Optimum TW160 & TW225 Instruction & Operation Manual

SPRAYING DEVICES INC.

Manufacturer of Quality Power Sprayers

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Table of Contents

General Specifications - All Models

Tank / Agitation / Color:

All tanks are constructed from multiple layers of isophthalic resin and chopped fiberglass, hand rolled for maximum density and strength. The exterior is a high-gloss color gel coat with UV inhibitor. The interior is sealed with chemical resistant isophthalic resin for long life and easy complete cleaning. Each tank is equipped with an offset 16" screw-in lid with spring-assisted bullet venting and c-pillow perimeter ring gasket sealing system. Nylon mesh strainer basket with reinforcement ribs is also standard.

Convex horseshoe sump design on low profile solution tank forces fluid from the center "zero zone" area of the tank to the pick-up sump for continuous pump priming. Combined with a custom anti-vortex sump plate and v-6 hydro mix ceramic orifice venturi-jet "zero zone" mounted agitation system. Six venturi volumetric agitator jets with long wearing ceramic orifice discs provide a steady 3 to 1 liquid output increase through the nozzle discharge orifice. External liquid level sight tube with calibration marks in gallons on tank front corner. Reinforced nylon fittings and SST lid and suction flange hardware are also standard. Custom color-match red gel coat on tank's exterior. Pump mounted to tank over integrated metal/composites platform (up and out of the way) with an easy access top mount position. Tank secured to carrier frame by 4 tank anchor assemblies.

Frame / Pump / Plumbing:

Frame is fabricated from high strength welded steel. Frame attaches directly to the vehicle frame. Pump is positive diplacement, 3-cylinder, combo piston - diaphragm design with positive pressure backed desmophan skins, aluminum cases, epoxy-coated fluid manifolds and intergrated pulsation damper. Pump is conveniently mounted to a reinforced zone on the top of the solution tank and is powered by the vehicle's auxiliay hydraulic system. Plumbing is reinforced nylon, brass, SST and hoses are rubber or reinforced plastic/nylon/ PVC blends.

"Economy" Manual Lift (Equal Flow) Booms:

Wet booms feature all steel support frames with variable adjustment mounting and height adjustment brackets. Equal-flow design includes equal length 304SST tubes with nylon end caps. Brass and nylon feeder saddles with ¾" inlet and ¾" feed hoses. Nozzle bodies are polypropylene, 10 PSI, diaphragm check assembly, ¼ turn on/off locking cap with gasket and 50 mesh slotted nylon tip strainer. Test tips are TeeJet TP11008VP polymer material included. Other sizes, styles, etc. are available upon request for additional charge. Breakaway hinge with forward and reverse action, fold-up for transport and adjustable dampening spring are also standard.

Optimum Turf Booms (Standard and Convertible):

Heavy duty welded frame anchors the premium boom's structure and unique design allows the addition of several operator assist features. 1"ID x .065 WALL 304SST tubing with SST tube end plugs is attached to strong tube frame for protection. Heavy duty breakaway hinge has swag style cable level anchor system. Capacity to add 12-volt assist wing actuators for remote wing section raise/lower. Ground contour wheel option allows constant contact "tip to ground" pattern protection minimum height adjustment. Standard single outlet or 3-way propeller style split eyelet nozzle body assemblies with cap, gasket, slotted strainer, and polymer test tip. Additional nozzles and adapters available upon request for additional charge. Convertible style flip-out wing extensions for increased area coverage and more spray width sizes when different combinations of sections are on at the same time. Outer wings fluid supplied thru manually operated ball valve. Extensions held out with spring-assisted locking device.

Controls-Manual or Electronic with Motorized Valves / Computerized with Motorized Valves – See individual product data sheets for specifications.

Accessories / Hose Reel /Turf Walker Boom / Spray Gun / Foam Marker / Spray Hose: - See individual product data sheets for specifications.

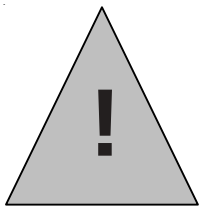
Pump / Drives / Specs / Capacities – All Models:

Pump: Hydraulic driven, 3-cylinder, positive-displacement, piston-diaphragm, aluminum bodied, epoxy-coated wetted manifold components, SST/nylon suction/discharge valve assemblies, top mounted to reinforced tank mount platform area, see-thru oil fill/reservoir indicates diaphragm integrity status, all moving internal components in flooded oil bath design for lubrication and proper dynamic diaphragm action.

Maximum Capacities / Pressure: Up to 30 GPM @ maximum vehicle hydraulic output capacity. Up to 200 PSI maximum system pressure developed at relief valve pressure gauge – agitation gate valve closed.

Pump hydraulic drive system uses a flow regulating valve on the inlet pressure hose (the valve is not tamper-proof and should only be adjusted by trained technicians – factory set) vehicle operating RPM's may change the hydraulic system output which affects pump speed/ output. Factory settings allow operation in the most common vehicle engine RPM/gear settings for spraying (2-7 MPH). Other extreme spraying requirements may require minor component adjustment with tips form the factory for best results/performance.

Safety Data:



This symbol is a safety warning and appears next to information which may help keep you and others from being injured.
SAFETY WORDS – CHEMICAL MATERIAL DATA SHEETS (Know what you are spraying and safe handling techniques).

Recommended Safety Equipment:

Required to prevent accidental exposure or poisoning. (Consult chemical supplier for proper material compatibility.)

Spray Suit – Full coverage (arms and legs) – free of rips or tears.

Shield – To prevent accidental facial contact with chemicals.

Goggles – To cover eyes (glasses for better protection).

PVC / Nylon Gloves – Protects hands and sleeve openings.

Mask / Respirator – Approved canister type with appropriate filter cartridges for chemicals being used.

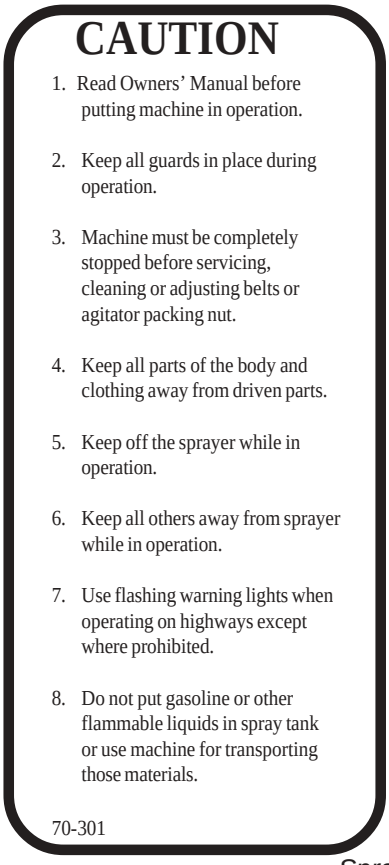
Work Area Safety Recommendations:

- Chemical Storage – check local regulations – vary by region.
- Sprayer Storage – check local regulations – vary by region.
- Fill / Mix and Load Station – area should not be high traffic and should have run-off containment. DO NOT allow non-spray personnel to enter mix area. All mix should be performed with proper safety gear in place.
- Water Supply – if using public water system, recommend using anti-back flow protection on fill hoses and water source outlets. Air gap filler (anti-siphon) is available as an option.
- Fill Hose – should never be put into spray tank, you could contaminate hose (a habit that should be avoided).
- Overflow/Over Filling – recommend recovery or containment system. If not available, be certain run off does not contaminate public sewers or natural wetland areas. See local regulations.
- Moving Mechanical System Parts – keep hands away from rotating pump shaft and restrain loose clothing. Use caution around system when in operation.

