that hydraulics operate properly.
- Test nozzle charges.

### Before each spray season

- Apply dielectric silicone grease to all wiring harness pin assemblies and all nozzle electrical connections.
- Drain and replace the gearbox oil every 500 hours.
- Thoroughly clean all nozzles with Nutra-Sol™ by following the procedure outlined in the Cleaning and Maintenance section (p. 13).
- Thoroughly inspect all wiring harnesses and red high voltage wiring for cuts or abrasions that show black streaks. This is evidence of electrical arcing. Replace any wires that may show signs of cuts, abrasions or joints as this may indicate arcing. Follow the procedure outlined in the Repairing Power Supply Wires section (p. 14–15).
- Inspect the centrifugal pump for evidence of leaking. Follow the exact instructions found in the Hypro operator's manual for seal replacement.
- Drain and replace blower oil, following the chart above.
- Follow all procedures covered in the daily maintenance section.



Apply enough dielectric silicone grease to coat the metal pin and socket connections of the nozzles. Also use dielectric silicone grease to protect the low-voltage connectors.



It's important to keep your MaxCharge™ nozzles clean and working efficiently.

## Troubleshooting Guide

Symptom	Possible Problem(s)	
<b><u>Air pressure is low</u></b>	PTO speed too low	Increase tractor RPM
	Air fittings are loose	Spray fittings with soapy water—tighten ones that bubble
	Air fittings are too tight causing washers or seals to be pinched crushed	Check fittings for damage. Replace damaged seals
	Hoses unattached	Inspect for loose hoses and reattach
	Hoses cracked or cut	Inspect for failed air lines—replace damaged lines
	Pop off valve may be open	Inspect pop off valve for trash in inlet
<b><u>Spray from nozzle is erratic or spits</u></b>	Debris in the nozzle	Clean nozzle according to Operator's Manual
	Liquid filters are clogged	Clean main filter and liquid filters in the flow setups
	Low liquid level in the tank	Increase liquid level in tank above two or three gallons
	Loose liquid fitting near nozzle	Inspect to see if black hose is pulled from back of nozzle. Reattach hose
	Liquid control lever in 'OFF' position.	Verify that liquid control lever is in the 'ON' position to open ball valve
	Ball valves not open	Verify that the master and spray switch is on
<b><u>Liquid will not turn on or off</u></b>	Main power switch turned off before liquid control switches	Verify that power supply switch is on so that ball valve will turn off correctly
	Fuse blown on liquid control	Replace fuses found inside back of control box
<b><u>Charging indicator (LED) light is out</u></b>	LED bulb is blown	First, test to see if liquid is producing a charge reading, using the multimeter. If it is, you may need to replace the LED bulb.
	Bad or loose ground wire	Ensure that green ground wires are connected to battery and sprayer
	Bad power supply	Inspect power supply for electrical output. Replace if needed
	Wire has been cut or broken	Inspect for cut or damaged wires. Replace if needed
	Bad air switch	Jump air switch by putting the two wires together.
<b><u>Low charge on one or more nozzles</u></b>	Incorrect air flow	Adjust PTO speed
	Incorrect liquid flow	Adjust Liquid Pressure
	Leaky connections	Check all air, liquid connections
	Dirty nozzles	Clean nozzle according to instruction-
	Bad power supply	Inspect power supply for output
	Cut or damaged wire	Inspect for cut or damaged wirescon-



**Nozzle charging is low or zero on ALL nozzles**

Bad or loose ground wire	Check that the green ground wires are connected to battery and sprayer
Bad Power Supply/Bad Air Switch	Inspect power supply for electrical output. Replace if needed
Blown fuse	Replace power supply fuse inside control box and/or in power supply harness
No input power	Inspect for 12-volt DC current to power supplies
Bad multimeter or multimeter leads	Inspect meter for blown fuse or leads that have been cut or shorted. Change batteries

**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
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**Liquid pressure too high**

Throttle valve setting incorrect	Adjust pressure down by opening throttle valve
Blocked liquid return line	Inspect for blocked return line to tank

## Troubleshooting 3-pin ball valve connectors



To isolate the cause of a problem with the ball valve, remove the connector from the sprayer boom and check the voltages on its 3 pins.

