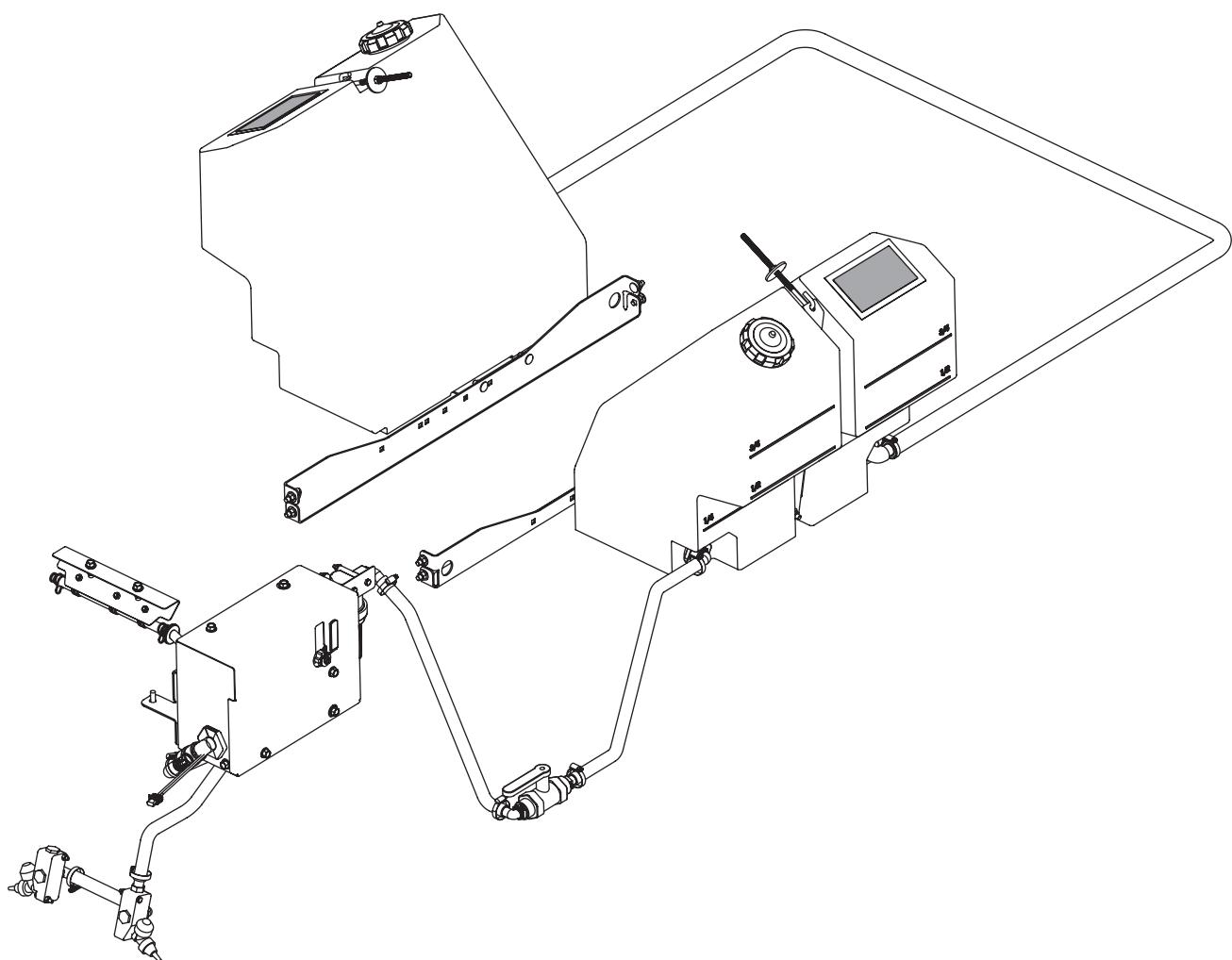


50 Gallon Pre-Wet and DLA System

#93265-1

Owner's Manual / Installation Instructions / Parts List



⚠ CAUTION

Read this manual before installing or
operating the liquid kit.



A DIVISION OF DOUGLAS DYNAMICS, LLC

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SAFETY

SAFETY DEFINITIONS

⚠ WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious personal injury.

⚠ CAUTION

Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

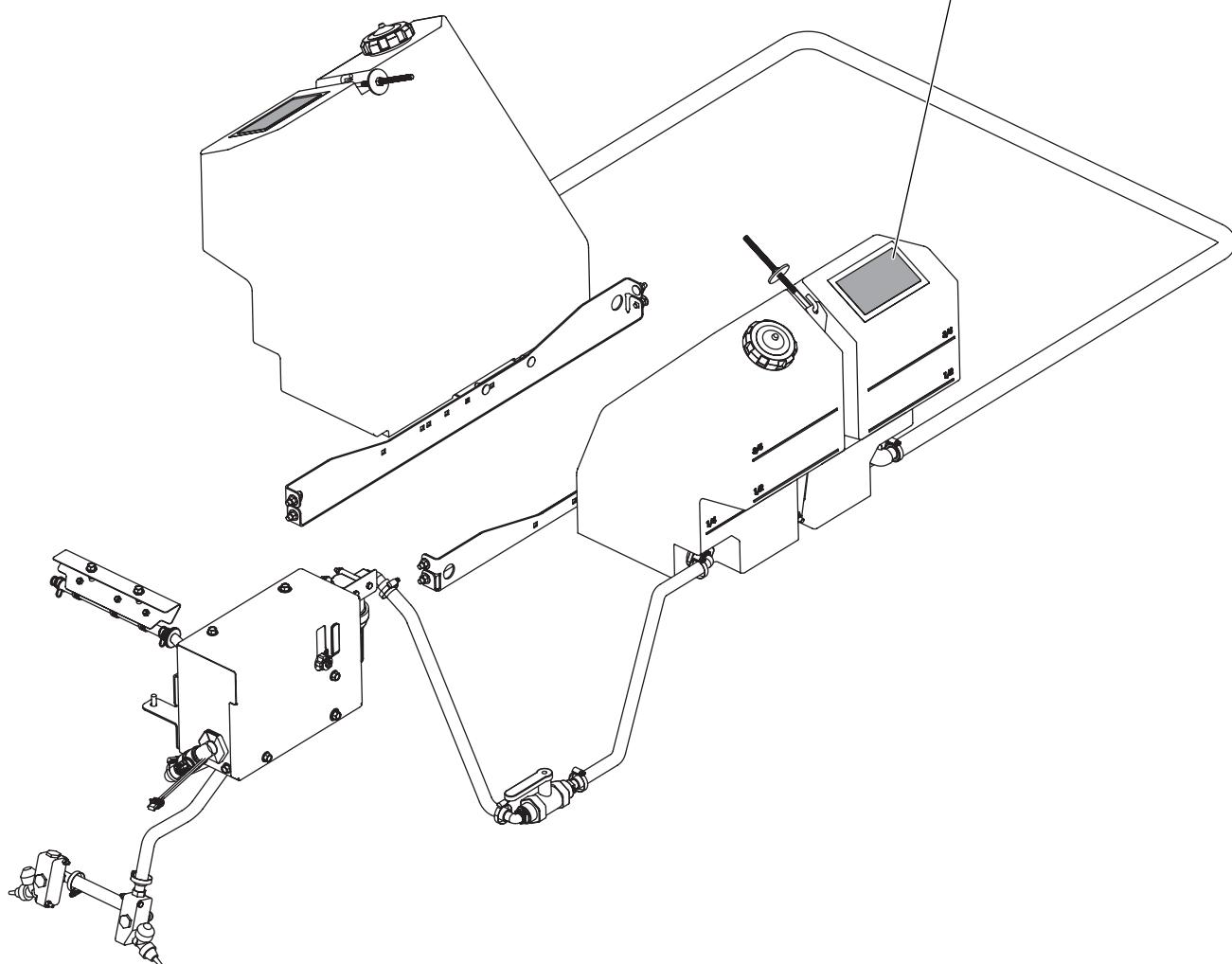
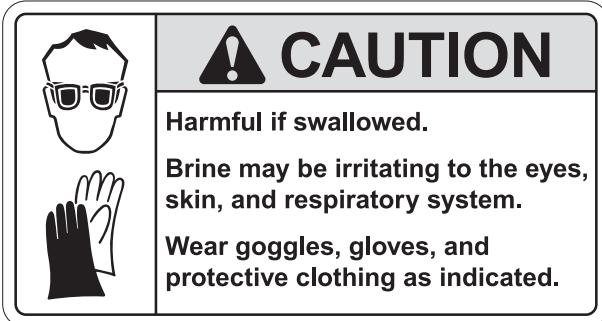
NOTE: Indicates a situation or action that can lead to damage to your liquid system and vehicle or other property. Other useful information can also be described.

WARNING/CAUTION LABELS

Please become familiar with the warning and caution labels on the liquid system.

NOTE: If labels are missing or cannot be read, see your sales outlet.

Warning Label – Corrosivity Hazard



SAFETY PRECAUTIONS

Improper installation and operation could cause personal injury and/or equipment and property damage. Read and understand labels and the Owner's Manual before installing, operating, or making adjustments.

⚠ WARNING

- Driver to keep bystanders a minimum of 25 feet away from operating liquid system.
- Before working with the liquid system, secure all loose-fitting clothing and unrestrained hair.
- Before operating the liquid system, verify that all safety guards are in place.
- Before servicing the liquid system, wait for conveyor or auger and spinner to stop.
- Do not climb into or ride on liquid system.

⚠ WARNING

Overloading could result in an accident or damage. Do not exceed GVWR or GAWR ratings as found on the driver-side door corner post of the vehicle. See Loading section of your spreader Owner's Manual to determine maximum volumes of spreading material.

⚠ WARNING

- The drive shafts, conveyor, and spinner assemblies transmit great amounts of power and, accordingly, are hazardous when in operation. All maintenance, inspections, or operator adjustments must be made with all source power OFF.
- Keep liquid system and surrounding area clear of personnel and property when operating.
- When traveling, especially fully loaded, this machine may have a high center of gravity, and care should be exercised when turning or driving on banked surfaces.
- Unauthorized modifications to the liquid system and related components may impair the function and/or safety.