- Broken or Worn Components – follow recommended safety and repair/maintenance schedules. DO NOT operate without wearing proper safety gear or operate if machine is not in proper working order. Proper operation is not only safer but, it can save you money by properly applying the desired chemicals at the correct rate.
- Accidents / Problems – in case of injury, accident or unprotected exposure, notify your supervisor of incident and if necessary, contact poison control board, EPA, local fire department to help with the situation.
- Record Keeping – proper records showing chemical being used, batch size, time, date, areas treated, weather conditions, and unusual occurrences can protect you and others should any problem occur after a turf application has been made.
- Local / State Regulations – request, read and follow all local and state regulations for your area. These will vary by region. Be informed, not a victim!
- Licensing – it is recommended that all spray technician operators secure proper CPA (Certified Pesticide Applicators) license or equivalent. Check your local regulations.

Warning: SDI strongly recommends that you read and understand completely, the Operator's Manual for the specific truck you mount the sprayer to – be confident and sure of your skills before operating the truck with the sprayer attached. The large liquid payload reacts differently during vehicle movement, than an equal size dry load!

Please Use Caution!



Decals / Serial Tag Locator:

Decal, Part # 70-301 – "Caution" - located on the upper left corner of rear of sprayer tank.

Decal, Part #70-090 - "Warning" - located on tank sump.

Decal, Part #70-357 - SDI Model Number and Serial Number - located on the sprayer frame area.

Pre-System Maintenance Checks:

See Vehicle's Operation/ Maintenance Manual for specific instructions. SDI recommends you read it completely. Typical checks: fuel, oil, and tire pressure.

Spray Tank Checks:

- Frame hold down hardware – tight and unbroken.
- Visually inspect fiberglass spray tank for leaks or cracks.
- Visually inspect sprayer frame for cracks or broken welds.
- Check all fasteners for tightness – replace worn items as needed.
- Lid and Gasket (Lid Threads) inspect for leaks or warping, wipe off dirt from threads and gasket. Apply light lubricant to gasket, such as silicone spray. Check operation of spring-assisted bullet vent in lid center – remove any debris and clean or replace broken or missing springs (spring critical to leak-free lid design). Replace any c-pillow perimeter lid gasket if damage is present. Some repairs can be made with a vulcanizing adhesive application. Consult the factory for options.
- With lid open and basket removed, visually inspect the inside of the spray tank for flaking, residue build-up, check anti-vortex plate (black circle in sump area) and sump box for debris, i.e. rags, instructions, etc. Remove as needed. Blocked suction can result in poor performance and pump problems.
- Check jet agitator venturi nozzle position – aim as necessary.
- Periodically check ceramic orifice discs in venturi nozzles for cracks or blockages. These problems can lead to reduced agitation and possible products mixing problems. Replace or clean as needed.

Pump and Power Checks:

- Inspect hoses for rubs, cracks or any damage that could result in a leak of fluid – repair as needed.

CAUTION: Normal vehicle engine RPM operating range for sprayer use is 1500 to 3500 RPM's and 1st, 2nd, and 3rd gears in the low range. Consult the factory if you need to operate the machinery at settings other than those specified.

- Inspect exterior of pump, drive motor, and hydraulic supply hoses for damage or leaks that could cause problems later. Consult manuals for repair options.

- With each fill-up of solution tank, inspect the pump's see-thru oil reservoir for evidence of diaphragm failure. Oil will appear milky or cloudy if one or more diaphragms has structural damage allowing chemical into the pumps lubrication environment. Replace damaged diaphragms and replace oil in pump body with proper non-detergent oil.

- Inspect and clean pump suction strainer screen.

- Inspect bowl and gasket – improper gasket seating can result in poor pump performance. Replace with correct size gasket only! During bowl replacement, only hand tighten! *DO NOT USE ANY TOOLS!*

- Remove black nylon suction strainer bowl and clean SST screens of debris. 20 mesh is factory standard size. Using 40 mesh or finer will require more checks for trapped debris in SST screen. Plugged mesh can result in decreased fluid availability to the pump (starved-suction condition) resulting effects can range from poor output/ performance to the extreme – diaphragm surface ruptures/tears.

- Check bottom load 3-way suction ball valve and turn handle to pump suction (arrow points up) arrow points to direction of fluid flow through valve. Arrow to side-off, arrow down – drain tank contents. Do not place valve handle in off or drain position while pump is moving – diaphragm damage may occur from starved suction environment.

- Check to see that agitation control valve is fully open. Turn knob to the left (counter clockwise) to open. Due to the unique design of the tank bottom suction and anti-vortex area – turning the agitation down or off when the tank is low on gallons is not necessary. The tank will pump down to dry with the agitation fully on.

Spray Boom Checks:

- Inspect mounting hardware and support frame for fastener tightness and worn or broken components. Repair as needed.
- With vehicle tires properly inflated and tank full of water, check boom for levelness and proper height. See Set-up Manual for proper adjustments.
- Grease boom hinges (breakaways), be sure and remove any debris (i.e. grass, sand, dirt, etc.) from greased area on pivot plates. Dirt affects the proper operation of the breakaways.
- Adjust return spring tension to stiffer or looser action. See Set-up Manual for details.
- With booms in the down (operational) position, check section level again.
- Between sprays, check and clean all boom nozzle assemblies. Inspect check valve diaphragms for tears or warping, check and clean tips with a soft nylon tip brush (DO NOT use hard/metal items – tip damage will occur!). Clean strainer screens and tip gaskets also. Replace worn or defective items as needed. Proper tip maintenance will result in optimum performance and pattern development.
- Inspect boom tube end caps for cracks or leaks. Repair as needed.

Motorized Boom Control Checks:

- Check battery connections – alligator clips – for proper pole (+/-) hook up. Check wire fastener screw on clips for tightness. Remove any corrosive terminal build-up with a mixture of baking soda and white vinegar. Apply with an old toothbrush. Brush away build-up, but careful to protect eyes and clothing from acid splashes. Use caution during this cleaning. ALSO – NO SMOKING – flammable hydrogen gas is normally present.

USE EXTREME CAUTION!

- Check control box mount and console wing nuts for tightness. Clean dirty console with a damp cloth (mild soap). DO NOT USE solvents.
- Check all toggle switched for play and replace as needed. If switches are rubber booted, check boots for tears and replace worn ones.
- Check control console pressure gauge bezel (clear plastic ring which holds gauge into console). Raised tabs should be at 6 and 12 o'clock positions.
- Check back side of console and make sure power and control cable assemblies are locked into multi-pin connectors. Then replace protective rubber boots.
- Check fuse and rubber boot.
- Check plastic pressure gauge tube for kinks, breaks or blockages. To clean a blocked tube (packed with dry powder), #1 – put some clean water in the spray tank (2-5 gallons), #2 – turn sprayer on and set RPM's to 3000 on truck, #3 – on back side of console, is a metal tube receiver with 1/8" tube engaged. Push tube and top of metal

coupler with your thumb and index finger, #4 – while holding metal ring in, pull tube out with your other hand, #5 – point disengaged tube away from box and face, and allow debris to clear from tube, #6 – if unsuccessful, stop and shut sprayer off, #7 – disengage other end of tube from boom valve inlet, #8 - use rubber tipped air nozzle to force high pressure air through tube, #9 – if unsuccessful, replace with new tube and start flushing now after each spray application.

- Move back to rear of sprayer – boom area.
- Inspect motorized valve harness connector plugs – they should be tight against valve body – screw tight – no prongs showing from valves.
- Check valve mating joints (seams) for product leakage. If leakage is detected, tighten nuts on the 4 guide rod bolts and bring valves closer together. Not too tight – o-rings are in each joint area. If leak persists, separate valve bodies and replace o-rings with new ones.
- Check that all horse-shoe clips on boom feed barbs and metered by pass valves are pushed in and secure. Leakage can result if u-clips are not in place.
- Follow boom hoses from each motorized valve to the corresponding boom section – nylon split-eyelet feed saddle with nylon hose barb adapter should fit tight against SST tubing. If saddle rotates on tubing (alignment nipple most likely broken) replace as needed.
- Move back to control console – LISTEN carefully as you perform the next checks.
- Push up on pressure adjust toggle switch – servo motor on yellow striped valve should run. Reverse toggle position and verify motor works in both directions. Failure – See Troubleshooting Section.
- Push master power toggle to on position – now one switch at a time, try each boom, 1-2-3, in both directions. Slowly verify the working in both directions of each blue stripped valve. Failure – See Troubleshooting Section.

