



ESS



Operator's Manual 150RB



ESS

Electrostatic
Spraying Systems

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OPERATOR'S MANUAL

MODEL 150RB

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.¹ (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 services of ESS write or call us at:

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support@maxcharge.com**

Please take time to read this manual before operating the 150RB Grape 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.



¹ ESS 150RB (Rotating Breakaway) Grape Sprayer™, RB™, MaxCharge™, and the ESS logo are copyrights or registered trademarks of Electrostatic Spraying Systems, Inc.

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Overview of the Model 150RB Air-Assisted Electrostatic Sprayer

The heart of the 150RB 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.

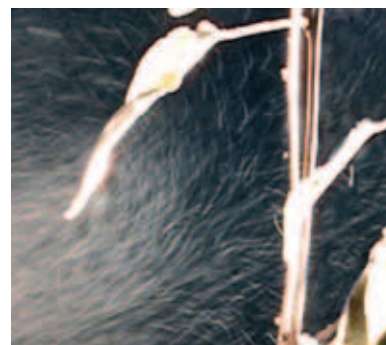
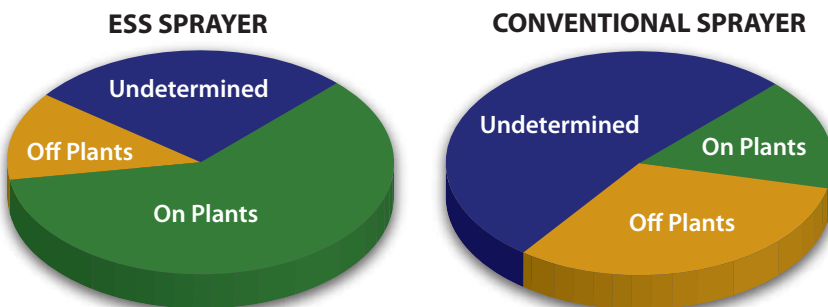
The MaxCharge™ nozzle is easy to clean and corrosion-proof. The interior ceramic outlet resists wear three times better than stainless steel outlets. These features combine to give the best spray coverage on the market.

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



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

Where Does the Spray Go?






Electrostatically charged droplets are attracted to plant surfaces.

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!

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 150RB 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 decals¹ on the 150RB 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.

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

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.

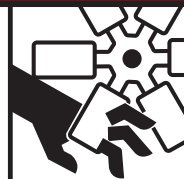
! DANGER!	! ¡PELIGRO!
ROTATING DRIVE PARTS BENEATH Entanglement with rotating drive parts can cause injury or death. Do not operate without this and all other shields in place and in good condition.	EQUIPO EN ROTACION DETRAS DE LAS PROTECCIONES No operar el equipo sin todas sus protecciones. El contacto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



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

Do not operate the 150RB without the proper safety shielding in place.

DANGER!	! ¡PELIGRO!
MOVING PARTS CAN CRUSH AND CUT Do NOT operate with guard removed. Do NOT place hands or fingers under guard.	MANTÉNGASE ALEJADO Zona de protección para evitar riesgos. No opere este equipo sin todas sus protecciones instaladas.



This warning decal is located inside the sprayer on the shields designed to protect you from the sprayer's fan and belts.

Do not operate the 150RB without the proper safety shielding in place.



¹ 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.

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 150RB 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:

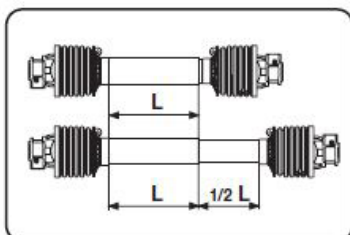
NEXT: Shorten the driveline (if needed)

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.

4. **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.**

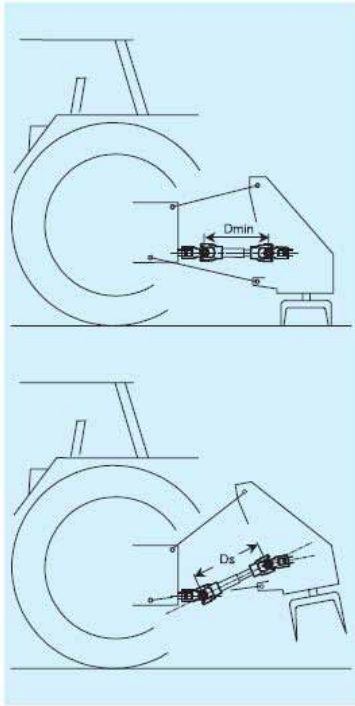
NOTICE

FAILURE TO USE THE ESS SUPPLIED DRIVELINE WILL VOID THE WARRANTY



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

5. **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.
6. **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.
7. **Install the driveline shield restraint chains** per the manual supplied with your Bondioli & Pavesi driveline.



Proper driveline angle



Driveline shield restraint chain installed



Driveline holding cable

NOTICE

Driveline angles should not exceed 25 degrees.

Installing the Control Box

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



Alternate Control Box Locations

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.