⚠ CAUTION

- Do not operate a liquid system in need of maintenance.
- Before operating the liquid system, reassemble any parts or hardware removed for cleaning or adjusting.
- Before operating the liquid system, remove materials such as cleaning rags, brushes, and hand tools from the liquid system.
- While operating the liquid system, use auxiliary warning lights, except when prohibited by law.
- Tighten all fasteners according to the torque chart. Refer to torque chart for the recommended torque values.

⚠ CAUTION

Disconnect electric and/or hydraulic power and tag out if required before servicing or performing maintenance.

⚠ CAUTION

DO NOT leave unused material in the unit. Material can freeze or solidify, causing unit to not work properly. Empty and clean after each use.

PERSONAL SAFETY

- Remove the ignition key and put the vehicle in PARK or in gear to prevent others from starting the vehicle during installation or service.
- Wear only snug-fitting clothing while working on your vehicle or liquid system.
- Do not wear jewelry or a necktie, and secure long hair.
- Wear safety goggles to protect your eyes from battery acid, gasoline, dirt, dust, and brine.
- Avoid touching hot surfaces such as the engine, radiator, hoses, and exhaust pipes.
- Always have a fire extinguisher rated BC handy, for flammable liquids and electrical fires.

SAFETY

CELL PHONES

A driver's first responsibility is the safe operation of the vehicle. The most important thing you can do to prevent a crash is to avoid distractions and pay attention to the road. Wait until it is safe to operate mobile communication equipment such as cell phones, text messaging devices, pagers, or two-way radios.

VENTILATION

⚠ WARNING

Vehicle exhaust contains lethal fumes. Breathing these fumes, even in low concentrations, can cause death. Never operate a vehicle in an enclosed area without venting exhaust to the outside.

BATTERY SAFETY

⚠ CAUTION

Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks, or lit tobacco to come near the battery. When charging or working near a battery, always cover your face and protect your eyes, and also provide ventilation.

- Batteries contain sulfuric acid which burns skin, eyes, and clothing.**
- Disconnect the battery before removing or replacing any electrical components.**

NOISE

Airborne noise emission during use is below 70 dB(A) for the liquid system operator.

VIBRATION

Operating liquid system vibration does not exceed 2.5 m/s² to the hand-arm or 0.5 m/s² to the whole body.

TORQUE CHART

⚠ CAUTION

Read instructions before assembling. Fasteners should be finger tight until instructed to tighten according to torque chart. Use standard methods and practices when attaching liquid system, including proper personal protective safety equipment.

Recommended Fastener Torque Chart

Inch Fasteners Grade 5 and Grade 8

Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Grade 5	 Grade 8		 Grade 5	 Grade 8
1/4-20	8.4	11.9	9/16-12	109	154
1/4-28	9.7	13.7	9/16-18	121	171
5/16-18	17.4	24.6	5/8-11	150	212
5/16-24	19.2	27.3	5/8-18	170	240
3/8-16	30.8	43.6	3/4-10	269	376
3/8-24	35.0	49.4	3/4-16	297	420
7/16-14	49.4	69.8	7/8-9	429	606
7/16-20	55.2	77.9	7/8-14	474	669
1/2-13	75.3	106.4	1-8	644	909
1/2-20	85.0	120.0	1-12	704	995

Metric Fasteners Class 8.8 and 10.9

Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Class 8.8	 Class 10.9		 Class 8.8	 Class 10.9
M6 x 1.00	7.7	11.1	M20 x 2.50	325	450
M8 x 1.25	19.5	26.9	M22 x 2.50	428	613
M10 x 1.50	38.5	53.3	M24 x 3.00	562	778
M12 x 1.75	67	93	M27 x 3.00	796	1139
M14 x 2.00	107	148	M30 x 3.50	1117	1545
M16 x 2.00	167	231	M33 x 3.50	1468	2101
M18 x 2.50	222	318	M36 x 4.00	1952	2701

These torque values apply to fasteners except those noted in the instructions.

MOUNTING THE SPRAY BRACKET & PUMP BOX

NOTE: Installation instructions vary depending on the style of your spreader.

Instructions for stainless steel hoppers with chain begin below.

Instructions for stainless steel hoppers with auger begin on Page 9.

Instructions for poly hoppers with chain begin on Page 11.

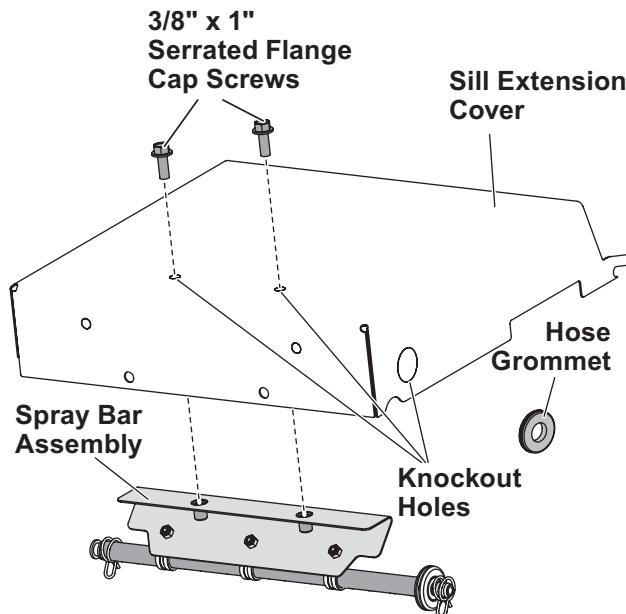
Instructions for poly hoppers with auger begin on Page 13.

STAINLESS STEEL HOPPER WITH CHAIN

MOUNTING THE SPRAY BAR ASSEMBLY

1. Remove all packing material from the liquid kit before installation.
2. Remove four 3/8" cap screws and remove the sill extension cover from the rear of the spreader. Retain for reinstallation.

3. Remove the two knockouts from the top and one knockout from the right hand side of the extension cover. Install a hose grommet into the side hole.

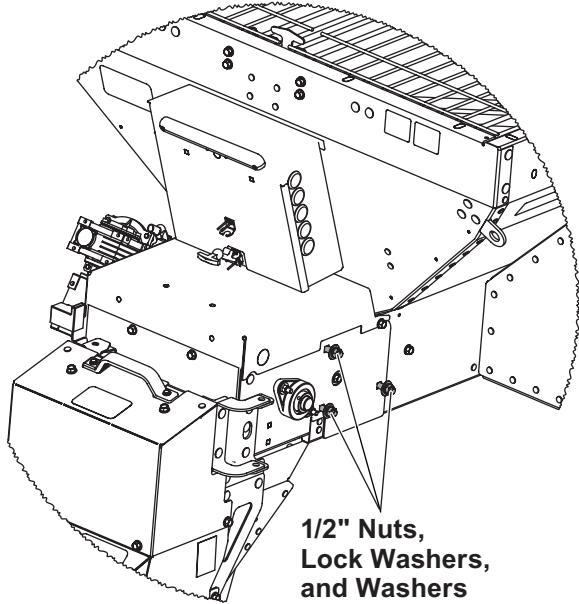


4. Install the spray bar assembly to the sill extension cover with two 3/8" x 1" flanged cap screws as shown. Verify that the slits in the spray hose face the sill or trough bed when installed. The slits are along the painted line.
5. Connect the 1/2" hose to the spray hose with a hose clamp and feed it through the grommet.
6. Reinstall the sill extension cover with the four removed 3/8" cap screws.

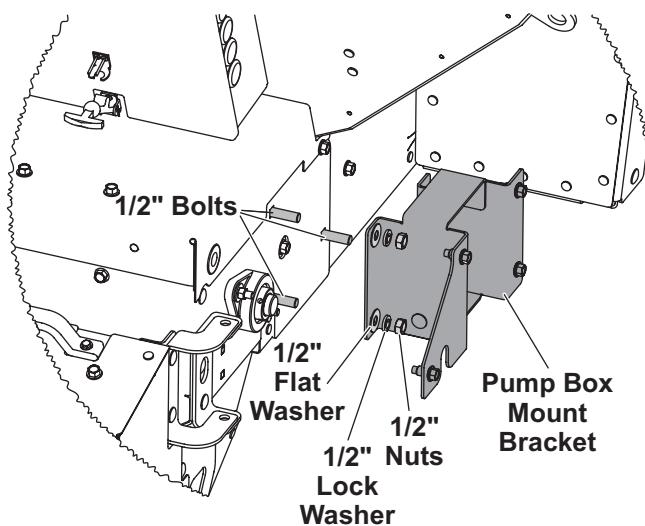
MOUNTING THE SPRAY BRACKET & PUMP BOX

MOUNTING THE PUMP BOX

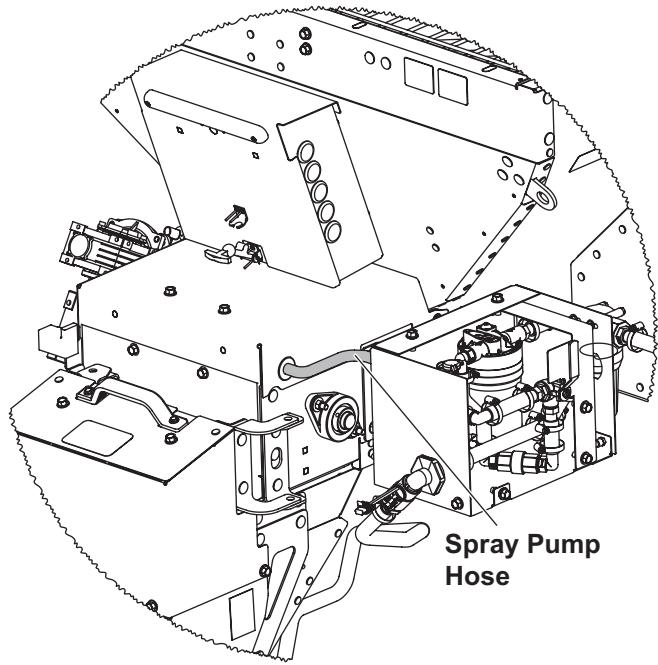
1. Remove three 3/8" flanged cap screws and remove the pump box cover.
2. Remove and retain the three 1/2" nuts, 1/2" lock washers, and 1/2" flat washers from the right side of the spreader as shown.



3. Slide the pump box mount bracket assembly onto the three exposed 1/2" bolts and secure with the three removed 1/2" flat washers, 1/2" lock washers, and 1/2" nuts.



4. Install the pump box to the pump box mount bracket with four 3/8" x 1" flanged cap screws.
5. Connect the 1/2" hose from the extension cover to the pump box's needle valve fitting. Hose may be cut to length if necessary. Secure with a spring clamp at each end.