Computerized Boom Control Checks:

- Procedures are similar to Motorized Valves – refer to supplied Computerized Manual for test procedures.
- Inspect and wipe debris from console with a damp cloth.
- Verify your pre-set calibration numbers – DO THEY MATCH YOUR RECORDS SHEET IN THE MANUAL? Modify any numbers that do not match.
- Check all harness connectors on back of box.
- Inspect speed sensor assembly, especially the magnets if that style is in use. Clean any debris from the face of the magnet and check alignment / orientation to the center of the pick-up sensor. If radar is in use, check orientation to ground and wipe sensor face of any debris. Consult Manual for additional information.
- Place control box power switch to manual position.
- Check motorized valve operation – same procedures as standard controls – exception (NO metered by-pass).

Electric Boom Lift (optional)

- For set-up and complete instructions, see Boom Lift Owners Manual.
- Check both actuator mounting bolts for tightness and for wing down position parallel to ground position, adjust level to ground with swag cable anchor eyebolt.
- Periodically spray a penetrating lubricant onto pivot points and hinge bushing assemblies.
- Check control harness fuse – 30 amp rating.
- Check control console toggle switch for play and proper operation.
- Check harness connectors at control box pigtail and each actuator pigtail hook-up.

Foam Marker (optional)

- For set-up and complete instructions, see Foam Marker Owner's Manual.
- Inspect solution tank for leaks or cracks.
- Check cap assembly for cracks or leaks.
- Check fuse in control harness – 10 amp rating.
- Be sure to only use SDI Foam Concentrate, other brands will cause adverse performance. **AVOID!**
- Activate power switch to left and then right positions and verify compressor will start up and if container has fluid, liquid should flow to feed blue tube on corresponding foam generator cone and foam should start or liquid will drip from outlet steady.
- Foamer uses two solenoids per side activation. One for air, one for solution – both are inside of black turtle shell cover with a matching pair for the other side and the main compressor unit. White hoses carry air to system, blue hoses carry solution. Hose connections are colored coded white or blue, so are fly nuts and hoses. Just match the colors and make sure to get adequate hose on bib contact before tightening down on fly nut fastener. If system fails to start, check 12 volt power supply first. System is run/tested at the factory prior to shipping to your dealer for installation. A running system will not foam with water only – 160:1 ratio (water: concentrate) or similar solution must be added to the solution tank's water. SDI foam concentrate is recommended for best machine performance.
- Check supply hose fasteners on boom tubes for proper position, tightness, and routing. Should not interfere with tips or nozzle check valves – Loom (black smooth cover) should run along the top of boom tube fastened with nylon zip ties.
- Check foam generator cone position. Should be at boom wing end and clear spray pattern distribution area. Keeping cones out of spray by tilting up (required for raindrop style tips).

Hose Reel (optional):

- Check supply hose from pressure side of pump to swivel inlet on reel drums for cuts, scrapes, kinks or leaks.

- Lubricate reel swivel at grease zerk – if equipped.
- Check reel to tank fastener hardware for tightness and evidence of leaks. Rubber well nuts and fender washers should be used with SST bolts. See Hose Reel Mounting Instructions and fastener use sequence.
- If electric rewind, check battery and all power harness connections. 40 amp circuit breaker should also be part of electrical hook-up.

System Dynamics
How Your System Works – Why they call it a sprayer:

POWER – Utility vehicle's auxiliary hi-output hydraulics provides fluid to sprayer's pump drive motor. On/off control is located on the center lower dash (push top of button to turn auxiliary hydraulics on).

TRANSPORTATION – Sprayer/truck mounting style makes the two systems act as one complete machine.

Fluid path through sprayer – items 1 through 12:

1. **Spray Tank –** containment for fluid and product mix chamber – made of fiberglass and resin compound. Unique bottom shape has raised bottom attached to directional side gutters to effectively direct solution to the tanks rear sump. This design allows sprayer to maintain performance even at low liquid levels. Design also works as damper (anti-slosh control) for fluid levels less than full tank.
2. **Anti-Vortex Plate –** located in sump (lowest part tank interior), facilitates complete liquid draining without causing pump cavitations (suction loss) or prime break. Attaches to suction flange.
3. **Suction Flange** – external hose barb assembly on tank sump area – connects tank to main suction hose.
4. **Suction / Off / Drain "Bottom Load Valve" –** large 1½" 3-way ball valve (all-in-one design). Arrow on handle points in direction of fluid flow – up (suction/pump) – side (off) – down (drain). Off allows cleaning of suctions strainer screen with loaded tank. Pump should only be running when arrow points up (suction open) – pump diaphragm damage can occur when valve is off or drain position while running (starved suction conditions).
5. **Suction Strainer –** filters our particulate matter and debris from supply tank. Extends pump life and eliminates foreign objects which may disrupt normal boom or gun operations.
6. **Diaphragm Pump –** piston /diaphragm design uses desmophan diaphragm attached to the piston's top and supported by trapped oil from pumps main case – SST and nylon spring valves control fluid during suction and discharge strokes, has 3-cylinders and discharge pulsation damper on outlet control pulsations of fluid upon exit to pressure regulator.

7. **Pressure Regulator –** controls peak allowable pressure to systems accessories. T-handle turns clockwise to raise system pressure and counter clockwise to lower system pressure. Once desired pressure is reached tighten lock nut on base of T-handle to fix the setting. Once system is charged to set limit, an internal spring and seat releases the excess pressure and fluid for low pressure recirculation back to the tank through the by-pass hose.
8. **Agitation Control Gate Valve –** controls amount of tank agitation by amount of liquid through Venturi nozzle multiplier orifice. Recommend you leave full open at all times. No need to close with low tank liquid level.
9. **V-6 Jet Agitation –** mounted on top of tank's tunnel bottom on raised bracket. 6 venturi style nozzles with ceramic metering orifice disc multiply the exiting fluid and disperse materials throughout the solution tank – for hydraulic mixing.
10. **Hose Reel –** hose holding spool which allows hook-up of Spray System to a spray handgun or walking type spray boom. Holds and organizes supply/spray hose for repeated organized uses.
11. **Boom (Boom Controls) –** supplies liquid to boom control valve (manual) or motorized valve assemblies for dispersal (through the spray distribution bar (boom)).
12. **Boom Tubes –** SST pipe/tubing with nozzle bodies attached, evenly distributes spray liquid to target (ground, turf area) with an overlapping pattern. Nozzle bodies are diaphragm check (drip-free) and supply the nozzle (tips) when liquid pressure exceeds 10 PSI. When boom shuts off, the diaphragm keeps the tips from dripping product and also allows a quick air-free (hiss-free) resumption of the spray pattern.

Notes on System Dynamics

Diaphragm Pump Lubrication – internal mechanical components operate in a flooded oil bath environment – the pumps cylinder diaphragms keep contaminants/spray solution from entering the oil's environment. Diaphragms should be inspected yearly and replaced when wear or abnormalities are discovered. Case mounted see-thru oil reservoir will cloud or be cloudy if spray has entered the oil's environment. Pump can handle all materials and run dry (no solution) without damage.

Venturi-Jet Agitator Nozzles – installed with ceramic metered orifice disc (long wearing vs. plastic). Long lasting ceramic discs provide stable agitation flow rates for trouble-free fluid mixing

Suction Strainer – provides liquid filtering of particulate matter in spray material. Screen mesh sizes available: 40, 50, 80, and 20 (standard) in SST material. Should be cleaned daily or more often as the need arises.

Non-Corrosive Plumbing – all spray plumbing is SST, nylon, PVC or polypropylene for all liquid handling parts.