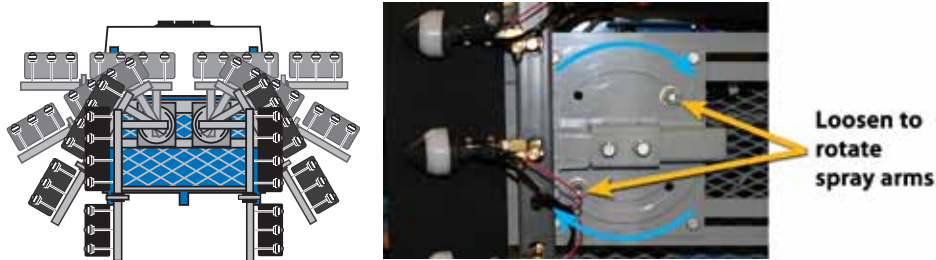
This is a 12-volt system. Using a 24-volt system will damage electronics.



Adjusting the Rotating Spray Arms

In order to spray effectively, the nozzles need to be approximately 18 inches (46 cm) from the crop. In addition, the 150RB sprayer has four ways to adjust the spray arms for maximum benefit. The H-Frame can be raised or lowered if it needed.

Rotation



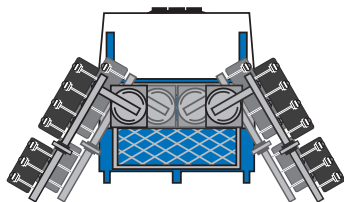
Each spray arm can be rotated from a nearly horizontal to a vertical position. Loosen the two 15/16" nuts that secure the round rotating plate (see illustration above), then rotate the arms to the desired angle. **CAUTION:** Do not remove the 15/16" nuts. **LOOSEN ONLY.** Make sure to tighten the nuts securely. Repeat for the other spray arm.

Width



The spray arm's mount plate can slide the width of its frame. Loosen all four 3/4" nuts from the back. The mount plate will then slide left or right as needed. Make sure to tighten the nuts securely. Repeat for the other mount plate.

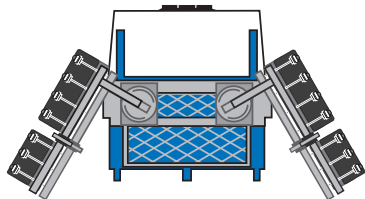
Height



When installing the H-frame choose the bolt on location that will place the nozzle tips with the extensions in the lowest position approximately 24 inches below the anticipated height of the hanging bunches for overhead style trellis systems. For gabled trellis systems, place the grape area in the center of the boom when adjusted for rotation.

Additional adjustment and fine tuning can be done by adjusting the height of the 3 point hitch and utilizing the extension adjustment.

Extension



Loosen to slide
sprayer arm out

The arm that connects the spray arm to the rotating plate extends for an additional 4 inches (10 cm) on each side. Loosen the two 3/4" jam nuts and their bolts, then slip the arm out to the desired position. Do not pull the arm out of the rotating plate. Tighten the bolts first, then tighten each jam nut to prevent the bolt from working loose. Repeat for the other connecting arm.

It's best to make these adjustments one at a time.

Take care to avoid straining the air and liquid connections.

Inspect all connections after adjusting the sprayer arms.

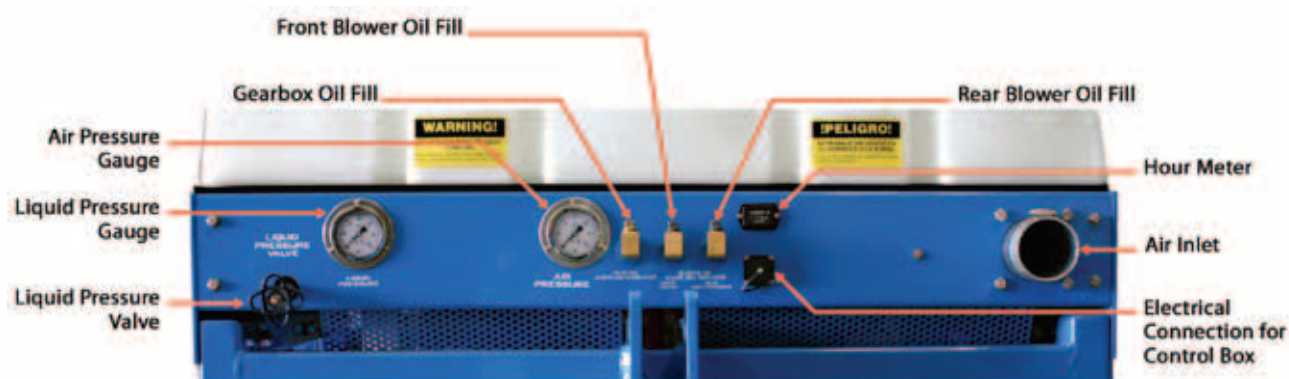
Make sure all bolts are secure before moving the sprayer.

Operating Instructions

Fill the main liquid tank with water. Wettable powder chemicals should be pre-mixed before adding to the tank; liquid chemicals may be added directly to the main sprayer tank. Follow all instructions on the chemical or pesticide manufacturer's label.

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.

NOTE



Setting the Air Pressure

With the tractor just above idle speed, engage the PTO and increase the tractor speed until the air pressure reads 15 PSI. The blower is equipped with a pop-off valve that protects the blower from overpressure. The loud hissing noise created by the air escaping from the open pop-off valve will alert you to slow the tractor PTO speed until the pop-off valve closes. At this point, the blower will be supplying the correct airflow needed for spraying.