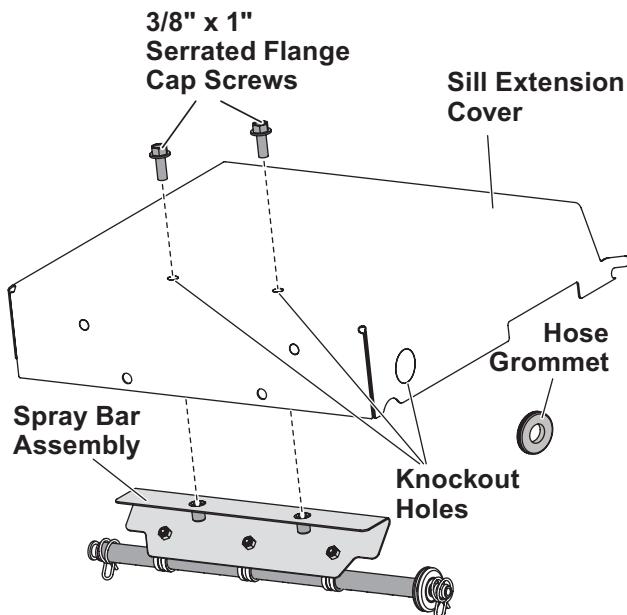
6. Reinstall the pump box cover with the three removed 3/8" flanged cap screws.
7. Skip ahead to "Mounting Manifolds & Nozzles (All Spreaders)" on page 15.

MOUNTING THE SPRAY BRACKET & PUMP BOX

STAINLESS STEEL HOPPER WITH AUGER

MOUNTING THE SPRAY BAR ASSEMBLY

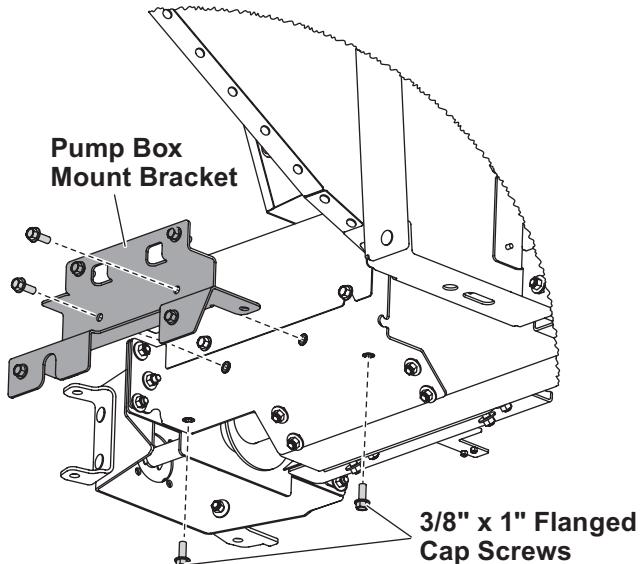
1. Remove all packing material from the liquid kit before installation.
2. Remove four 3/8" cap screws and remove the sill extension cover from the rear of the spreader. Retain for reinstallation.
3. Remove the two knockouts from the top and one knockout from the right hand side of the extension cover. Install a hose grommet into the side hole.



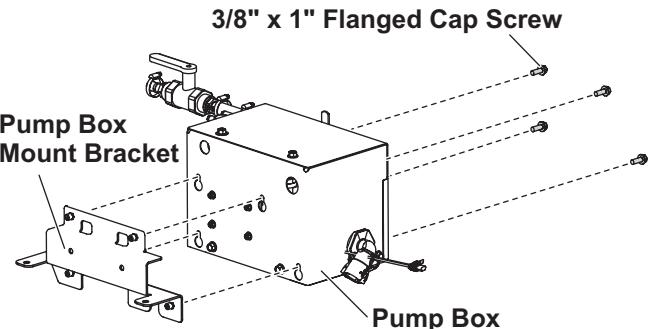
4. Install the spray bar assembly to the sill extension cover with two 3/8" x 1" flanged cap screws as shown. Verify that the slits in the spray hose face the sill or trough bed when installed. The slits are along the painted line.
5. Connect the 1/2" hose to the spray hose with a hose clamp and feed it through the grommet.
6. Reinstall the sill extension cover with the four removed 3/8" cap screws.

MOUNTING THE PUMP BOX

1. Remove three 3/8" flanged cap screws and remove the pump box cover.
2. Install the pump box mount bracket to the sill with four 3/8" x 1" flanged cap screws as shown.

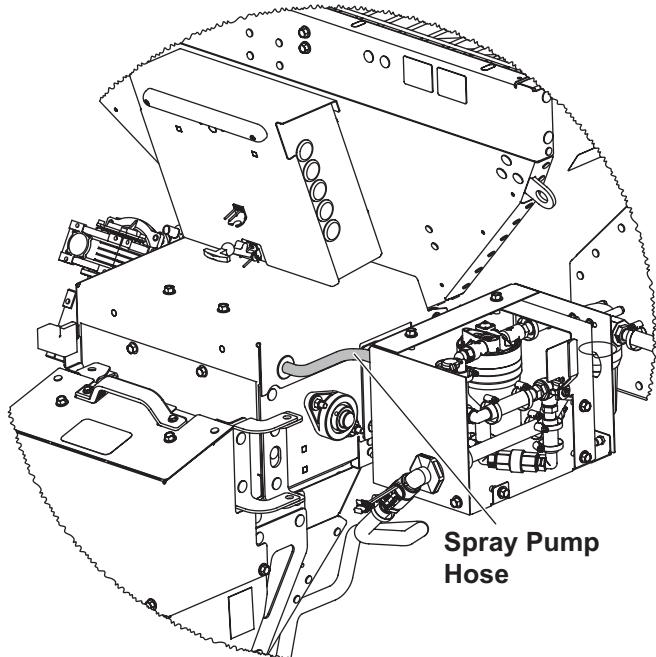


3. Install the pump box to the pump box mount bracket with four 3/8" x 1" flanged cap screws.



MOUNTING THE SPRAY BRACKET & PUMP BOX

4. Connect the 1/2" hose from the extension cover to the pump box's needle valve fitting. Hose may be cut to length if necessary. Secure with a spring clamp at each end.



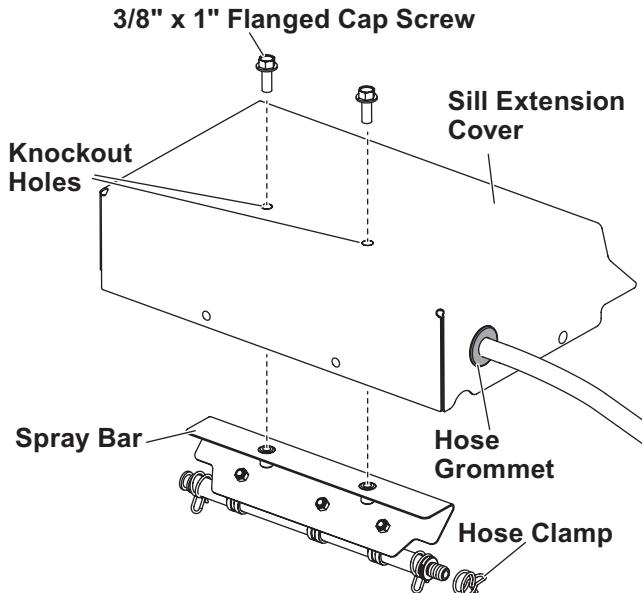
5. Reinstall the pump box cover with the three removed 3/8" flanged cap screws.
6. Skip ahead to "Mounting Manifolds & Nozzles (All Spreaders)" on page 15.

MOUNTING THE SPRAY BRACKET & PUMP BOX

POLY HOPPER WITH CHAIN

MOUNTING THE SPRAY BAR ASSEMBLY

1. Remove all packing material from the liquid kit before installation.
2. Remove four 3/8" cap screws and remove the sill extension cover from the rear of the spreader. Retain for reinstallation.



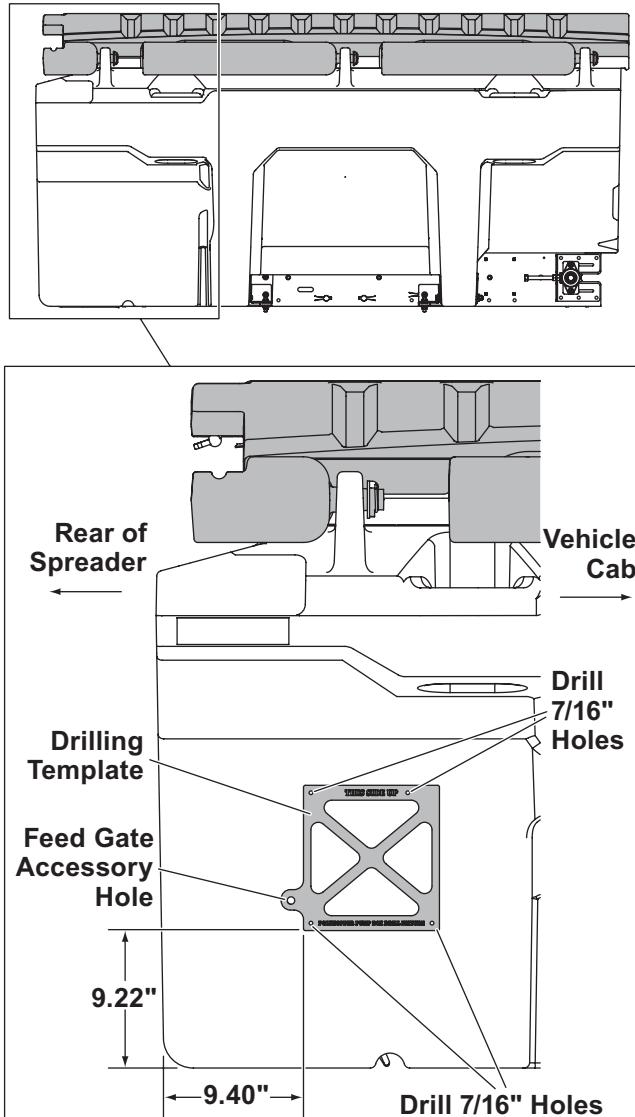
3. Remove the two knockouts from the top and one knockout from the right hand side of the extension cover. Install a hose grommet into the side hole.
4. Install the spray bar assembly to the sill extension cover with two 3/8" x 1" serrated flange cap screws as shown. Verify that the slits in the spray hose face the sill or trough bed when installed. The slits are along the painted line.
5. Connect the 1/2" hose to the spray hose with a hose clamp and feed it through the grommet.
6. Reinstall the sill extension cover with the four removed 3/8" cap screws.