System Dynamics – Materials Compatibility

- SDI's diaphragm pump is capable of pumping almost any non-flammable liquid without trouble or damage to the pump. On extremely thick or gritty suspensions, it is advisable to operate the sprayer with the suction strainer screen removed. Clogging up the screen can starve the pump and cause pre-mature diaphragm damage. For materials with high residue, it is advisable to rinse pump and plumbing as soon as you return to the sprayer fill area. Do not wait until after a long lunch break – just add a few gallons of clean water to the tank and run pump for 30 seconds to dilute the previous residue in system.

  Avoid heavy, thick dye markers and add dyes into a full mixing tank, not an empty filling tank. See Troubleshooting Section for scrubbing suggestions.

- Spray Liquid Viscosity – the addition of certain WP, WDG, EC's etc. may cause the viscosity (thickness) of the water to increase. This can sometimes affect the calibration of the spray nozzle output at pre-calibration water numbers. Consult chemical supplier for recommended modifications to your system.
- Specific Gravity of Sprayed Suspension – water on average weights 8.34lbs./ gallon – when you add mix to the water, the weight will change. Sometimes the solution gets lighter less than 8.34lbs./ gallon and sometimes it gets heavier than 8.34lbs./ gallon. Weight of solution changes the affect output calibrations of nozzles. See Table and Formulas to make necessary adjustments to compensate. Especially critical when using computer controlled rate systems.

Getting Started:

Practice with water – after you have followed all recommendations, it is advisable to familiarize yourself with the operation of the new truck and sprayer package. Practicing with plain water before the addition of expensive and destructive chemical formulas (when miss-applied) can be smart and cost effective.

Practice and calibrate before you spray dollars away! Know your machine and its operation.

Calibration – First Step to Spraying:

To spray and spray accurately, you must have a set of standards to spray by. They are:

- Desired Application Rate (GPA or G/1000 FT^2).
- Nozzle spacing (W") – Distance between spray tips.
- Desired ground speed – recommend a fixed (governed) speed/MPH to maintain accurate calibration. Tip style-type of pattern for particle distribution for applicable chemical to be applied, i.e. FL, XR, TT.

- Tip Size – determines volume per nozzle and desired droplet (micron) size of spray carrier particles.

When used in the following formulas, the application rate can be maintained by fixing the constants for each category. See Technical Information Section.

The easiest method of calibration is to use as many fixed constants that can be controlled, and then modify the tip size and output pressure to lock in your desired application rate.

Technical Information:

Useful formulas:

$$\text{GPM (per Nozzle)} = \frac{\text{GPA} \times \text{MPH} \times \text{W}}{5{,}940}$$

$$\text{GPM (per Nozzle)} = \frac{\text{GAL/1000FT}^2 \times \text{MPH} \times \text{W}}{136}$$

$$\text{GPA} = \frac{5{,}940 \times \text{GPM (per nozzle)}}{\text{MPH} \times \text{W}}$$

$$\text{GAL/1000FT}^2 = \frac{136 \times \text{GPM (per nozzle)}}{\text{MPH} \times \text{W}}$$

Measuring Travel Speed

Measure a test course in the area to be sprayed or in an area with similar surface conditions. Minimum lengths of 100 and 200 feet are recommended for measuring speeds up to 5 and 10 MPH, respectively. Determine the time required to travel the test course. To help ensure accuracy, conduct the speed check with a partially loaded (about half full) sprayer and select the engine throttle setting and gear that will be used when spraying. Repeat the above process and average the times that were measured. Use the following equation or the table at right to determine ground speed.

$$\text{Speed (mph)} = \frac{\text{Distance (ft)} \times 60}{\text{Time (seconds)} \times 88}$$

Speed in mph (Miles per hours)	Time Required in SECONDS to Travel a Distance of:		
	100 Ft.	200 Ft.	300 Ft.
0.5	136	272	409
1.0	68	136	205
1.5	46	92	136
2.0	34	68	103
2.5	27	54	82
3.0	23	46	68
3.5	20	40	58
4.0	17	34	52
4.5	15	30	46
5.0	13	28	41

GPM – Gallons per Minute
GPA – Gallons per Acre
GAL/1000FT² - Gallons per 1000 Square Feet
MPH – Miles per Hour
W – Nozzle spacing (in inches)

A – Nozzle volume required to obtain desired GPA rate at desired speed and spacing. See TeeJet Catalog for style and size of tip to complete job.

B - Nozzle volume required to obtain desired GAL/1000FT² rate at desired speed and spacing. See TeeJet Catalog for style and size of tip to complete job.

Specific Gravity Adjustments (When You Spray More Than Water): typical US gallon weighs 8.34lbs. Most manufacturer's nozzle charts show performance with water only. Example: target application rate – 50 GPA (water specific gravity 1.0), add 28% nitrogen to the solution typical weight per gallon is 10.65lbs. (28% nitrogen in water specific gravity is 1.28)

The formula (new method)
GPA (solution) x conversion factor = GPA from table

50 x 1.13 = 56.5 GPA corrected

This new output could require a larger nozzle or more PSI if previous nozzle has the range.
*Specific gravity can be determined by weighing a measured gallon of your solution once mixed. Then use the table to find your conversion factor.

Spraying Solutions Other Than Water - New Method

All the tabulations in this catalog are based on spraying water, whch weighs 8.34 lbs. per USA gallon, conversion factors must be used when spraying solutions which are heavier or lighter than water. To determine the proper size nozzle for the solution to be sprayed first multiply the desired GPM or GPA of solution by the water rate conversion factor. Then use the new converted GPM or GPA rate to select the proper size nozzle.

Example:

Desired application rate is 20 GPA of 28%N. Determine the correct nozzle size as follows:

GPA(solution) x Conversion factor =GPA (from table)

20 GPA (28%) x 1.13
= 22.6 GPA (water)

The applicator should choose a nozzle size that will supply 22.6 GPA of water at the desired pressure.

Weight of Solution	Specific Gravity	Conversion Factor
7.0 lbs. per gallon	.84	.92
8.0 lbs. per gallon	.96	.98
8.34 lbs per gallon-WATER	1.00	1.00
9.0 lbs. per gallon	1.08	1.04
10.0 lbs. per gallon	1.20	1.10
10.65 lbs per gallon-28% nitrogen	1.28	1.13
11.0 lbs. per gallon	1.32	1.15
12.0 lbs. per gallon	1.44	1.20
14.0 lbs. per gallon	1.68	1.30

Ground Speed:

The Workman Vehicle offers 3 speeds forward, one in reverse, and two ranges (high / low). This gives 6 speeds forward. For safety and best performance, most spraying is done in low range using gears 1, 2, or 3.

The hydraulic drive pump will operate in this range but will have reduced output at RPM's below 2500 on the engine. High volume outputs should be done at the 3500 RPM setting.

Use the "Measure Travel Speed" formula to gauge your exact speed for calibration formulas and tip selection. See Tachometer/Speedometer picture.

Miscellaneous Conversion Factors:

One Acre = 43,560 square feet
= 43.56 1000FT² blocks

One Acre = 0.405 Hectares

One Hectare = 2.471 Acres

One Gallon per Acre = 2.9 Fluid Ounces per 1000FT²
= 9.35 Liters per hectare

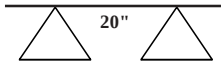
One Gallon per 1000FT² = 43.56 Gallons per Acre

One Gallon = 128 Fluid Ounces
= 8 Pints
= 4 Quarts
= 3.79 Liters
= 0.83 Imperial Gallons

One Mile = 5,280 Feet
= 1,610 Meters
= 1.61 Kilometers

One Pound per Square Inch = 0.069 Bar
= 6.896 Kilopascal

Chart below from Page 12 of TeeJet Catalog 50A. For a complete listing of tip options and charts, contact SDI or your local dealer for a new TeeJet Catalog:



		PSI	Drop Size 80°	Drop Size 110°	Capacity One Nozzle In GPM	Capacity One Nozzle In Oz./ Min.	GPA 4 MPH	GPA 5 MPH	GPA 6 MPH	GPA 8 MPH	GPA 10 MPH	GPA 12 MPH	GPA 15 MPH	GPA 20 MPH	Gallons Per 1000 Sq. Ft. 2 MPH	Gallons Per 1000 Sq. Ft. 3 MPH	Gallons Per 1000 Sq. Ft. 4 MPH	Gallons Per 1000 Sq. Ft. 5 MPH
XR8001 XR11001 (100)	**Orange**	15	M	F	0.061	7.8	4.5	3.6	3.0	2.3	1.8	1.5	1.2	0.91	0.21	0.14	0.10	0.08
		20	F	F	0.071	9.1	5.3	4.2	3.5	2.6	2.1	1.8	1.4	1.1	0.24	0.16	0.12	0.10
		30	F	F	0.087	11.0	6.5	5.2	4.3	3.2	2.6	2.2	1.7	1.3	0.30	0.20	0.15	0.12
		40	F	F	0.10	13.0	7.4	5.9	5.0	3.7	3.0	2.5	2.0	1.5	0.34	0.23	0.17	0.14
		50	F	VF	0.11	14.0	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
		60	F	VF	0.12	15.0	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
XR80015 XR110015 (100)	**Green**	15	M	F	0.092	12.0	6.8	5.5	4.6	3.4	2.7	2.3	1.8	1.4	0.31	0.21	0.16	0.13
		20	M	F	0.11	14.0	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
		30	F	F	0.13	17.0	9.7	7.7	6.4	4.8	3.9	3.2	2.6	1.9	0.44	0.29	0.22	0.18
		40	F	F	0.15	19.0	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
		50	F	F	0.17	22.0	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
		60	F	F	0.18	23.0	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
XR8002 XR11001 (50)	**Yellow**	15	M	M	0.12	15.0	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
		20	M	F	0.14	18.0	10.4	8.3	6.9	5.2	4.2	3.5	2.8	2.1	0.48	0.32	0.24	0.19
		30	M	F	0.17	22.0	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
		40	F	F	0.20	26.0	14.9	11.9	9.9	7.4	5.9	5.0	4.0	3.0	0.68	0.45	0.34	0.27
		50	F	F	0.22	28.0	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
		60	F	F	0.24	31.0	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
XR110025 (50)	**Purple**	15		M	0.15	19.0	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
		20		M	0.18	23.0	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
		30		F	0.22	28.0	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
		40		F	0.25	32.0	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
		50		F	0.28	36.0	21.0	16.6	13.9	10.4	8.3	6.9	5.5	4.2	0.95	0.63	0.48	0.38
		60		F	0.31	40.0	23.0	18.4	15.3	11.5	9.2	7.7	6.1	4.6	1.10	0.70	0.53	0.42
XR8003 XR11003 (50)	**Blue**	15	M	M	0.18	23.0	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
		20	M	M	0.21	27.0	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
		30	M	F	0.26	33.0	19.3	15.4	12.9	9.7	7.7	6.4	5.1	3.9	0.88	0.59	0.44	0.35
		40	M	F	0.30	38.0	22.0	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.00	0.68	0.51	0.41
		50	M	F	0.34	44.0	25.0	20.0	16.8	12.6	10.1	8.4	6.7	5.0	1.20	0.77	0.58	0.46
		60	F	F	0.37	47.0	27.0	22.0	18.3	13.7	11.0	9.2	7.3	5.5	1.30	0.84	0.63	0.50
XR8004 XR11004 (50)	**Red**	15	C	M	0.24	31.0	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
		20	C	M	0.28	36.0	21.0	16.6	13.9	10.4	8.3	6.9	5.5	4.2	1.0	0.63	0.48	0.38
		30	M	M	0.35	45.0	26.0	21.0	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
		40	M	M	0.40	51.0	30.0	24.0	19.8	14.9	11.9	9.9	7.9	5.9	1.4	0.91	0.68	0.54
		50	M	F	0.45	58.0	33.0	27.0	22.0	16.7	13.4	11.1	8.9	6.7	1.5	1.00	0.77	0.61
		60	M	F	0.49	63.0	36.0	29.0	24.0	18.2	14.6	12.1	9.7	7.3	1.70	1.10	0.83	0.67

Based on the chart, a tip pressure of 45 PSI with the yellow XR8002, or 20 PSI with the blue XR8003 TeeJet tips, will apply the proper amount based on speed, spacing, rate constants. **Example:**

(GPM/Nozzle)=Gal/1000 Ft^2 (1) x MPH (2.9) x W" (10) = 2.13

Suggested Minimum Spray Heights - Turf Nozzles:

Tip Style	Spray Angle/Degrees	Pressure Range	Nozzle Height/20" Spacing Tip to Grass Top
XR Extended Range	80°	15 - 60 PSI	17" to 19" 30% overlap minimum
TT Turbo TeeJet	110°	15 - 90 PSI	15" to 18" 30% overlap minimum
TF Turbo FloodJet	120°	10 - 40 PSI	14" to 16" 30% overlap minimum
FL FullJet	120°	15 - 40 PSI	10" to 18" 30-100% overlap

Note: TP11008VP test tips supplied with SDI Booms. Order other sizes or styles from your local SDI Dealer.

Mixing and Loading Pesticides Product Active Ingredient Formulas or How Much Pesticide Do I Add to My Spray Tank?

To determine the amount of pesticide to add to the spray tank, you need to know the recommended application rate of pesticide, the capacity of the spray tank, and the calibrated output of the sprayer.

The recommended application rate of the pesticide is given on the label. The rate is usually indicated as pounds per acre for wettable powders, and pints, quarts, or gallons per acre for liquids.

Sometimes the recommendation is given as pounds of active ingredient (lb. per active ingredient) per acre rather than the amount of product per acre. The active ingredient must be converted to actual product.

Dry Formulation:

Example 1 – A carbaryl recommendation calls for 2 pounds of active ingredient (a.i.) per acre. You have purchased Sevin (80% wettable powder). Your sprayer has a 200 gallon tank and is calibrated to apply 20 gallons per acre. How much Sevin should be added to the spray tank?

Step 1 – Determine the number of acres that your can spray with each tankful.

Tank Capacity (gallon per tank) 200
Spray Rate (gallon per acre) 20
=10 acres sprayed per tankful

Step 2 – Determine the pounds of pesticide product needed per acre. Because not all of the Sevin in the bag is an active ingredient, you will have to add more than two pounds of the product to each "acre's worth" of water in your tank. How much more? The calculation is simple: Divide the percentage of active ingredient (80) into the total (100).

$$2 \text{ lb. a.i. per acre} \times \frac{100\%}{80\%} = \times 1.25$$

= 2.5 lbs. of product per acre

You will need 2.5 pounds of product for each "acre's worth" of water in the tank to apply 2 pounds of active ingredient per acre.

Step 3 – Determine the amount of pesticide at add to each tankful. With each tankful, you will cover 10 acres (step 1), and you want 2.5 pounds of product per acre (step 2). Add 25 pounds (10 acres x 2.5 pounds per acre = 25 pounds) of Sevin to each tankful.

Example 2 – The insecticide Diazinon recommendation calls for 4 lbs. / acre. Your 5 gallon air-compression sprayer applies 1.25 gallon/1000 Square feet. How many ounces should you add to your spray tank?

Step 1 – Convert the recommended rate to oz/1000 square feet.

$$\text{Oz/ 1000 sq. ft} = \frac{\text{recommended lb/A x 1000 Sq. ft.}}{2{,}722^*}$$

$$= \frac{4 \times 1000}{2{,}722} = \frac{4{,}000}{2.722} = 1.5 \text{ oz/1000 sq. ft.}$$

*2,722 = a constant arrived at by dividing the number of square feet in 1 acre (43,560) by the number of ounces in 1 pound (16).

Step 2 – Determine the amount of pesticide to add to each tankful.

oz. pesticide/tankful =

$$\frac{\text{gal / tank x oz. pesticide/1000 sq. ft.}}{\text{gal applied/1000 sq. ft.}}$$

$$= \frac{5 \times 1.5}{1.25} = 6 \text{ oz/tankful}$$

Liquid Formulation

Example 1 – A trichlorfon recommendation calls for 1 pound of active ingredient per acre. You have purchased Dylox 4E (4 lbs. per gallon formulation). Your sprayer has a 150 gallon tank and is calibrated at 15 gallons per acre. How much Dylox should you add to the spray tank?