It is normal for a small amount of air to leak from the pop-off valve during routine operation. The operating air pressure should be 15 PSI.

Setting the Liquid Pressure

Turn on the "MAIN POWER" switch and verify that the hour meter is working. Now, turn on the "SPRAY" switch, which turns on the motorized ball valve that control the nozzles. The nozzles will begin to spray.

At the front of the sprayer, left 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 liquid pressure valve will decrease pressure and closing it (turning clockwise) will increase pressure. When the valve is fully closed, some liquid will still be able to return to the tank to maintain tank agitation. Fully closing the valve will minimize the tank agitation. Liquid pressure at the factory will be set between 20–30 PSI in order to achieve a nominal 150 ml/minute flow ($\pm 10\%$) out of each nozzle.

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 can be angled if necessary to achieve minimum spray distance. In some conditions it may be necessary to lower the nozzles and angle slightly forward to combat wind.



Correct sequence for turning on the Sprayer controls.



Operating Electrostatics

When the air supply reaches 4 PSI, the air switch will activate and supply electricity to the spray boom, turning the nozzle LED lights on. The LED lights on will glow for each power supply operating. If an LED does not illuminate it may be an indication that there is a fault with the power supply. If replacement is necessary refer to page 12.

Following the procedure in the Cleaning and Maintenance section on page 9, set the voltage meter (provided with your sprayer) to measure current in the micro-amp (μA) range. Check the charge level of all nozzles. Readings will vary from 9 to 18 μA depending upon conditions. A reading of 0.00 μA indicates a nozzle that is not receiving voltage. A low reading from 2 to 6 μA indicates that the nozzle has some debris present and needs to be cleaned. If all the nozzles read low, the sprayer is not grounded properly.

Shutting Down the Sprayer

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

NOTE



First turn off the liquid flow by shutting off the spray switches and the electrostatic 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, you should turn off the PTO drive. Then shut down the tractor..

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

NOTE

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

Calibration And Field Operation

The model 150RB Grape Sprayer is a low volume sprayer. Therefore, tank mixes must be adjusted accordingly. Use the Calibration Guide (next page) to determine GPA (Gallons per acre). After determining the desired amount of active ingredient per acre, mix the equivalent amount of active ingredients for acres to be sprayed.

The average nozzle flow rate can be adjusted and operated from 120 to 180 ml/min. Outside this range, nozzle charging is poor and spray deposition is low. Optimum performance is achieved by setting the liquid flow of the nozzles from 120 to 160 ml/min. Adjust the liquid pressure using the Liquid Pressure Valve. A variety of flow disks have been provided in the Sprayer's Spare Parts Kit. A lower-valued disk will reduce the flow; a higher-valued disk will increase the flow.

Using the H-frame height adjustment and the tractor's height adjustment for the three-point hitch, adjust the spray bars so that the nozzles are about 18 inches from the crop. At this distance, 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 booms are too close to the crop, there will not be enough room for the spray cloud to develop and coverage will be uneven. This is known as striping. If the spray bars are too far away, then spray may not reach into the canopies or spray drift may occur. In windy conditions, the nozzles can be angled forward and the spray bars moved closer to the 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.

How to conduct a jar test

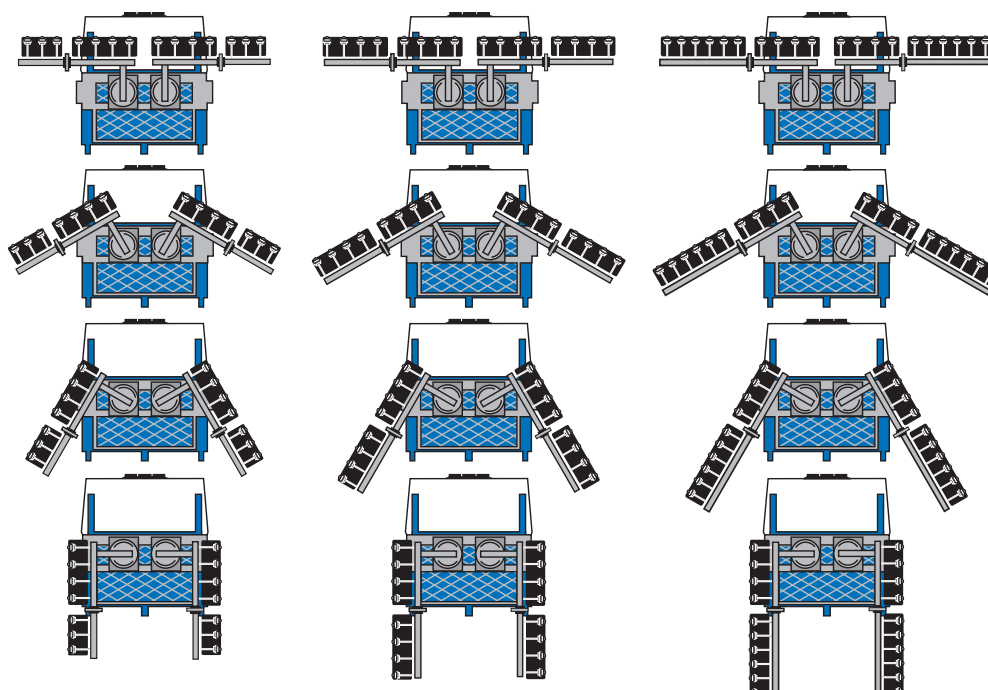
Needed:

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

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

$$GPA = \frac{5940 \times GPM}{MPH \times W}$$

where the variables stand for:

1. *GPM* = Gallons per minute per nozzle. To determine gallons per minute per nozzle, first measure the flow rate of one nozzle in milliliters/minute with a graduated cylinder. Convert the volume of the flow rate from milliliters to gallons by dividing the volume by 3,800 (1 gallon = 3,800 milliliters). The normal flow rate of an ESS nozzle is between 120 and 200 milliliters per minute (0.0316 and 0.05263 gallons per minute). The flow rate can be varied by adjusting liquid pressure.

Conversion: 1 gallon = 3,800 milliliters

So,
120 ml/min = 0.0316 *GPM*
150 ml/min = 0.0395 *GPM*
180 ml/min = 0.0474 *GPM*
200 ml/min = 0.0526 *GPM*

Example:

$$\frac{120 \text{ ml}}{3,800 \text{ ml/gal}} = 0.0316 \text{ GPM}$$

2. *MPH* = Tractor speed in miles per hour
3. $W = \frac{\text{Total spray swath in inches (distance between the rows)}}{\text{Total number of nozzles}}$

EXAMPLE:

John's 150RB has 14 nozzles. The distance between the rows is 8 feet and he is spraying each row. The average flow rate is 180 milliliters per nozzle. The tractor on which the sprayer is mounted will travel at 5 miles per hour during spray application. How many gallons per acre will this sprayer apply?

$$GPM = \frac{180 \text{ ml/min}}{3800 \text{ ml/gal}} = 0.0474 \text{ GPM}$$

$$MPH = 5$$

$$\begin{aligned} \text{Total spray swath} &= 8 \text{ feet (2.5 meters)} \\ &= 96 \text{ inches (250 centimeters)} \end{aligned}$$

$$\text{Total number of nozzles} = 14$$

$$W = \frac{96 \text{ inches}}{14 \text{ nozzles}} = 6.86$$

$$\frac{5940 \times 0.0474 \text{ GPM}}{5 \text{ MPH} \times 6.86} = \frac{281.56}{34.3} = \mathbf{8.21 \text{ GPA}}$$

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 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 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.

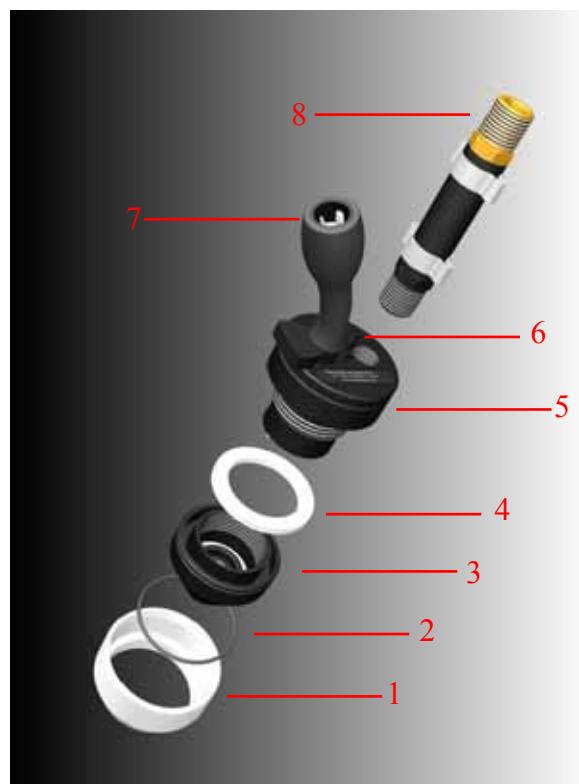
Simple cleaning of the nozzle interior and exterior with soap and water after each day of use is the most important thing you can do to ensure trouble free operation. Cleaning each day avoids long-term chemical buildup that eventually causes clogs, poor spray patterns and shortens nozzle life. After 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 grease to coat the metal pin and socket connections of the nozzles. Also use dielectric silicone grease to protect the low-voltage circular connectors.



NOTE

Draining and Flushing the Sprayer

To drain the 150RB unit, remove the right side door. With the pump assembly exposed, open the ball valve with the drain piping. After properly disposing of any remaining spray solution, flush the 150RB 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). Disassemble the main bowl filter and clean the screen. Before and after each use disassemble the flow disk assemblies and clean the enclosed screens.