MOUNTING THE PUMP BOX

7. Position the poly hopper pump box mount drilling template with the feed gate accessory hole.

If the feed gate accessory is not installed, hold the template with a bolt through the feed gate accessory hole.

If no feed gate accessory hole is present, locate the drilling template according to the measurements shown.

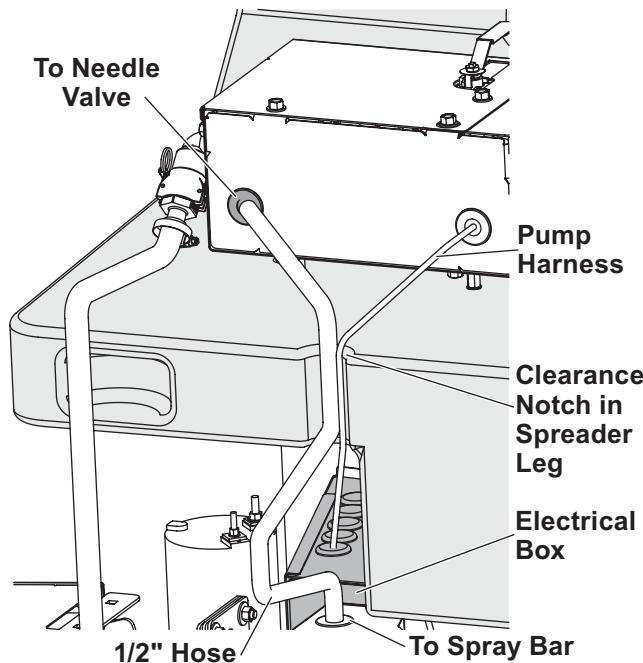


8. Drill four 7/16" holes using the drilling template as a guide. Remove the drilling template.

MOUNTING THE SPRAY BRACKET & PUMP BOX

9. Insert the four well nuts into the drilled holes. Install four 1/4" standoffs into the well nuts. Install four 1/4" set screws into the 1/4" standoffs.
10. Install the pump box onto the four standoffs and secure with four 1/4" locknuts.
11. Install a rubber grommet into the bottom knockout hole of the pump box. Route the 1/2" hose from the extension cover through the grommet, under the clearance notch in the spreader leg to the pump box's needle valve fitting. Hose may be cut to length if necessary. Secure with a spring clamp at each end.

View Upward from Below Spreader



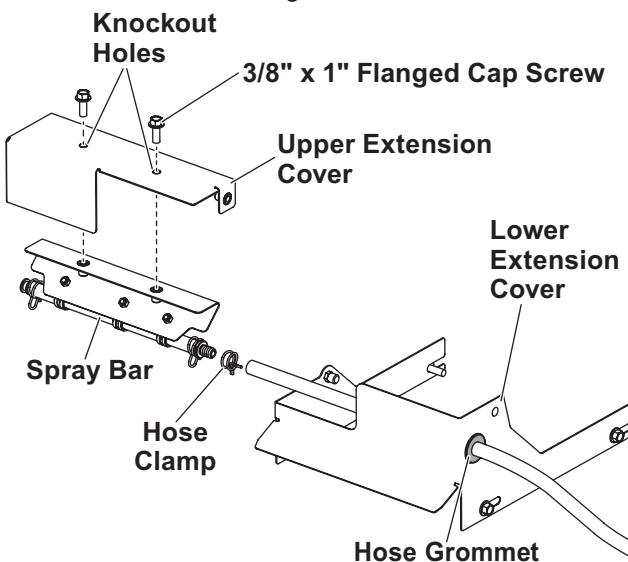
12. Connect the pump harness to the connector and route out of the pump box through its cab side grommet. Route through the clearance notch in the spreader leg and to the electrical box.
13. Skip ahead to "Mounting Manifolds & Nozzles (All Spreaders)" on page 15.

MOUNTING THE SPRAY BRACKET & PUMP BOX

POLY HOPPER WITH AUGER

MOUNTING THE SPRAY BAR ASSEMBLY

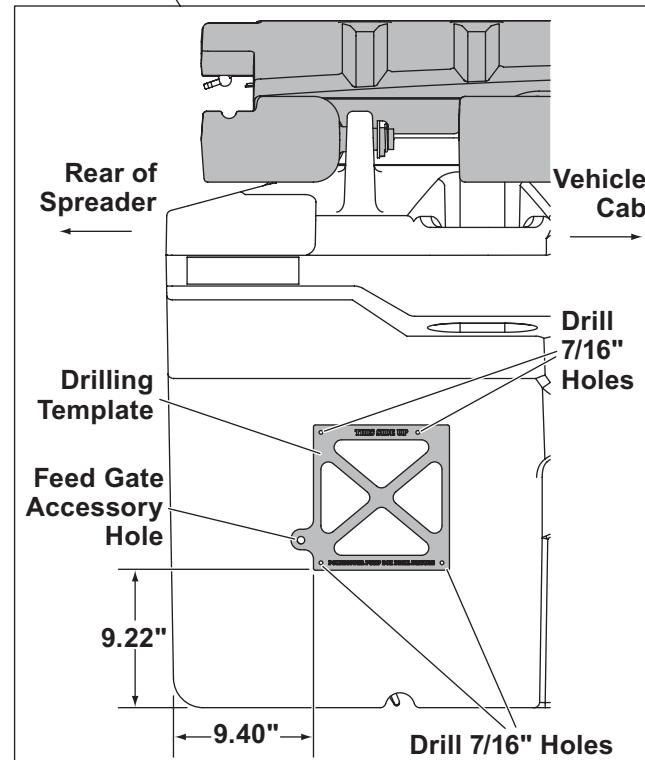
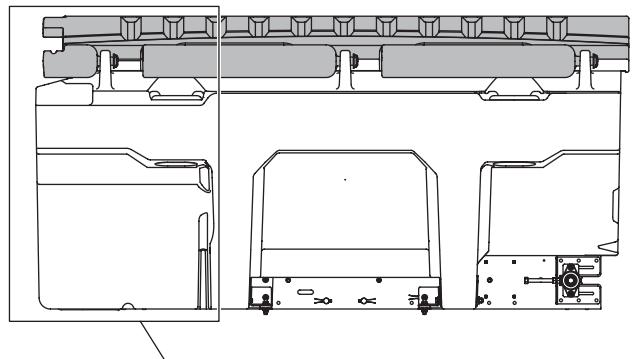
1. Remove all packing material from the liquid kit before installation.
2. Remove four 3/8" cap screws and remove the upper sill extension cover from the rear of the spreader. Retain for reinstallation.
3. Remove the two knockouts from the top and one knockout from the right hand side of the extension cover. Install a hose grommet into the side hole.



4. Install the spray bar assembly to the sill extension cover with two 3/8" x 1" flanged cap screws as shown. Verify that the slits in the spray hose face the sill or trough bed when installed. The slits are along the painted line.
5. Connect the 1/2" hose to the spray hose with a hose clamp and feed it through the grommet.
6. Reinstall the sill extension cover with the four removed 3/8" cap screws.

MOUNTING THE PUMP BOX

7. Position the poly hopper pump box mount drilling template with the feed gate accessory hole. If the feed gate accessory is not installed, hold the template with a bolt through the feed gate accessory hole. If no feed gate accessory hole is present, locate the drilling template according to the measurements shown.

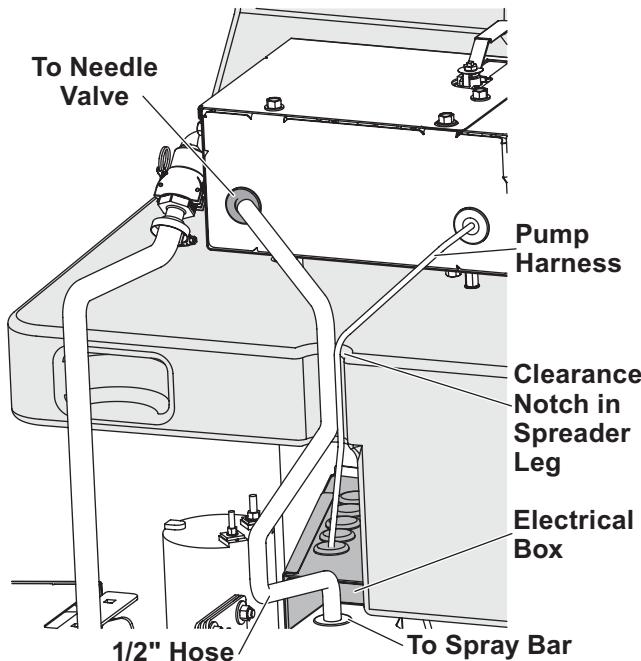


8. Drill four 7/16" holes using the drilling template as a guide. Remove the drilling template.

MOUNTING THE SPRAY BRACKET & PUMP BOX

9. Insert the four well nuts into the drilled holes. Install four 1/4" standoffs into the well nuts. Install four 1/4" set screws into the four 1/4" standoffs.
10. Install the pump box onto the four standoffs with four 1/4" locknuts.
11. Install a rubber grommet into the bottom knockout hole of the pump box. Route the 1/2" hose from the extension cover through the grommet, under the clearance notch in the spreader leg to the pump box's needle valve fitting. Hose may be cut to length if necessary. Secure with a spring clamp at each end.

View Upward from Below Spreader



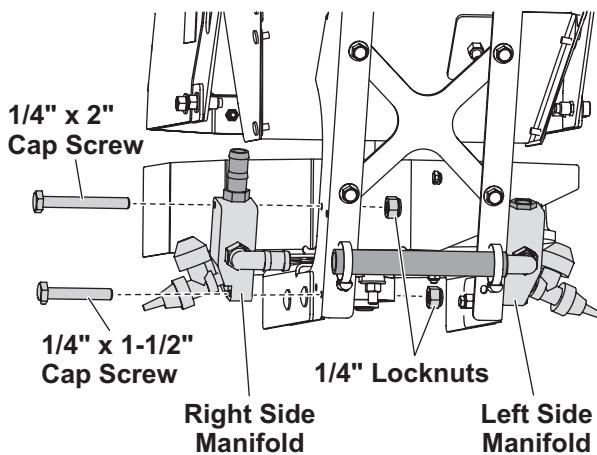
12. Connect the pump harness to the connector and route out of the pump box through its cab side grommet. Route through the clearance notch in the spreader leg and to the electrical box.
13. Continue to "Mounting Manifolds & Nozzles (All Spreaders)" on page 15.