Step 1 – Determine the number of acres that you can spray with each tankful. Your sprayer has a 150 gallon tank and is calibrated for 15 gallons per acre.

$$\frac{\text{Tank capacity (gallons per tank)}}{\text{Spray rate (gallons per acre)}} = \frac{150}{15}$$

=10 acres sprayed with each tankful

Step 2 – Determine the amount of product needed per acre by dividing the recommended a.i. per acre by the concentration of the formulation.

$$\frac{\text{1 lb. a.i. per acre}}{\text{4 lb. a.i. per gallon}} \quad ¼ \text{ gallon per acre}$$

One fourth gallon or 1 quart of product is needed for each "acre's worth" of water in the tank to apply 1 pound of active ingredient (a.i.) per acre.
Step 3 – Determine the amount of pesticide to add to each tankful. With each tankful, you will cover 10 acres (step 1) and you want ¼ gallon (1 quart) of product per acre (step 2). Add 10 quarts (10 acres x 1 quart = 10) of trichlorgon to each tankful.

Example 2 – The insecticide Malathion recommendation calls for 1 gallon of product per acre. You have a 4 gallon knapsack sprayer that has been calibrated to apply ½ gallon per 1000 square feet. How many ounces should you add to the spray tank?

Step 1 – Convert the recommended rate to pints/acre.

$$\text{Pints / acre} = \frac{\text{gal}}{\text{acre}} \times \frac{8\text{Pt}}{\text{gal}} = 1 \times 8 = 8\text{pts / acre}$$

Step 2 – Convert the required pints/acre to oz/1000 sq. ft.

$$\text{oz/1000 sq. ft.} = \frac{\text{recommended pt/A x 1000 sq. ft.}}{2{,}722}$$

$$= \frac{8 \times 1000}{2{,}722} = 2.94 \text{ oz/1000 sq. ft.}$$

Step 3 – Determine the amount of pesticide to add to each tankful.

$$\text{oz/1000 sq. ft.} \quad \frac{\text{gal/tank x oz/1000 sq. ft.}}{\text{gal applied/1000 sq. ft.}}$$

$$= \frac{4 \times 2.94}{.5} = 23.5 \text{ oz/1000 sq. ft.}$$

Adjuvants

The manufacturer may recommend that you add a small amount of an adjuvant (spreader-sticker, surfactant, etc.) in addition to the regular chemical. This recommendation is often given as "percent concentration."If you use an adjuvant at a ½% concentration by volume how much should you add to a 300 gallon tank?

Solution 1 – 1% of 100 gallons = 1 gallon
(0.01 x 100 = 1)
½% of 100 gallons = ½ gallon
You will need ½ gallon per 100 gallons or 1½ gallons for 300 gallons (1/2 x 3 = 1½).

Solution 2 – ½% = 0.005
0.005 x 300 gal – 1.5 gal

System Pressure Adjustment

Pressure adjustment procedures vary by control style.

Set Pump Output Pressure and Agitation - set speed limiter on vehicle's throttle to a RPM that corresponds to desired MPH with selected gear and range of spraying. Open suction valve on sprayer, then press auxiliary hydraulics switch on vehicle's center dash. Go to pump assembly and close all outlet valves (agitation, boom supply, and hose reel). This will give the system a closed loop for proper setting of the system's pressure relief. Adjust relief valve by loosening lock nut then turn T-handle to right to increase (raise) pressure or to the left to decrease (lower) system pressure shown on the liquid dampened gauge. Set pressure in closed loop to 90 – 100PSI. This setting is below the pressure rating for boom components. Once system is set to fixed pressure you can open and set the tank agitation output. The gate valve will allow a full range of settings by turning the knob left for more agitation or turn the knob right for less. The maximum allowable flow is metered by ceramic orifice discs inside the venturi jet nozzles. System pressure may drop but should remain above the maximum needed for boom spraying (15 - 60 PSI).

Manual Control – with pump running and system pressure set, open the boom supply ball valve on the pump/relief manifold (this supplies fluid to the controller's inlet). The manual controller has a micrometer adjustment knob for setting spray boom pressure at the controller. Knob is black and is next to large red master on/off lever. Turn the knob to increase or decrease the boom nozzle pressure shown on the liquid filled gauge on the end of the controller manifold assembly. Raise (open) all three red levers on the individual boom section valves and turn the red round knobs on the valve bodies to the right until closed (stops turning right). This step closes the metered by-pass feature on each valve. Boom assembly should have the proper size tips to apply the desired rate at a fixed vehicle speed. Pull down on the long red master control lever to supply the three open individual boom valves with liquid. Adjust the black knob of micrometer until pressure reads the desired pressure on the gauge. This pressure will go up if you turn the booms off at this time. So it is recommended that you take the time to set the metered by-pass for hands free operation. Metered by-pass works on the principle of matching volumes on boom section combined nozzles outputs to the volume through the valve body's by-pass outlet. If you change tip sizes on boom after set-up of metered by-pass adjustments, it will be necessary to start adjustment sequence from the closed position again. Failure to use the metered by-pass feature as designed will lead to control performance problems. Example: 15ft boom, 9 nozzles, 3 sections with 3 nozzles on 20" spacing, TP11008VP test tips. At 40 PSI, TP11008VP tip flows .3GPM/nozzle or 38.4 oz. each. Three per section (3 x 38.4 = 115.2 oz. each boom section). Once the metered by-pass for this section is opened to 115.2 oz. / minute, the flow through both is equal, equal flow keeps the pressure on the gauge the same time. The quickest and easiest way to set the metered by-pass is as follows: boom tips all match – boom on – metered by-pass knobs closed on each valve – adjust to 40 PSI boom pressure – turn valve #1 off by lowering flat handle (pressure should go up as a result of lower demand) – turn red metered by-pass to the left to open (turn until the boom

pressure drops back to 40PSI) – now open valve flat handle and view pressure again (should stay on 40 PSI with #1 open or closed) – repeat process for valves #2 and then #3. Once you have the system adjusted and you use the same tips as you calibrated for, you can make system pressure adjustments up or down and the metered by-pass settings will work throughout the nozzles pressure range. Change tip size and you need to recalibrate the metered by-pass.

12-volt Motorized Boom Valves – follow the same set-up procedures on pump and relief valve adjustment to set system pressure to 90 – 100 PSI. The electronic controller has switches in lieu of levers to control boom functions. Turn all switched on console box to off position and hold down on pressure adjust switch until pressure will go no lower (motorized regulator in full by-pass/open setting). Again, turn all metered by-pass knobs on motorized valves to the right until closed. Push up on pressure adjust switch until the console mounted gauge reads 40 PSI then stop. Push boom switches 1, 2, and 3 to up/on position then activate the boom master switch to the up/on position. All three boom sections should be spraying and console gauge will probably show less than 40 PSI. Use the pressure adjust switch to raise the boom pressure to 40 PSI. With system at 40 PSI, turn boom switch #1 switch to off – pressure should rise above 40 PSI. Move to motorized valve and open metered by-pass knob on/off valve until pressure drops back to 40 PSI. Position yourself so you can see the electronic console's gauge or have someone help you by calling out when you have adjusted back to 40 PSI. Cycle the #1 boom switch on and off as you watch the pressure gauge reading. Except for a short bounce of the gauge's needle, the final pressure should read 40 PSI. If it is ok, repeat steps for boom #2 and then for boom #3. Advance users will notice a live boom pressure when console master control is off. Now it is possible to change speeds and also correct the nozzles output volume/pressure while the boom sections are off (no more puddles under a stopped boom!). Remember, as long as the tip sizes in the boom remains the same as was in during metered by-pass set-up, you can run the nozzles in the full pressure range.