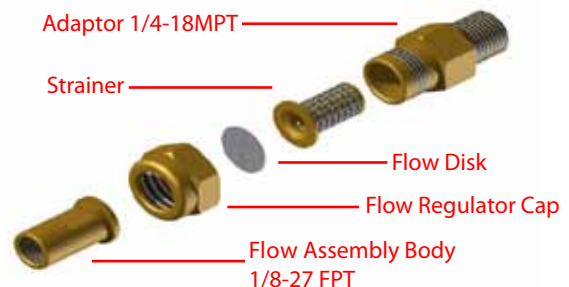
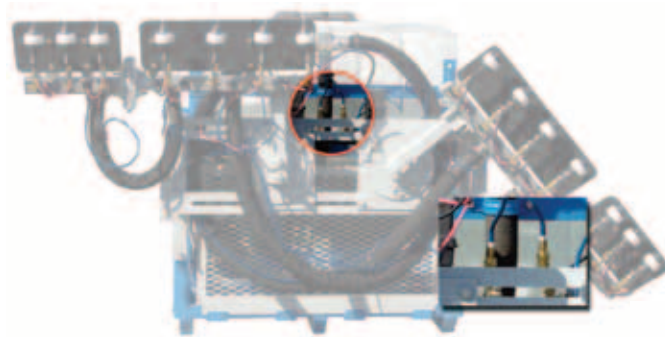


Flow Disks

The illustration below shows where the flow disk assembly is found on the sprayer. The assembly, centrally located on the back of the unit, is used to regulate the liquid supply to the spray boom. Since chemical build up and clogging can drastically effect the performance of the unit it is imperative that these assemblies are checked and cleaned regularly. Using a 13/16" and 11/16" wrench, separate the regulator cap from the adaptor, being cautious not to lose or mix up the flow disk, as they can be different from spray bar to spray bar. With all ball valves open, operate the sprayer to thoroughly flush all lines. After cleaning reassemble in the orientation shown to the right; be cautious not to over-tighten, as you may damage the assembly.

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.

◀ NOTE



*An exploded view of the
disassembled flow disk assembly
Please take note of the correct order.*

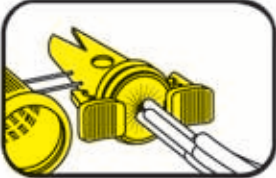

Repairing Power Supply Wires

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.

Instructions

1.  

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).

2.   

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."

3.  

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.

Uses

Under-ground	<ul style="list-style-type: none">• Lawn Irrigation Systems• Low-Voltage Lighting• Security Systems• Telephone Wire Splices
Vehicle	<ul style="list-style-type: none">• Boats, Recreational Vehicles• Heavy Construction Equipment

Revolutionary Design

Keeps low-voltage connections dry and corrosion-free.

Wire Sizes Tamaños de los cables

Min. 2 #18 AWG • Max. 3 #10 AWG STR with 1 #18
Min. 2 del # 18 AWG • Máx. 3 del #10 AWG STR,
1 del #18

Application Aplicación

Maximum 30 Volts • 30 Amps.
Copper wire, solid or stranded
Máximo 30 Voltios • 30 Amperios
Cable de cobre, sólido / retorcido

Sealant Temperature Temperatura del sellador

-40°F to 400°F -40 grados F hasta 400 grados F
-40 hasta 200 grados Celsius

WARNING! ADVERTENCIA!

WARNING: Not for high-voltage connections.
ADVERTENCIA: No es para aplicaciones de alto voltaje.

MADE IN USA

Use only in accordance with local and national codes. Use solamente de acuerdo con los códigos vigentes en su país. U.S. Patent 6,051,791. All other appropriate trademarks, U.S. and Foreign Patents apply. Printed in USA. ©2004 Blazing Products, Inc.

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St. Louis, Missouri USA

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Option 2: Soldering

If you do not have one of the black Blazing 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.

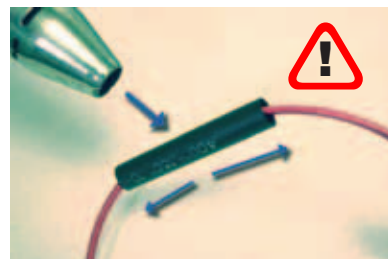
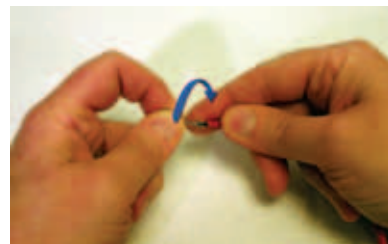
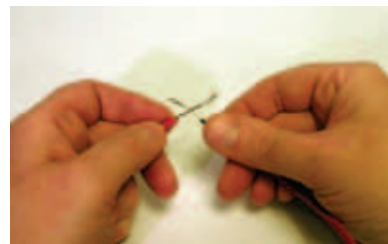
Caution! Always be careful with heated tools like soldering irons.

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.

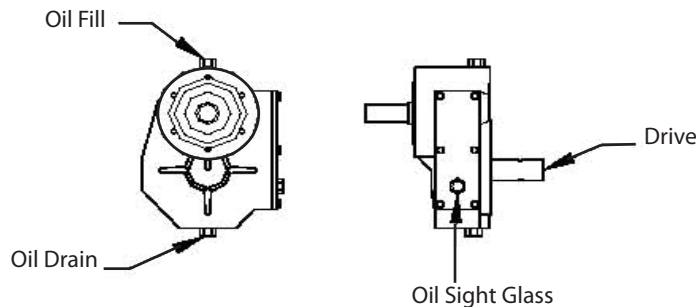
NOTE



Maintenance

Gear Multiplier

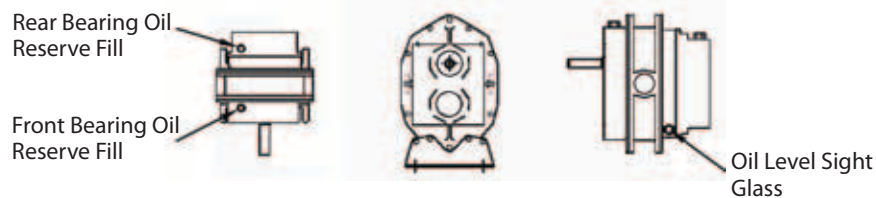
Check oil in gearbox regularly. Add SAE90EP (extreme pressure) gear oil through the oil fill inlet piping, located on the front panel, until the oil level reaches the middle of the sight glass (shown below)