The 3 pins are:

- 1 Constant 12 V (on whenever the sprayer is on)
- 2 Switched 12 V (on when Main Spray switch is on)
- 3 Ground

Check voltages with sprayer switch on and off.

- ♦ If voltages are normal, the ball valve motor needs to be replaced.
- ♦ If voltages are low, check ground connections.
- ♦ If voltages are absent, trace the wires through the wire harness to the control box, looking for loose connections or broken wires.



## Parts Kit List

Every 450RC 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
* 11082	1	Belt 3VX425 1 Groove—Pump
12181	3	Low Voltage Connector, Yellow
12182	1	High Voltage Connector, Black,
1285	1	Graduated Cylinder
1293	10	Flow disk, #51
1321	12	Wire Ties, 15"
1391	3	Hose Assembly, Row Crop Nozzle
14271	3	Nylon Brushes
1464	1	Spare Parts Case
1566	1	Tank Cleaner, Nutra-Sol
16197	2	Connector Ring, #10 — Ground
1662	5	Hose Clamp, Worm, Size 4. SS
209	1	Hose, 1/8" × 1/4" OD, Vinyl, Black, 20" lg
2572	1	Multimeter assembly
2578	2	Fuse, 5 Amp. AGC.1 1/4 × 1/4
3174	1	Dielectric Silicon Grease, 4oz. Tube
3250	1	Fuse, 15 Amp. AGC.1 1/4 × 1/4
3379	1	Fuse, 20 Amp. AGC.1 1/4 × 1/4
3380	2	Fuse, 8 Amp. AGC.1 1/4 × 1/4
3608	5	High Voltage Wire Assembly
396	1	Hose, 1/4" ID, Gray, 60" lg
4350	10	Flow Disk, #59
4705	6	Outside- Nozzle Swivel Gasket
4706	3	Internal- Nozzle Swivel Gasket
4890	2	Flow Regulator Body
5694	5	Insulator Ring
5770	5	External Nozzle O-Ring
5771	5	Internal Nozzle Base O-Ring
6601	1	Heat Shrink, 0.400–0.150, W/Adhesive, 18" lg
7064	20	Nozzle Base Liquid Inlet Hose Barb
7476	5	Ell, 3/16" HB × 3/16" HB White Nylon
764	10	Strainer, #24 Mesh
767	2	Flow Regulator Cap
7853	3	3/16" HB × 1/8" MPT, BR
7857	5	Tee, 3/16" HB × 3/16" HB × 1/8" HB, White Nylon
7858	5	Reducing barb, 1/8" HB × 3/16" HB, White Nylon
7859	5	Tee, 3/16" HB, White Nylon
* 7871	1	Belt 3VX400 1-Groove—Pump
* 7872	2	Belt 3VX560 3-Groove—Blower
7875	1	Hose, 3/16" ID, Blue Conductive, 120'
7892	1	Air Pressure Switch, NO, 4 psi, Two Lugs
8235	2	Tank Agitator Inserts 1/4" and 3/16", 1 each

Note: ESS will overnight ship nozzles or power supplies during the first year warranty period if necessary.

\* Only one set of replacement belts are provided. Refer to Notes on page 28 for the belts equipped on this specific unit.



## Parts Kit List, Continued

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Part Number	Quantity	Description
8246	1	Silicone Carbide Seal Kit- Hypro Pump
8253	5	Hose Mender, 3/16" HB, White Nylon
915	5	Hose Clamp, Two Ear, 3/4" SS
* 9946	2	Belt 3VX600, 3-Groove—Blower
9981	2	Coupling Ring, Size 11 Shell
9994	2	Coupling Ring, Size 13, TYCO
9995	1	Coupling Ring, Size 17 Shell

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\* Only one set of replacement belts are provided. Refer to Notes below for the belts equipped on this specific unit.

## Notes

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Gearbox to Blower Belt:

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Blower to Pump Belt:

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Gearbox Sheave/Bushing:

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Blower Sheave/Bushing:

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Pump Sheave/Bushing:

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## Service Parts

The following service parts are available from ESS.