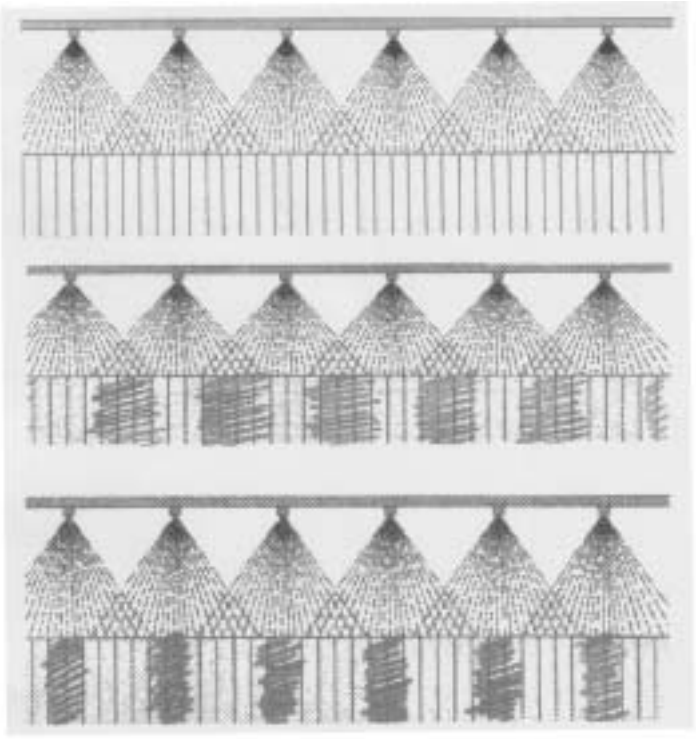
Computerized equipped sprayers can operate in the manual mode and follow same guidelines as standard motorized adjustment (no metered by-pass to adjust when computer is used). Computer should be in manual mode to adjust pressure on the system. Note: Computer System works on flow, not pressure. To operate the Computer by pressure vs. flow, it will be necessary to install a pressure gauge kit – available from your dealer. The computer system will still show flow rate field if the speed sensor and flow meter are operational. You will not be able to keep the rate exactly target on because the machine will respond to every little system change. When the computer is in control, it makes corrective adjustments many times faster than the operator could even think about. So do not let it worry you. Run in manual with a gauge and you will see the informetion without the sharp edges exposed.

Pressure adjustment is important to obtain the proper nozzle output based upon the standards given in the boom calibration formulas. See Technical Information Section.

Boom Spray Tip Overlap Checks

To verify the boom is properly set up and tip/nozzle height is correct, a water only pass over a dry concrete or asphalt parking area, can reveal much information about your system's set-up.

With only water in tank, operate machine and spray with boom full on and drive and apply a pattern to the dry driveway/parking area. After the first pass, watch the spray dry and look for uneven areas of extra wet or dry zones.



Uniform and even drying indicates the system applying a uniform pattern. Checks of each nozzle with a calibration catch container can assist your data on the system. Uneven drying or wet stripes can identify overlap problems.

Wet stripes between nozzle tips can mean the boom is too high – striped under the nozzles may indicate the boom is too low. Proper tip height and overlap are found in the Set-up Section.

The supplied TP11008VP polymer test tips are a tapered flat-fan design and require a minimum of 30% overlap when mounted on 20" spacing (this is a tip to ground height of 18" minimum). Consult the manufacturer's recommendations for the style of tip you plan to use. Patterns, overlaps, sizes, materials, droplet size, and pressure range can change with the tips selected. Test with water if you have no experience with new nozzles.

Spray Operation

The sprayer was designed to operate at an engine speed of 1500 RPM's to 3500 RPM's. The hydraulic drive diaphragm pump reaches full volume at 2500 RPM's on vehicles tachometer.

- Park vehicle on level ground with parking brake on – truck in neutral and engine off.
- Safety equipment should be used during all sprayer operations as a rule. Safety equipment should be in good condition, with no rips, holes, or tears. Your spray suit, neoprene/PVC gloves, goggles/face shield and approved breathing device (respirator).

- Sprayer mix and load area should not be a high traffic area or visited by workers who are not properly protected with safety equipment.
- To open the 16" filler lid, grasp the lateral raised ribs on lid – pull with the left hand and push with the right hand – rotate left until lid unthreads.
- If equipped with an anti-siphon device (air gap filler) for back flow protection, rotate and lock gooseneck filler into position.
- Attach water feed hose and slowly turn on water source and bring up to full stream (without splashing out).
- We recommend the strainer basket be left in place and used to strain all materials being put into the fiberglass tank.
- Pump suction strainer should be installed if not already in place. Also, open the bottom load valve to the pump at this time.
- Determine amount of spray mix to be used for your application. If required amount is less than full tank capacity, fill to desired level.
- If required amount is a full load (tank topped off), then only fill to a ¾ liquid level. This leaves room for adding chemical to be mixed and applied. (The balance of the fill water will be added later.)
- Place truck in neutral with parking brake engaged.
- Start engine according to procedures outlined in Truck Owner's Manual.
- Using throttle lock (manual or electric), set engine speed to 2500 RPM's.
- On vehicle's center dash – press auxiliary hydraulics switch at top and turn the pump drive on. If not operating, review the Troubleshooting Section for ideas.
- A quick look into the open lid assembly can verify the pump is working through the movement of the tanks contents (water). Agitation control valve is located with the pump and relief valve on the back section of the spray tank. Adjust to level of agitation required as described earlier. **NOTE** if system fails to work as described, shut auxiliary hydraulics to pump off and check Troubleshooting Section for possible cures.
- Once system is operational, a quick system test should be performed before adding product to the mix tank.
- Lower boom wings to the operational position. Be sure area is clear of non-authorized spray personnel.
- Turn on Master Boom Control (switch or lever) and adjust pressure to 40 PSI on controller pressure gauge.
- Check boom assembly for leaks. Inspect hose fittings, nozzle assemblies, end caps and the complete system. Repair and/or re-tape any leaking fittings. STOP all drips!
- All nozzles should come on and develop a full pattern. Clean or repair all non-working assemblies.

***NOTE** System Calibration and Product Active Ingredient formula calibration sections should already be completed. If not, refer to the appropriate sections and compute your application data before continuing.*

- With calibration formulas completed, tips sized, dry run calibration and nozzle pressure set, you may now proceed.

- Re-start truck and activate the pump switch and agitation system.
- Spoon feed (add slowly) the chemical to be applied to the agitating tank water. The addition of some products, all-at-once, may cause damage by plugging the in-line suction strainer screen which can cause a starved suction condition. Product labels (WP, EC, WDG, etc.) are abrasive in nature and should include extra mix time in the tank. Pre-packaged dissolvable bag types are also difficult to mix rapidly. The slow dissolve of the wrapper may lead to clogged suction strainers under certain "hasty" conditions. Liquid products can mix easier than most dry formulations, but can be difficult to mix in cold water areas. Consult with your chemical supply rep for any precautions or mix-it-up suggestions for any unfamiliar products.

ALERT TO ALL TEST PILOTS AND MAD SCIENTISTS!

**The mixing of non-compatible materials or formulations not previously tested by chemical professionals, should be avoided. Volatile "brews" can be damaging and costly to repair and dispose of. Leave the burden of mix up compatibility to the people who manufacture and sell the products to you!

****MISUSE OF CHEMICALS IS NOT A WARRANTABLE OFFENSE IF SPRAYER DAMAGE OCCURS****

- Mix times may vary by chemical, load size, water temperature and operator skill (experience).
- Normal mix times can be 20 to 30 minutes per tank! This allows enough time to provide complete particle distribution throughout the complete mixable liquid in tank.
- Just because the water is murky and clouded doesn't mean all the chemical is mixed up. **Give it some time!**
- Haste during critical mixing phase by spraying to soon, may cause severe damaging rate changes from what your original rate was suppose to be. *Example: 1st 1/3 of tank could apply more than the desired rate when heavy products are not fully suspended in the carrier water. The 2nd 1/3 could apply close to the right rate while the final 1/3 would be light on active ingredients.* This is only a possible scenario – adequate mix times will eliminate these costly errors from happening!
- At the completion of chemical mixing phase, you are now ready to apply the chemical mix to your fine turf areas.
- If machine is equipped with SDI's Quick Foam Marking System, refer to Operation's Manual for application techniques.
- Foamer use should be restricted to fairway and rough area with longer turf grass heights. Use on greens and tees area can cause browning under slow dissipating foam balls during high air temperatures.
- Be sure to allow enough spray overlap on end nozzle to cover the foam ball with a dissipating spray. This technique allows for proper pattern overlap and the water from the spray speeds up the foam ball's disappearing from the turf area.