MOUNTING THE SPRAY BRACKET & PUMP BOX

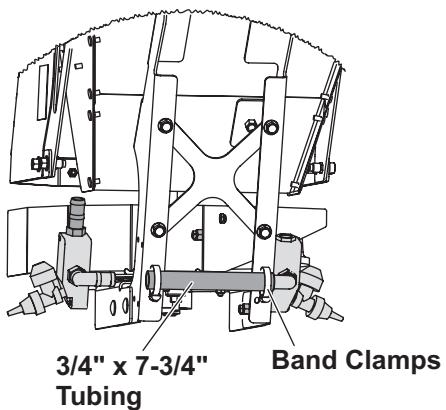
MOUNTING MANIFOLDS & NOZZLES (ALL SPREADERS)

1. Install the right hand and left hand side manifolds to the sides of the chute frame as shown with 1/4" x 2" cap screws in the upper holes and 1/4" x 1-1/2" cap screws in the lower holes. Secure with 1/4" locknuts.

NOTE: The right hand side manifold top port is plugged. The left hand side manifold top port has a straight barb fitting.



2. Connect the manifolds with a 7-3/4" long length of 3/4" tubing between the 90° elbow fittings. Secure the tubing with band-type clamps.



MOUNTING THE TANKS

MOUNTING THE TANKS

Before You Begin

NOTE: While handling the hopper, ensure that the hopper mounting bolts do not damage the liquid tanks.

If this is a new hopper spreader installation, follow the installation steps as outlined in the hopper spreader Installation Instructions. Once the spreader has been located in the vehicle and the mounting holes have been made, remove the spreader from the vehicle. Ensure that the mounting bolts are in the mounting bar holes before installing the liquid tanks to the hopper.

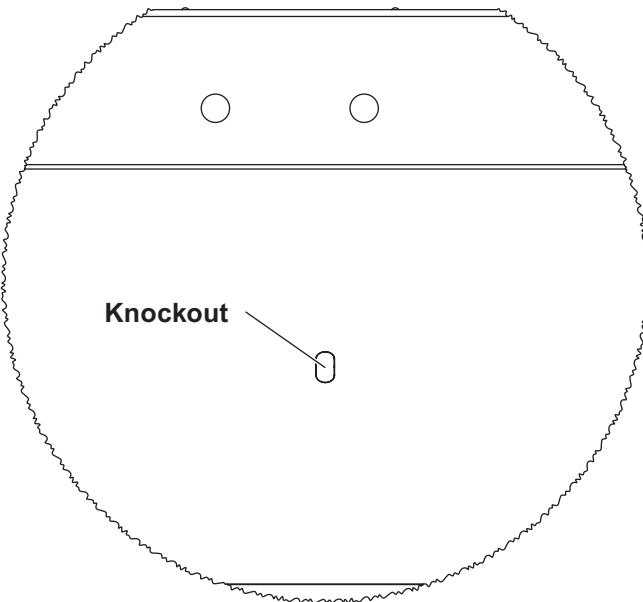
If the spreader has been previously installed in the vehicle, empty all material from the spreader, then remove the spreader from the vehicle. Ensure that the spreader mounting bolts are in the mounting bar holes before installing the liquid tanks to the hopper.

Once the tanks have been installed onto the hopper, place the spreader back into the vehicle and mount the spreader to the vehicle as described in the hopper spreader Installation Instructions.

NOTE: It is recommended to set spreader on blocks or 4 x 4 dimensional lumber to ease access to fasteners on and near the sill. Two people are recommended for this action.

CREATING THE MOUNTING HOLES

1. Determine the desired tank configuration.
2. For stainless hoppers only, remove the knockout from each side of the hopper.

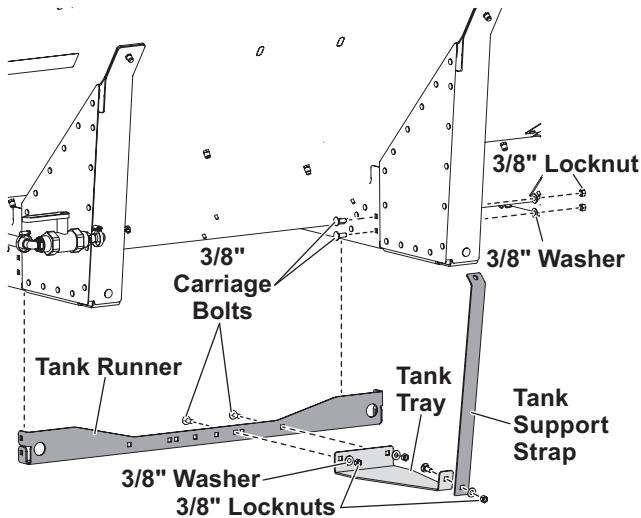


INSTALLING TANKS & STRAPS

INSTALLING TANKS & STRAPS

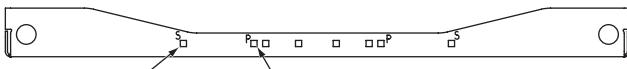
Auger Spreaders

1. Install the auger runners to the hopper sills with four stainless steel 3/8" carriage bolts and 3/8" locknuts as shown.



2. Install the tank trays to the auger runners according to hopper type as described below.

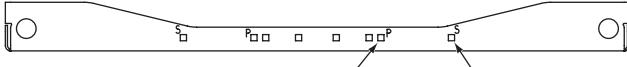
Left Hand Side



Stainless Hopper:
Install tank tray
rear mounting hole
to hole marked "S"

Poly Hopper:
Install tank tray
rear mounting hole
to hole marked "P"

Right Hand Side

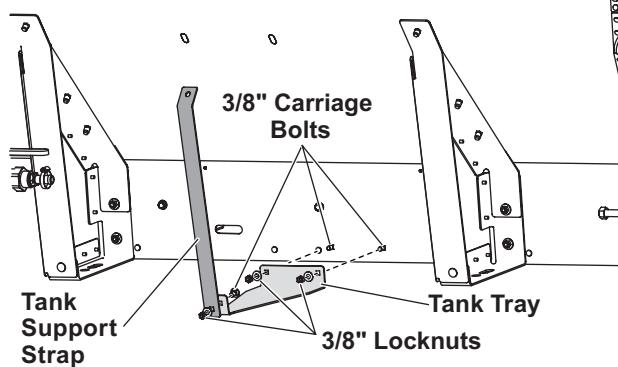


Poly Hopper:
Install tank tray
rear mounting hole
to hole marked "P"

Stainless Hopper:
Install tank tray
rear mounting hole
to hole marked "S"

Chain Spreaders

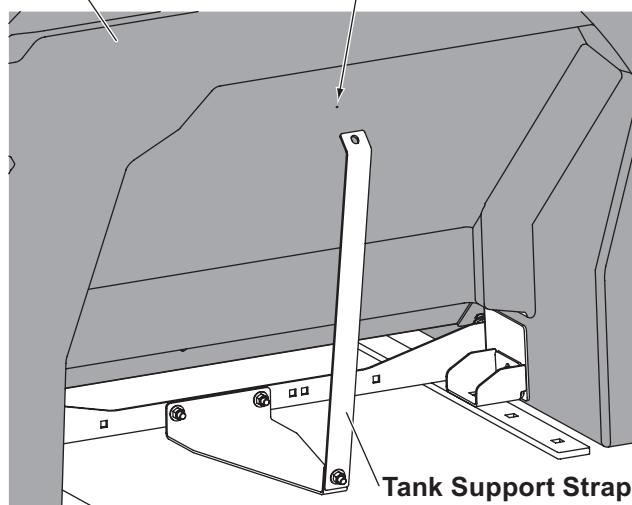
3. Install a tank tray to each sill with two 3/8" carriage bolts and 3/8" locknuts.



Auger and Chain Spreaders

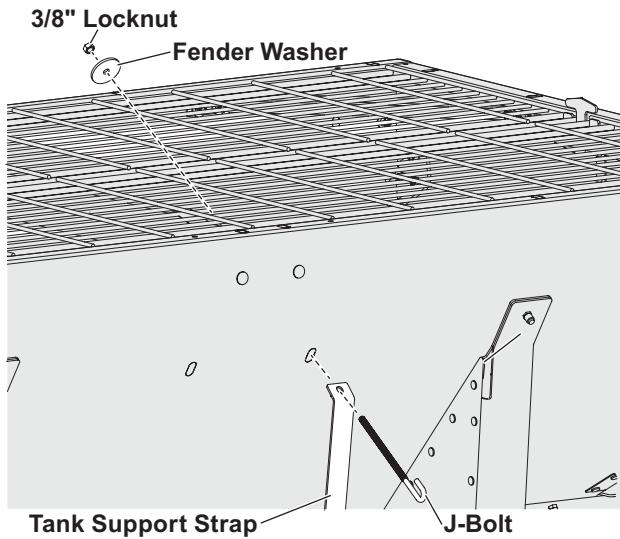
4. Place the tanks on the tank trays. Verify that the tanks are completely seated in the trays.
5. Install a tank support strap to each tank tray with one 3/8" x 1" carriage bolt and one 3/8" locknut with the bolt head facing the tank.
6. **Poly spreaders only.** Skip ahead to Step 7 for stainless spreaders. Drill a 3/8" hole through the inner and outer walls of the hopper at the drill point location shown.

Poly Hopper Drill 3/8" Hole



INSTALLING TANKS & STRAPS

7. Hook the 3/8" x 8" J-bolt into the tank support strap hole with the loop facing up and insert it through the knock-out (stainless) or drilled (poly) hole in the hopper.



8. Secure the J-bolt with a 3/8" fender washer and a 3/8" locknut on the inside of the hopper.

NOTE: Do not use power tools to tighten the J-bolts; use hand tools only. Overtightening can cause galling of the stainless steel threads.