P/N 6811: Gearbox M7  
1:4 Multiplier



P/N: 5834 Driveline (size 6)



P/N: 7872 Gearbox to Blower  
Belt 3/3VX560  
P/N: 9946 Gearbox to Blower  
Belt 3/3VX600



P/N 7871: Blower to Pump  
Belt 1/3VX400  
P/N 11082: Blower to Pump  
Belt 1/3VX425



P/N 7873: Centrifugal Liquid  
Pump



P/N 7887: Blower to Pump  
Belt Idler



P/N 17618: Omega SB220  
Blower Oil



P/N 17661: Synthetic 75W-90(EP)  
Gear Lubricant

## Air System Parts



P/N 7870: Air Filter Assembly  
P/N 8244: Pre-cleaner Assembly



P/N 8671: Replacement Air Filter



P/N 7869: Restriction-service  
Indicator



P/N 7850: Pressure Relief Valve



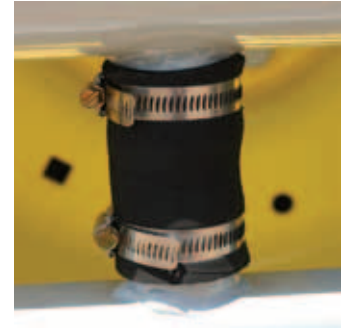
P/N 7892: Air Pressure Switch



P/N 7885: Silencer to Cooler  
Hose - Ø3" x 46" lg  
P/N 7861: 3" T-Bolt Hose Clamp



P/N 7885: Cooler to Boom Wing  
Hose - Ø3" x 55" lg



P/N 7886: Boom to Nozzle Tube  
Hose - Ø1.625" x 3.5" lg  
P/N 813: #28 Worm Clamp



## Liquid System Parts



P/N 7862: Main Tank Drain Valve



P/N 7863: Main Tank Shut-Off Valve



P/N 5068: Main Tank Filter Assembly



P/N 6600: Replacement 30 Mesh Filter Screen



P/N 1039-A: Panel Mount Liquid Pressure Gauge (0 - 60 PSI)  
P/N 1039: Panel Mount Air Pressure Gauge (0 - 30 PSI)  
P/N 7851: Liquid Pressure Valve



P/N 8425: Electric Spray Control Valve Assembly



P/N 9983: Electric Spray Control Valve (motor head only)



P/N 7906: Spray/Rinse Selection Valve



P/N 1664: Rinse Tank O-Ring



From the Left:

- P/N 768: Flow Regulator Adaptor
- P/N Various: Flow Disk (Specify size; see chart below)
- P/N 767: Flow Regulator Cap
- P/N 764: #24 Mesh Strainer
- P/N 4890: Flow Regulator Body