Troubleshooting

Cannot get enough pressure:

- Settings exceed pump capacity
- Vehicle's auxiliary hydraulics not working or switched on
- Spray tips too large
- Tank empty
- Hydraulic fluid in system at low level
- Bottom load valve on pump suction off or partially closed
- Liquid foaming in tank
- Suction vacuum leak / crack in hose
- Suction strainer screen clogged.

Operational Checks During Extended Product Applications:

- Frequently check your control pressure gauge for any changes from original calibration set. A rise in the pressure should alert you to a clogged or partially blocked spray tip orifice output. Routine nozzle screen cleanings and use of all factory standard strainer screens will greatly reduce this from happening. Another possible cause for pressure rise could be the increase of engine speed. Recommend the use of truck governor or throttle lock set for accurate speed (maintains power accurately under variable load conditions).

- One last cause for a system pressure increase could be from the increase in hydraulic oil temperature. As the hydraulic oil's temperature goes up, the viscosity gets thinner. Under ideal conditions, the thinner the oil can pass through the hydraulic flow limiting valve on the hydraulic motor and increase the number of RPM's. This small increase can be managed through the use of the pressure adjust feature on the sprayer's boom controls.

- Pressure loss can also occur during a spray application. Loss of engine speed – recommend the governor or throttle lock be used – loss of a spray tip or the excessive wear on all tips as compared to a non-current calibration check. Frequent checks of system calibration results in better system performance.

- The use of SDI's Motorized Valves with metered by-pass can also affect the system pressure if not properly adjusted. Refer to Motorized Valve adjustment procedure for more help. The metered by-pass affects the system pressure only when one or more sections are turned off. Loss or gain of pressure should not occur when all sections are on at once, because metered by-pass option in non-operational (when valve is on) only bleeds the system by-pass during valve shut down (off position).

- Another possible cause of pressure loss on the system could be the result of a clogged suction strainer. Your system uses a self-priming diaphragm pump. If the suction strainer screen becomes clogged, it restricts the flow of water to he pump. Under high liquid requirement applications, the output could drop enough to cause the system to lose pressure. Keep your strainer screen clean and protect your diaphragms too!
- Also, be sure the strainer bowl is properly tightened with the gasket in place. An improperly tightened bowl can result in a suction leak which will result in loss of fluid to the pump (same as getting a crack in a drinking straw – hard to pull liquid up through the straw to your mouth!).
- Another pressure loss cause could be the loss of system hydraulic fluid. This is rare and would require a large fluid loss to affect the PTO speed of the pump.

If any other problems arise, consult your local dealer or contact the factory.

More Operational Checks:

- If equipped with a speedometer, verify speed occasionally. The use of the ground speed governor or throttle lock control can maintain ground speed to keep your application rate on target. Stable speed is one of your necessary spraying constants.
- Boom wing orientation (levelness to the ground) ground contour wheel option can assist over uneven terrain.
- During turn-arounds, while stopped, visually check the tank liquid level sight tube for the amount of spray left in the tank. DO NOT do this operation during forward movement. Keep your eyes forward to avoid collision accidents.
- If using a Raven computer controller, periodically check the data/rate screen for proper flow rate output. If not holding the desired rate, consult Raven's User's Manual or contact your local dealer or the factory.

Between Tank Loads (refills):

- Check vehicle fuel level – fill as needed.
- Check solution tank on Foam Marker – fill as needed.
- If using wettable powders or equivalent, check suction strainer and nozzle tip strainers for possible debris build up. Clean as needed. Avoid costly and messy "in-field" service of plugged nozzle screens by checking and cleaning often.
- Refer to your calibration charts and area measurements to verify your application coverage is as planned. Make any necessary adjustments to obtain your correct rate. A 10% error in application rate can cost you hundreds of dollars in lost time and chemicals, not to mention the possibility of turf grass damage.

When the Job is Done / Sprayer Clean-Up:

Sprayers are often neglected during the winter, at the cost of valuable time and money in the spring to fix cracked or broken fittings, hoses, or pumps that have seized.

A sprayer is a long term investment. All sprayers' components, from tank to tips, should be checked. Items that need replacement should be listed. Replacement parts should be purchased during the off-season.

Sprayers should be protected against the harmful effects of snow, rain, sun, and strong winds. Moisture in the air, whether from snow, rain or soil, corrodes metal parts of unprotected equipment.

The sun helps reduce moisture in the air, but it also causes damage. Ultraviolet light softens and weakens rubber materials such as hoses. The best protection from the environment is to store sprayers in a dry building. Storing sprayers provides an opportunity to work on them any time during the off-season, regardless of weather conditions.

Clean Up:

Prior to storage, clean the sprayer thoroughly with a cleaning solution. Which solution to use will depend on the pesticides used during the season? Always check the pesticide label for specific cleaning instructions. During cleaning, follow these general tips:

- Use a cleaning solution containing 2 pounds of detergent for each 30 – 40 gallons of water. This should be sufficient for removing most pesticides.
- First, flush the sprayer clean with clean water. Then add the cleaning solution to the tank. Agitate thoroughly and allow the water/detergent solution to circulate through the system for several minutes.
- Remove nozzles and flush the system twice with clean water.
- Clean nozzle tips and screen in a strong detergent solution or kerosene, using a soft brush, such as an old toothbrush.
- Some pesticide combinations (especially if oil is used) may produce a putty type paste in the tank. Flushing out the residue of such chemicals after each load prevents an accumulation.
- If water alone doesn't dissolve the residue build-up, add Stoddard solvent, kerosene, or diesel fuel (1 gallon solvent for 25 gallons for water). Allow past to dissolve, then agitate and flush. When cleaning tanks which have carried some phenoxy herbicides, such as esters of 2, 4-d, first rinse the sprayer with clean water and then rinse with one of the following, in 25 gallons of water:

- 1 quart of household ammonia
- 1 pound of washing soda (sal soda)
- 2 pounds of trisodium phosphate

Circulate this solution and let a small amount flow through the nozzles. Keep the remainder of the solution in the system overnight, and then pump it out in the morning.

During the final cleaning, examine the hoses, clamps, connections, no-drip valve, nozzle tips and screens for needed replacement.

Winterize:

After the final cleaning, follow these tips to get the most out of your sprayer's life:

- Remove no-drip valve, nozzle tips, and strainers and dry them thoroughly. Clean tips with a toothbrush only. Store metal tips in a can of light oil, such as diesel fuel or kerosene.
- Store tips constructed of plastic and nylon in a dry place.
- Make a special effort in storing tips so that the orifices are not damaged by contacting each other or other parts such as loose screws.
- Drain water from all parts to prevent freezing. To insure the hoses are completely drained of water, purge them with compressed air.
- Pump requires special care – place automotive anti-freeze with rust inhibitor in the pump and other sprayer parts. This also protects against corrosion and prevents freezing in case all water is not drained
- Tape or cover all openings, so that insects, dirt and other foreign material cannot get into system.
- Check the sprayer for scratched parts. Touch up these areas with paint to eliminate corrosion.
- Store sprayer in a clean, dry location within a building. If storage in a building is not possible, provide some sort of cover.
- Remove hoses, wipe them clean of oil, and store them inside a building. DO NOT hang them over a nail or sharp object. This causes a permanent crease that reduces flow through the hose. Coil hoses around a basket or other large round object to prevent sharp bends.

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