BIMA M7 1:7 Gear Multiplier

Change gearbox oil after the first 20 hours of operation. Then change the oil every 500 hours of operation. Use SAE90EP (extreme pressure) oil. Variable weight oil is acceptable. The oil level should be checked each time the machine is taken out into the field.

Blower

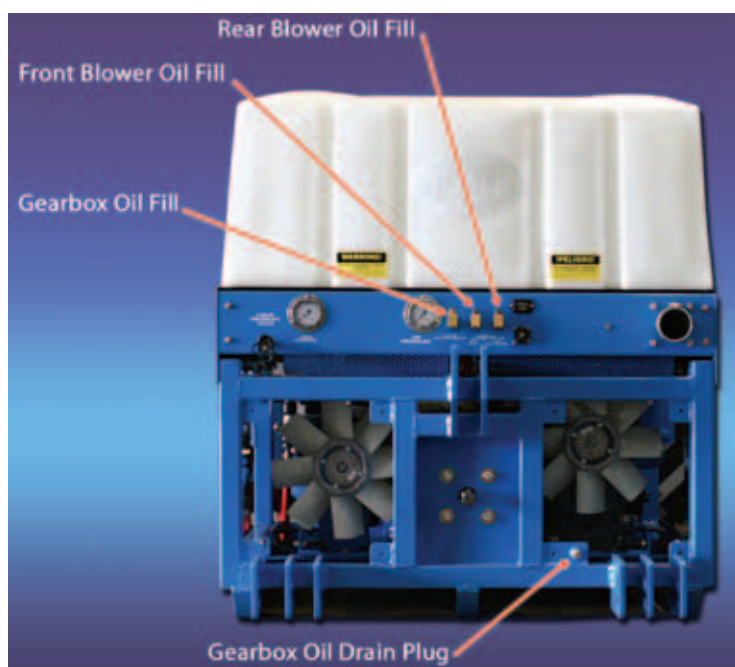


*Dresser Roots Universal RAI Series
Frame 42/53 Blower*

Change oil after the first 100 hours of operation. Then change the oil after every 500 hours of operation. Use DTE BB ISO Viscosity Grade 220 Oil (manufactured by Mobil, Shell, Texaco and Exxon).

DO NOT LET OIL LEVEL FALL BELOW THE MIDDLE OF SIGHT GAUGE WHEN IDLE.

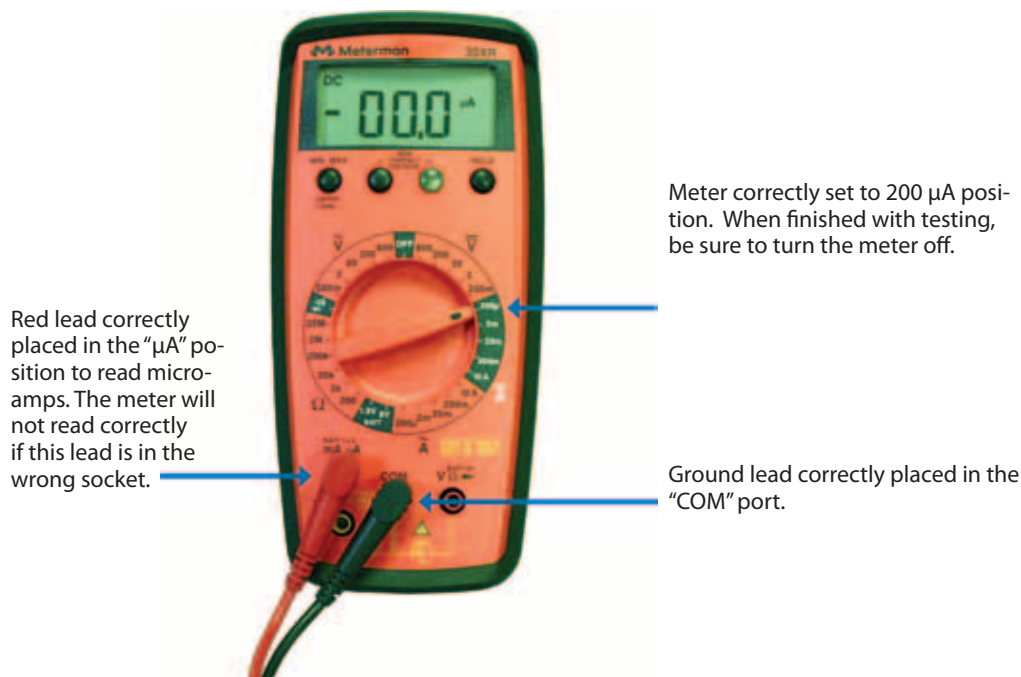
NOTE



*150RB Front View
(Shown without boom assemblies and
several panels removed)*

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 (μA).