9. If desired, trim excess J-bolt length.

PLUMBING THE SYSTEM

PLUMBING THE SYSTEM

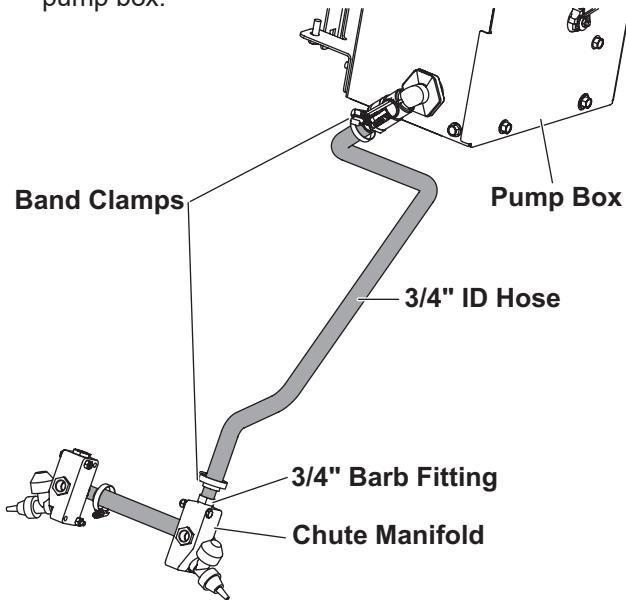
Secure all connections using hose clamps.

- **1/2" Hoses:** Use spring-type clamps.
- **3/4" and 1" Hoses:** Use stainless band clamps.

Use pipe sealant on all NPT fittings.

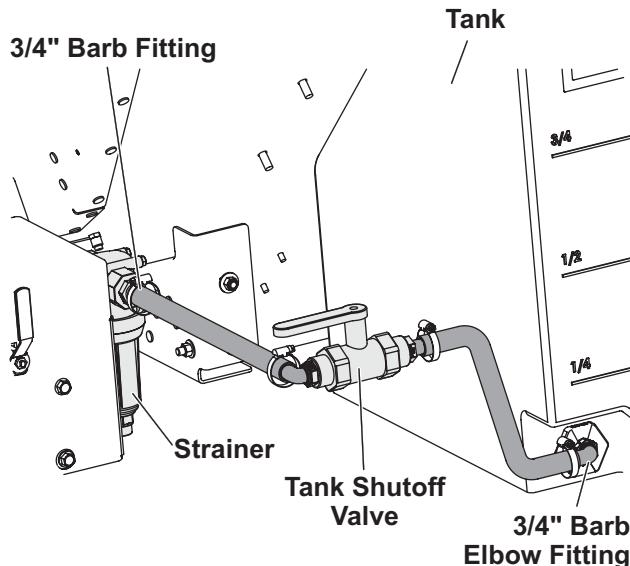
PLUMBING THE OUTPUT SIDE

1. Connect a 3/4" ID hose to the 3/4" barb fitting on top of the right hand side chute manifold. Secure with a clamp.
2. Cut the hose to a suitable length to reach the quick coupler on the pump box. Install the cam lever coupler (male end) and connect it to the pump box.



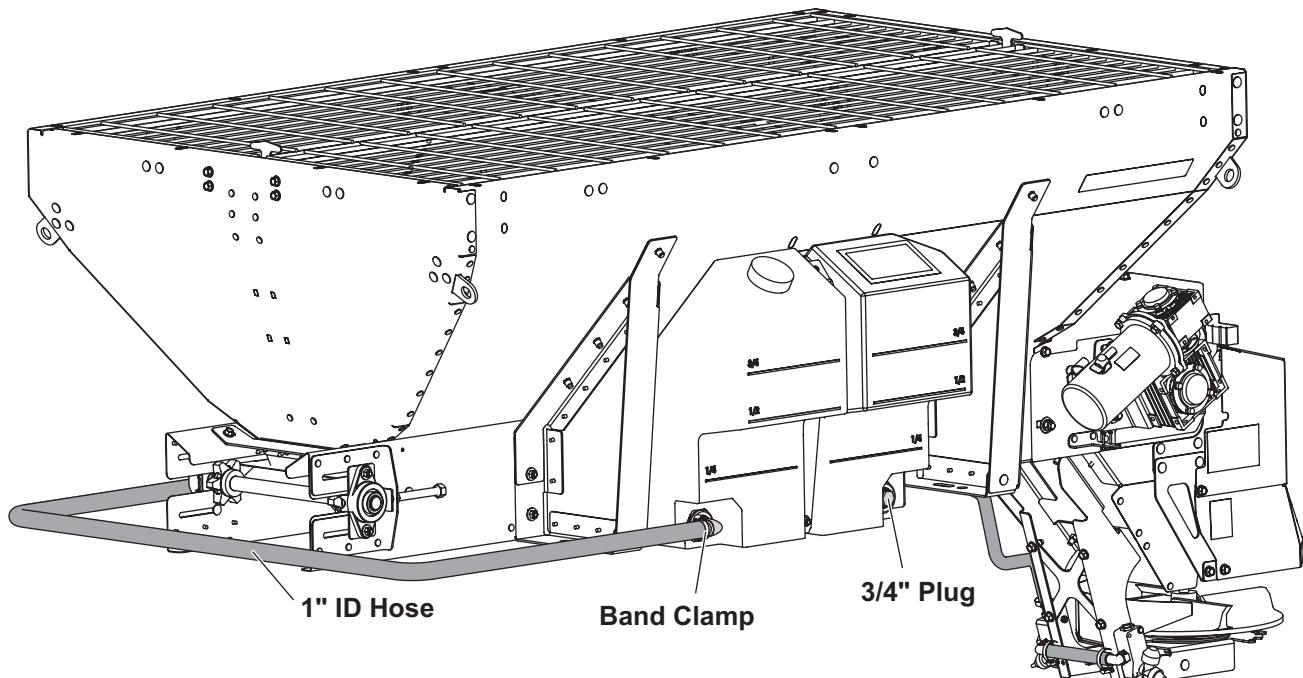
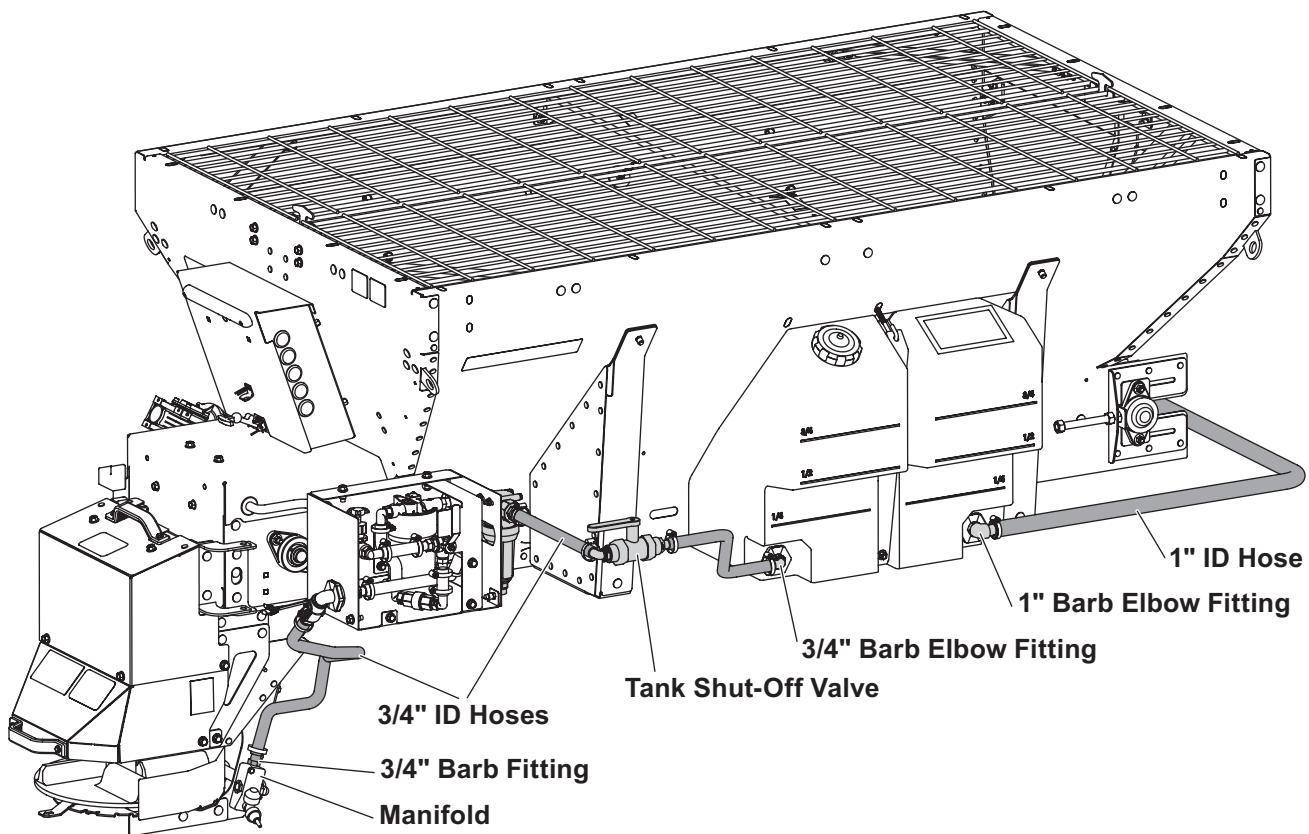
PLUMBING THE INPUT SIDE

1. Connect the tank shut-off valve to the nearest tank with a 3/4" ID hose and a 3/4" barb elbow fitting.



2. To connect additional tanks, install a 1" barb elbow into the tank bulkhead and connect the tanks in series with a 1" hose. Install the 3/4" plug in the final tank. See illustrations on page 18.
3. On the cab side of the spreader, route the hose around the sill.
4. Verify that all bulkhead fittings are tightened to 20 ft-lb.

PLUMBING THE SYSTEM



WIRING & HARNESS INSTALLATION

INSTALLING THE ON/OFF PUMP KIT

NOTE: The liquid accessory harness kit provides an ON/OFF switch to activate the liquid system from inside the vehicle.