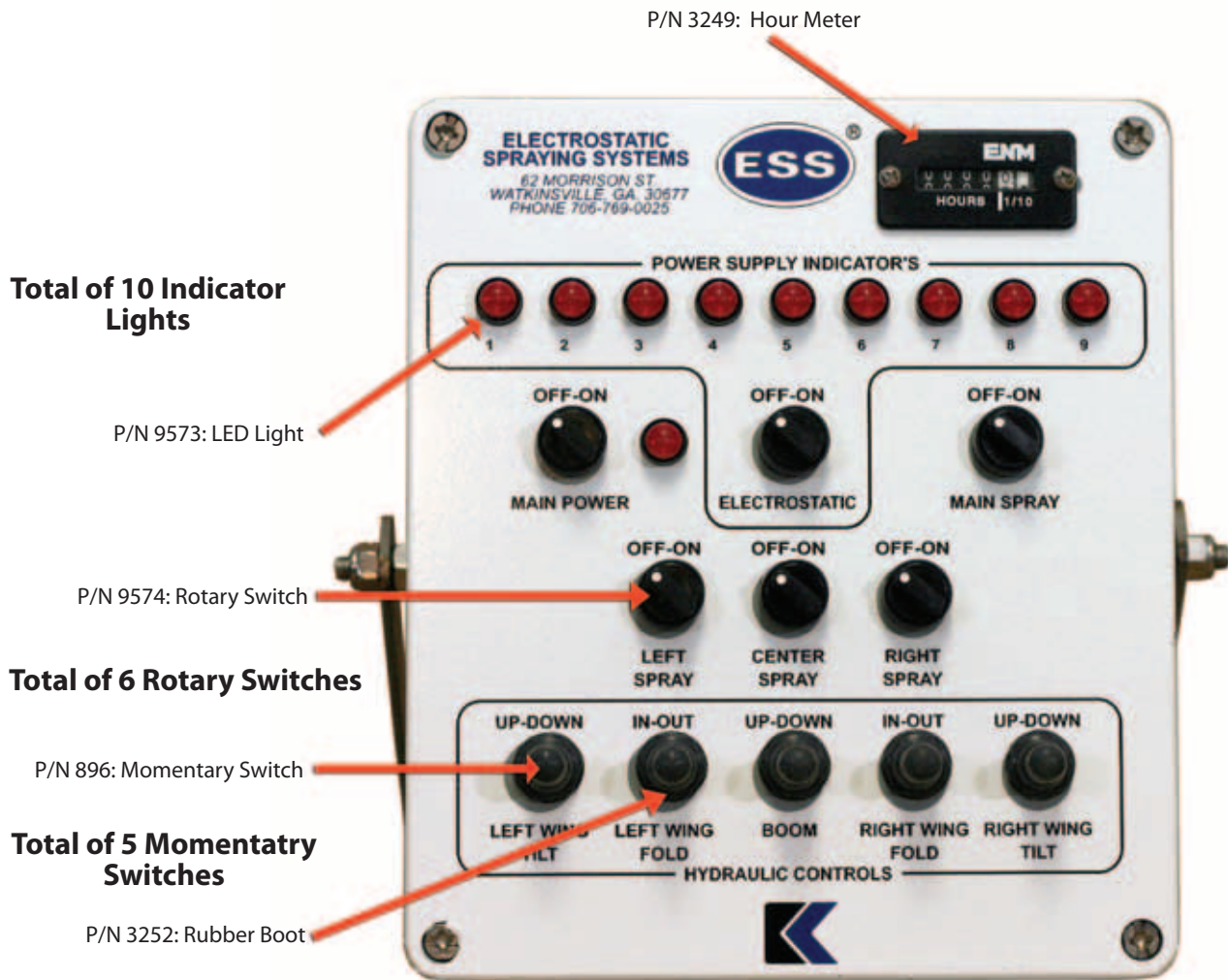
Flow disks are matched to the number of nozzles they control:

- P/N 1293: #51 (0.051") 5 to 6 nozzles
- P/N 4350: #59 (0.059") 7 to 8 nozzles



- P/N 7857: 3/16" x 1/8" Hose Adaptor
- P/N 209: Vinyl Hose - 1/8" Black (at specified length)
- P/N 7859: 3/16" Hose Tee Adaptor
- P/N 7875: Conductive Hose - 3/16" Blue (at specified length)

## Control Box Parts



Remove screws on the Control Box to access fuses.

P/N 3379: 20 Amp Fuse

P/N 3250 15 Amp Fuse

P/N 3380: 8 Amp Fuse

P/N 2578 5 Amp Fuse

## Nozzle Parts



P/N NB-5784: Nozzle Base Assembly



P/N 5770: O-ring, External



P/N 5771: O-ring, Internal



P/N NC-5775: Nozzle Cover Assembly



P/N 5694: Insulator Ring



P/N AP-5795: Row Crop Nozzle Hood

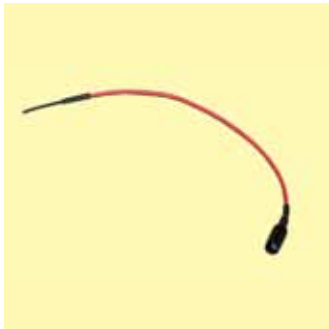


From the left:  
 P/N AS-1391: Hose Assembly (Nozzle End)  
 P/N 1298: Brass Swivel  
 P/N AS-7900: Hose Assembly (Boom End)

## Wiring Parts



P/N PS-1071: Power Supply Assembly



P/N AS-3608: HV Wire Assembly  
 P/N 1512: High Voltage Wire (at specified length)