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 μA 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 μA . In the image above the nozzle spray has an excellent reading of 26 μA . If the charge is below 10 μA you will not achieve good electrostatic 'wraparound'. For optimal performance, clean any nozzles that are below 10 μA by following the procedures outlined in the Cleaning and Maintenance section.

Routine Inspection

Restriction-service Indicator



Location of the Vacuum restriction-service indicator

Replace the filter immediately if the gauge shows red. This must be checked while the blower is running.

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.



Pre-cleaner and 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.

Examine the pre-cleaner drop tube before every work session. Empty the drop tube by squeezing the ends together. Collected dust and dirt will fall to the ground.

Check the blower drive belts and the pump drive belt for the correct tension and also for any signs of wear.

Maintenance Schedule

Daily

- ☐ Check the oil level at the sight glass gauge on the gearbox and blower. Refill to proper levels if necessary.
- ☐ Check filter screens at flow disk.
- ☐ Check main liquid filter.
- ☐ Check restriction indicator with sprayer running. See page 16.

Yearly

- ☐ 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. 10). Use a soft bristle toothbrush and pipe cleaners to remove any chemical deposits. The nozzle parts may have to soak in the cleaning solution to soften hardened deposits. 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 nozzle cover.
- ☐ Thoroughly inspect all wiring harnesses and red high voltage wiring for cuts or abrasions that show black streaks. This is evidence of electrical arcing. Any cuts, abrasions or joints that show this arcing should be repaired with thick-wall heat shrink tubing following the procedure outlined in the Repairing Power Supply Wires section (pgs. 12–13).
- ☐ If there is any evidence of leaking or unexplained loss of pressure output, inspect (and replace if necessary) the centrifugal pump seal following the exact instructions found in the Hypro operator's manual.
- ☐ Drain and replace the blower oil every 500 hours.



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.

Oil Change Schedule

Gear Multiplier and Blower

Oil Change Interval: 500 hours

20 hours	520	1020	1520	2020	2520	3020
(initial oil change)						

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.
 - If you fail to disengage the PTO before turning off the tractor, the motor has the potential to spin in reverse. This can cause serious damage to the gear-box!
2. ALWAYS use the driveline supplied with this sprayer.
 - This driveline is equipped with an overrunning clutch to help prevent damage due to PTO backlash.
 - PLEASE NOTE: Failure to use the ESS supplied driveline will void the super-charger warranty.

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.

Troubleshooting Guide

Possible Problem(s)

Air pressure is low

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

Spray from nozzle is erratic or spits

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 power supply switch is on

Liquid will not turn on or off

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

Charging indicator (LED) light is out

Dirty nozzles	Clean nozzle according to instructions
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.

Low charge on one or more nozzles

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	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
Dirty nozzles	Clean nozzles according to Operator's Manual

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. Turn off spray switch cycle and master switch
--	---

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

Parts Kit Listing

Part Number	Quantity	Description
11082	1	Belt, 3VX 425, 1-Strand Belt
11083	1	Belt, 3/3VX 425, 2-Strand Belt
NA 11298	1	Nozzle Assembly, 180, HT/RT 150
12181	3	Connector, Small, Yellow, Blazing Products
12182	1	Connector, Black, Blazing Products
12208	1	LED, Red
1285	1	Graduated Cylinder
1293	4	Orifice Disk, #51
1321	12	Wire Tie, Nylon, 15" long × 3/16" wide
AS 1391	3	Hose Assembly, Row Crop Nozzle
14271	3	Nylon Brush
1464	1	Box, Small Parts, (Grainger Over/Under)
15546	1	LED Lens Tool Idec
15547	1	LED Tool Idec
1566	1	Tank Cleaner, Nutra-Sol
1586	4	Orifice Disk, #41 (Flow Disk)
1592	3	Nipple, 1/4" × 1-1/2", Bronze
16197	2	Connector Ring, #10 – Ground
1662	5	Hose Clamp, Worm, Size 4 – SS
209	10 ft.	Hose, 1/8" × 1/4" OD, Vinyl, Black, 500'
AS 2572	1	Multimeter Assembly
2578	3	Fuse, 5 Amp, 250 V, AGC, 1-1/4" × 1/4", Main Power Control Box
3174	1	Silicon Grease, 4 oz. Tube
3251	1	Fuse, 3 Amp, AGC, 1-1/4" × 1/4"
AS 3608	5	Wire Assembly, High Voltage, Female
396	8 ft.	Hose, 1/4" ID, 500', Grey
4350	4	Orifice Disk, #59 (Flow Disk)
4705	6	End Gasket, for P/N 1298
4706	3	Center Gasket, for P/N 1298
4890	2	Body, 1/4" – 18 MPT
AP 5694	5	Insulator Ring
5770	5	O-ring, Viton, # 031
5771	5	O-Ring, Buna N, #209 for Nozzle Base
6270	1	Gray Bin Container w/Attached Lid
6601	1	Heat Shrink, Black Polyolefin, 0.400–0.150, W/ADH
7064	20	Hose Barb – 1/8" HB × #10-32 Taper, Black Nylon
7476	5	Ell, 3/16" HB × 3/16" HB White Nylon
764	4	Strainer, #24 Mesh
767	2	Cap, Flow Regulator, Brass
7853	3	Hose Barb – 3/16" HB × 1/8" MPT, BR
7857	5	Tee, 3/16" HB × 3/16" HB × 1/8" HB, WN
7858	5	Reducing barb, 1/8" HB × 3/16" HB, WN
7859	5	Tee, 3/16" HB, WN
7875	8 ft.	Hose, 3/16" ID, Blue Conductive
7892	1	Air Pressure Switch, NO, 5 PSI, Two Lugs
AK 8246	1	Seal Kit, 9203 Polypro Pump, Silicone Carbide
8235	4	Jet Agitator Flow Insert 5/16" and 1/4"
8253	5	Hose Mender, 3/16" HB, WN
915	5	Hose Clamp, Two Ear, 3/4" SS
9981	1	Coupling Ring, Size 11 Shell
9994	2	Coupling Ring, Size 13, TYCO
9995	1	Coupling Ring, Size 17 Shell