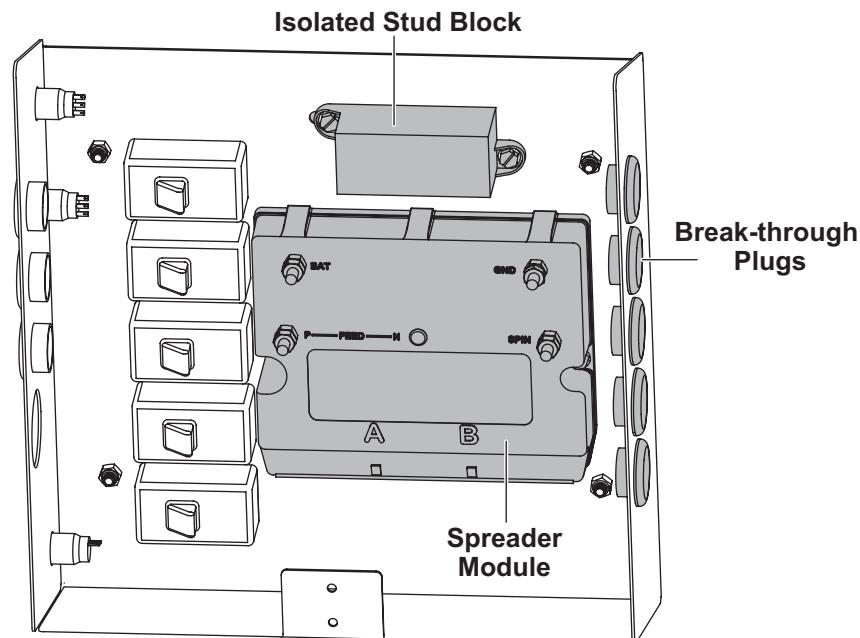
To properly wire the ON/OFF pump kit, follow these instructions and refer to the Liquid Kit Harness Wiring Diagram on Page 22.

⚠ CAUTION

Before drilling any holes, check both sides of the material for any wires, fuel lines, fuel tanks, etc., that may be damaged by drilling.

1. Remove the cover from the hopper electrical enclosure located on the end of the hopper.
2. Remove a break-thru plug on the passenger's side of the electrical enclosure. Route the liquid kit relay assembly harness through the opening.
3. Remove the break-thru plug on the inside face of the pump box. Route the harness from the passenger's side of the electrical box into the opening.

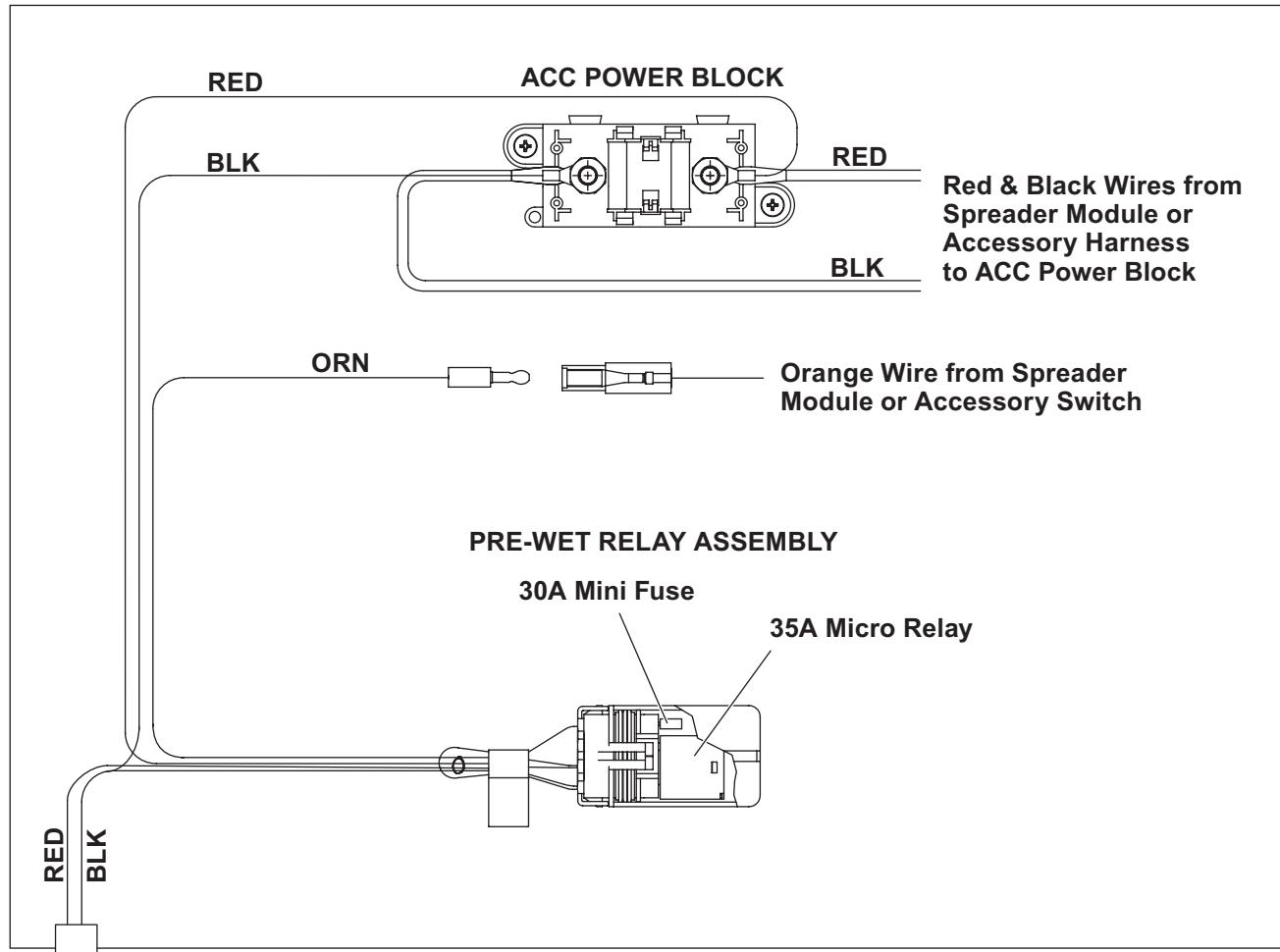
4. To protect the harness from wear, starting with one end of a split grommet, work a grommet into each opening and around the harness.
5. Remove the cover from the ACC power block.
6. Attach the ring terminal connected to the red wire of the liquid kit harness to the POSITIVE (+) terminal of the ACC power block.
7. Attach the ring terminal connected to the black wire of the liquid kit harness to the NEGATIVE (-) terminal of the ACC power block.
8. Connect the male bullet terminal of the liquid kit relay assembly harness to the orange wire coming from the spreader module.
9. Reinstall the covers onto the ACC power block and electrical enclosure.
10. Secure all harnessing to prevent damage to the wires, and mount relay to mounting bar.



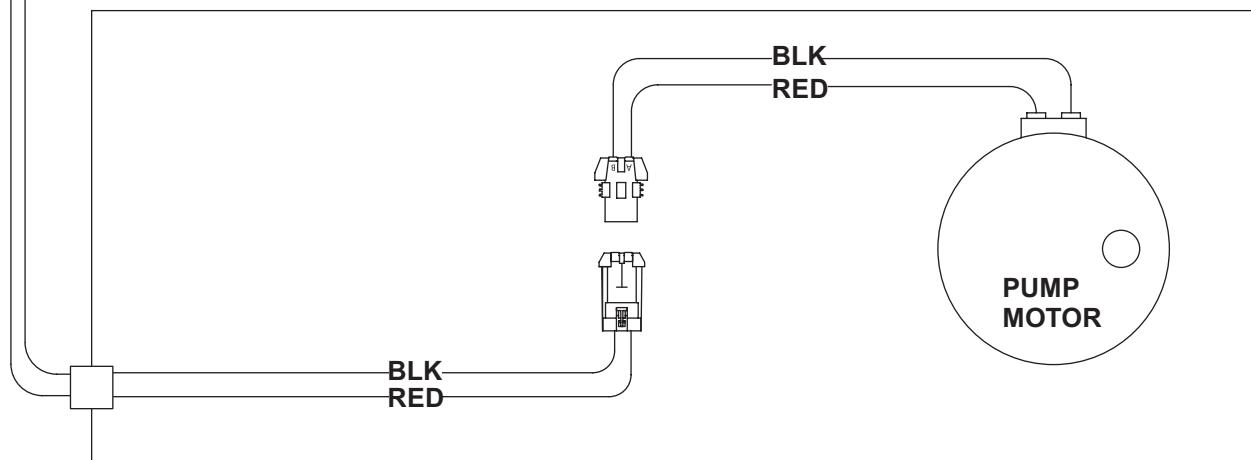
WIRING & HARNESS INSTALLATION

LIQUID KIT HARNESS WIRING DIAGRAM

SPREADER ELECTRICAL BOX



PUMP BOX



OPERATING INSTRUCTIONS

ADJUSTING THE FLOW

To adjust the flow between direct application on the chute and direct application to the material, rotate the valve on the front of the pump box.

The following table shows the flow rates for the ON/OFF system. These values are approximate and can vary based on system configuration, age of components, brine composition, and other factors.

The flow of the system is controlled by a needle valve inside the pump box. Follow the instructions below to adjust the flow.

1. Remove the pump box cover.
2. Turn the white plastic handle to the left of the pump. Clockwise will reduce the flow and counter-clockwise will increase the flow.

**NOTE: Do not overtighten the handle.
Overtightening may damage the valve.**

3. With the pump running, turn the valve clockwise until the flow stops. This is the "zero flow" point. **DO** turn the valve further.
4. Mark the valve handle and body to indicate the "zero flow" point for future reference.
5. Turn the valve counter-clockwise a number of complete turns as indicated by the "ON/OFF Flow Rates" table below.

ON/OFF Flow Rates	
Number of Turns from Zero Flow Position	gal/min
0	0
1/4	0.22
1/2	0.46
3/4	0.66
1	0.80
2	1.13
3	1.40
3-1/2+	1.60
No Valve	2.00

NOTE: If higher flow rates are required, bypass the needle valve to increase the flow. Refer to Bypassing the Needle Valve.

BYPASSING THE NEEDLE VALVE

1. Remove the needle valve and install the 1/2" hose barb directly into the street elbow.
2. Replace the hose with the 1/2" hose kit. The new flow rate will be approximately 2.63 gal/min.

MANUALLY CALIBRATING THE FLOW

To obtain a more precise measurement of the flow rate, follow the steps below.

1. Adjust the liquid system to the desired setting.
2. Disconnect the 1/2" hose connected to the spray hose and place it in a 5-gallon bucket.
3. Turn on the liquid system and time how long it takes (in seconds) for the system to fill the 5-gallon bucket.
4. Determine the flow in gal/min by dividing 300 by the results from Step 3 (in seconds).