P/N 12182: High Voltage Electrical Connector



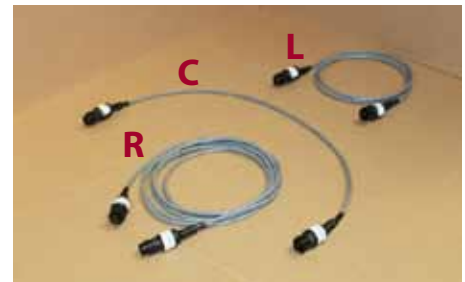
P/N 17304: Breakaway Intermediate Harness (2 required)



P/N 11539: Hydraulic Control Box Harness  
 P/N 11540: Valve and Power Supply Control Box Harness



P/N 7950: Main Unit Harness



P/N 11509: Right Intermediate Harness  
 P/N 11508: Center Intermediate Harness  
 P/N 11507: Left Intermediate Harness



## Miscellaneous Parts



P/N 7303: Breakaway Hinge Assembly



P/N 8235: Jet Agitator Nozzle with Inserts



P/N 7864: Anti-Vortex Fitting



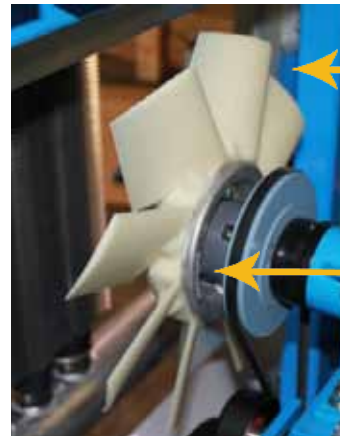
P/N 3174: Dielectric Silicone Grease



P/N 4132: Boom Assist Shock/Spring



P/N 1566: Nutrasol Tank Cleaner



P/N 7865: Cooling Fan

P/N 7918: Fan Hub Spacer



**For information on these parts, please call our office at: 706-769-0025 or toll-free at: 1-800-213-0518**

## ESS WARRANTY

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Electrostatic Spraying Systems, Inc. warrants to the original purchaser of any Electrostatic Spraying Systems equipment that the equipment shall be free from defects in material and workmanship for a period of one year after date of delivery or 1000 hours of operation. The electrostatic power supply warranty form must be returned for verification of date of purchase.

### **Disclaimer of Implied Warranties and Consequential Damages**

Electrostatic Spraying Systems' obligation under this warranty, to the extent allowed by law, is in lieu of all warranties, implied or expressed, including implied warranties of merchantability and fitness for a particular purpose and any liability for incidental and consequential damages with respect to the sale or use of the items warranted. Such incidental and consequential damages shall include, but not be limited to: transportation, charges other than normal freight charges, cost of installation other than cost approved by Electrostatic Spraying Systems, Inc., duty, taxes, charges for normal service or adjustments, loss of crops or any other loss of income, expenses due to loss, damage, detention or delay in the delivery of equipment or parts resulting from acts beyond the control of Electrostatic Spraying Systems, Inc.

### **THIS WARRANTY SHALL NOT APPLY:**

1. To vendor items which carry their own warranties such as, but not limited to, engines, air compressors, and liquid pumps. Electrostatic Spraying Systems, Inc. shall supply replacement parts at list price pending the warranty investigation of the vendor item. Vendor item parts such as air compressors, liquid pumps, solenoids, and other such items must be returned before warranty credit.
2. If the unit has been subject to misapplication, abuse, misuse, negligence, fire or other accident.
3. If parts not made or supplied by Electrostatic Spraying Systems, Inc. have been used in connection of the unit, if, in the sole judgement of Electrostatic Spraying Systems, Inc. such parts affect its performance, stability or reliability.
4. If the unit has been altered or repaired in a manner which, in the sole judgement of Electrostatic Spraying Systems, Inc. such alteration or repair affects its performance, stability or reliability. This shall include but not be limited to opening of the handgun shell by anyone not authorized by Electrostatic Spraying Systems, Inc. to do so.
5. All drivelines and all input bearing and input seal failures on gearboxes
6. **To normal maintenance, service and replacement items such as, but not limited to, engine lubricant, filters, or to normal deterioration of such things as, but not limited to, belts and exterior finish, due to use and exposure.**

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 IS SIGNED BY A CORPORATE OFFICER OF  
ELECTROSTATIC SPRAYING SYSTEMS, INC.