Parts Kit List, Continued

Part Number	Quantity	Description
7892	1	Air Pressure Switch, NO, 4 psi, Two Lugs
8235	2	Tank Agitator Inserts 1/4" and 5/16", 1 each
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

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

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

Notes

Gearbox to Blower Belt:

Blower to Pump Belt:

Gearbox Sheave/Bushing:

Blower Sheave/Bushing:

Pump Sheave/Bushing:

Principal Parts



P/N 11068: Gearbox M7
1:7 Multiplier



P/N 17686: Driveline (size 4)



P/N 11083: Gearbox to Blower
Belt 2/3VX425



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



P/N 4862: Centrifugal Liquid
Pump



P/N 11970: Roots Blower (42)



P/N 17618: Omega SB220
Blower Oil



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

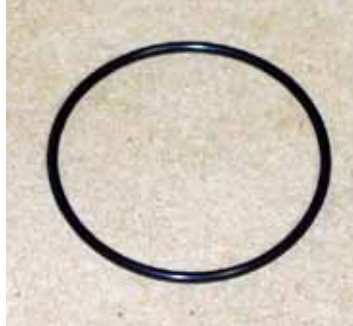


P/N 7865: Cooling Fan 13"

Nozzle Parts



P/N NB-5808: Nozzle Base Assembly (CG)



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 AP5798: Chile Grape Nozzle Hood



P/N 1298: Brass Swivel



P/N AS1391: Hose Assembly (Nozzle End)



P/N 725: 1/4" Hex Nipple



P/N 7064: Liquid Inlet Barb



P/N 1592: 2 1/2" Nipple (Boom End)

**Image Currently
Unavailable**

P/N 4705: Gasket for #1298
(2 Each)

**Image Currently
Unavailable**

P/N 4706: Center Gasket For #1298
(1 Each)

Liquid System Parts



P/N 12093: Agitation Return Shut-Off 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 7851: Liquid Pressure Valve



P/N 8425: Electric Spray Control Valve Assembly



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

150RB OPERATOR'S MANUAL

P/N 1039: Panel Mount Air Pressure Gauge (0 - 30 PSI)



P/N 7857: 3/16" × 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)



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

Air System Parts



P/N 6838: Air Filter Assembly



P/N 6839: Pre-cleaner Assembly



P/N 15233: Replacement Air Filter



P/N 7869: Restriction-service Indicator

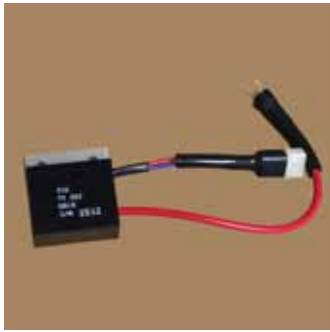


P/N 7892: Air Pressure Switch

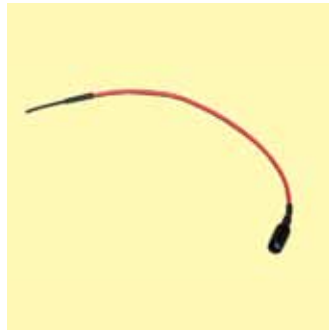


P/N 7850: Pressure Relief Valve

Wiring Parts



P/N PS-1071: Power Supply Assembly



P/N AS-3608: HV Wire Assembly
P/N 16763: High Voltage Wire
(at specified length)



P/N 12182: High Voltage Electrical Connector



P/N AS16144: Control Box to Unit Harness



P/N AS16132: Unit Harness
(14-16 nozzles)

P/N AS16133: Unit Harness
(18-20 nozzles)

P/N AS16131: Unit Harness
(HT only)



P/N AS16123: Control Box
(14-16 nozzles)

P/N AS16137: Control Box
(18-20 nozzles)

P/N AS16135: Control Box
(HT only)



P/N AS16141: Power Supply Enclosure

Miscellaneous Parts



P/N 3174: Dielectric Silicone Grease



P/N 1566: Nutrasol Tank Cleaner



P/N PP6876: Side Panel



P/N 3249: Hour Meter



P/N AS2572: Multimeter Assembly



P/N AS7055: Test Leads for Multimeter



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706-769-0025 · 1-800-213-0518 · Fax: 706-760-8072
Email: support@maxcharge.com · www.maxcharge.com

ESS Warranty

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. 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.