Example:

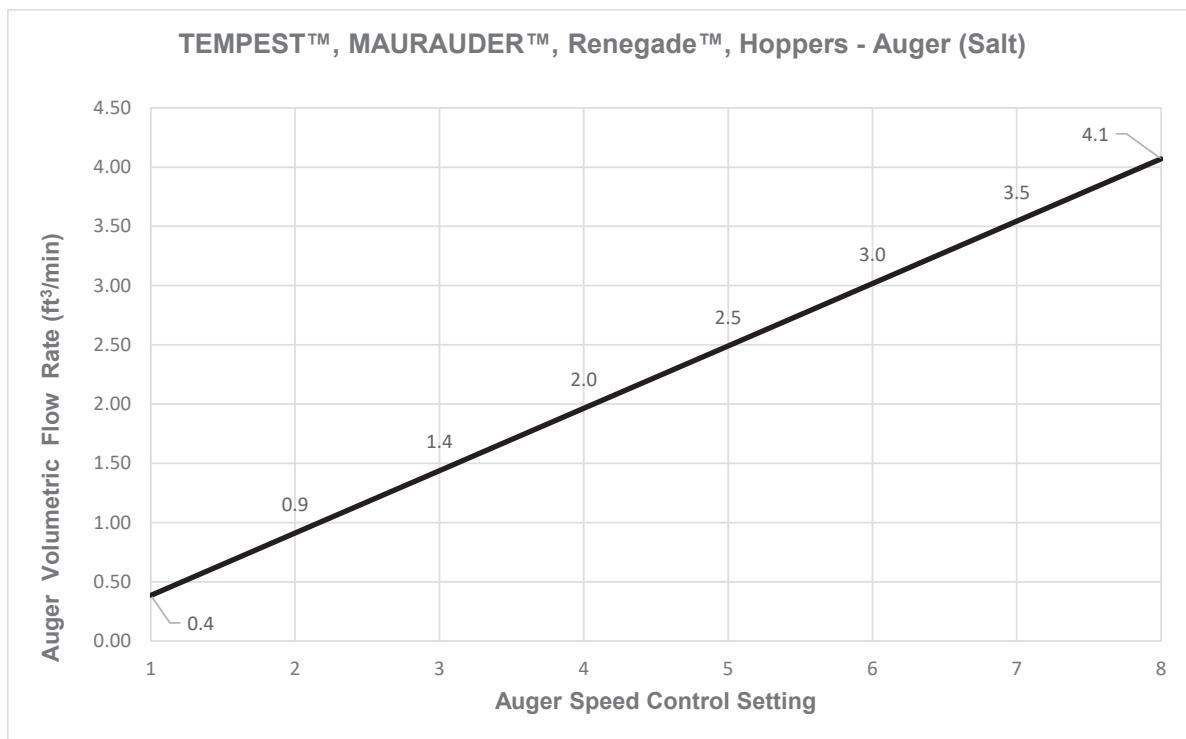
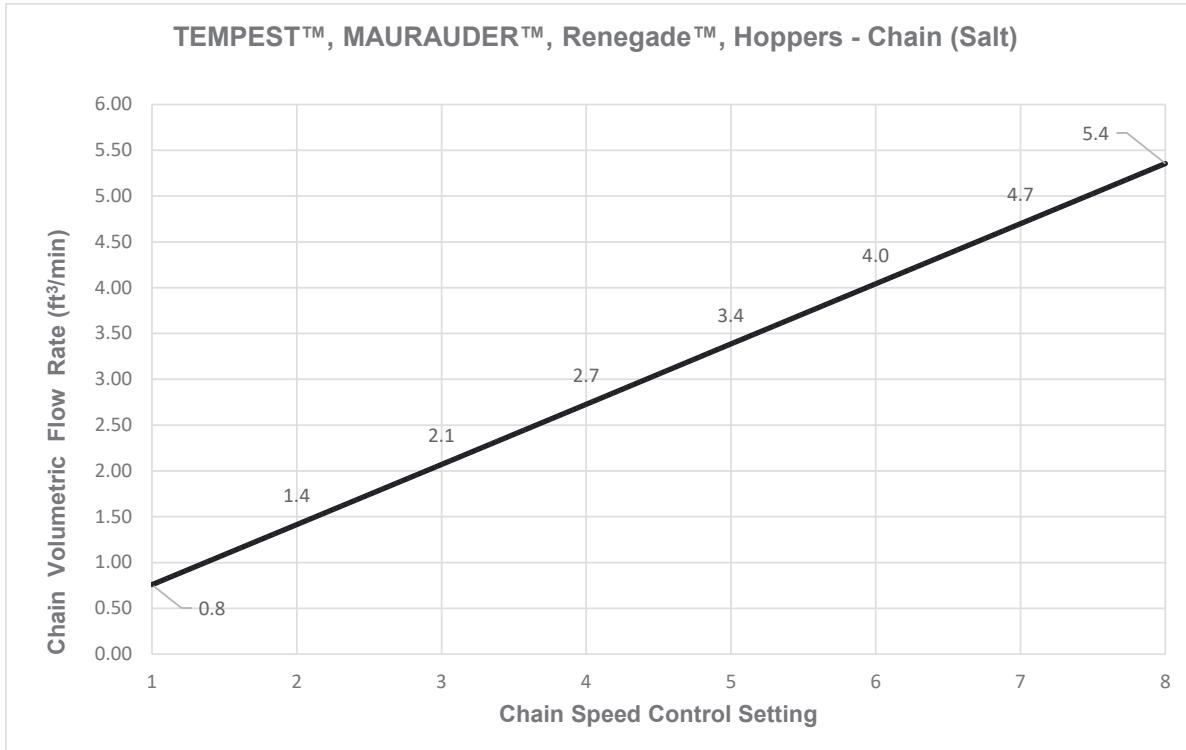
It took 165 seconds to fill the bucket.

$$\frac{300}{165} = 1.82 \text{ gal/min}$$

OPERATING INSTRUCTIONS

APPLICATION RATES

The following application chart shows the approximate material delivery rate for installed spreader. Use these charts to determine the delivery rate of de-icing salt, which is based on the conveyor or auger speed.



OPERATING INSTRUCTIONS

After the delivery rate has been determined, use the following table to determine the optimal flow rate for the liquid system.

NOTE: This value may vary depending on de-icing chemicals used and weather conditions. Consult the material manufacturer's recommended application rates. Gallons per ton refers to the amount of pre-wetting agent applied per ton of de-icing salt.

Optimal Flow Rate

Delivery Flow Rate (ft ³ /min)	Gallons per Ton			
	6	8	10	12
0.5	0.11	0.15	0.19	0.22
1	0.22	0.30	0.37	0.44
1.5	0.33	0.44	0.56	0.67
2	0.44	0.59	0.74	0.89
2.5	0.56	0.74	0.93	1.11
3	0.67	0.89	1.11	1.33
3.5	0.78	1.04	1.30	1.56
4	0.89	1.19	1.48	1.78
4.5	1.00	1.33	1.67	2.00
5	1.11	1.48	1.85	2.22
5.5	1.22	1.63	2.04	2.44
6	1.33	1.78	2.22	2.67
7	1.56	2.07	2.59	—
8	1.78	2.37	—	—
9	2.00	2.67	—	—
10	2.22	—	—	—
11	2.44	—	—	—
12	2.67	—	—	—

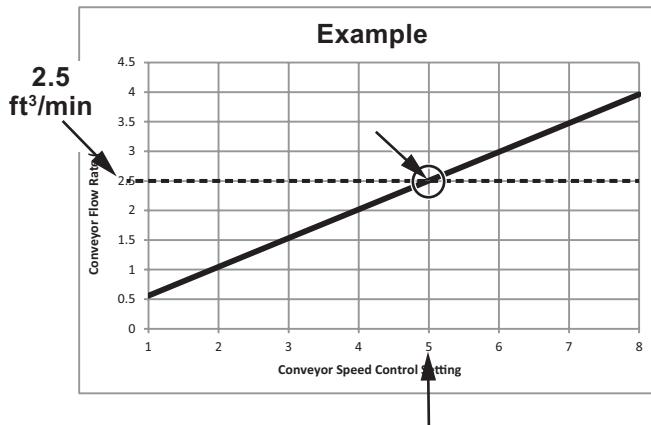
OPERATING INSTRUCTIONS

MATERIAL APPLICATION EXAMPLE:

Auger hopper spreader is running at delivery-drive speed 5. The desired liquid rate is 8 gallons per ton.

Use the following procedure to determine the optimal flow rate in gal/min.

1. On the Application Rates charts on Page 24, refer to the appropriate chart for your application (chain or auger), and find the point on the graph where the 5 on the Control Speed axis and the line intersect.
2. Follow from the point of intersection across to the Flow Rate axis, as shown below. The delivery flow rate for this example is 2.5 ft³/min.



3. On the Optimal Flow Rate table on page 25, find the Delivery Flow Rate value (previously determined in Step 2 (2.5 ft³/min) and the Application Rate (8 gal/ton).
4. Find the point at which these two values meet on the table (see example below). This box shows the Optimal Flow Rate for this liquid application (0.74 gal/min).

Delivery Flow Rate (ft ³ /min)	Gallons per Ton			
	6	8	10	12
0.5	0.11	0.15	0.19	0.22
1	0.22	0.30	0.37	0.44
1.5	0.33	0.44	0.56	0.67
2	0.44	0.59	0.74	0.89
2.5	0.56	0.74	0.93	1.11
3	0.67	0.89	1.11	1.33
3.5	0.78	1.04	1.30	1.56
4	0.89	1.19	1.48	1.78
4.5	1.00	1.33	1.67	2.00

5. To achieve the desired liquid rate in this example, you would adjust the system to 0.74 gal/min. For details, refer to "Adjusting the Flow" on Page 23.

MAINTENANCE & TROUBLESHOOTING

PERIODIC MAINTENANCE

- Wash unit after each use to prevent material build-up and corrosion.
- When the system is not in use, remove chute nozzles from manifolds to prevent clogging with road dirt/grime.
- Use dielectric grease on all electrical connections to prevent corrosion each time power or signal plugs are disconnected.
- Inspect unit for damage, such as broken, worn, or bent parts.
- Inspect all tubing, hoses, and harnesses for cracks and leaks.
- Clean the brine filter as needed. Close the shut-off valve and access the filter by unscrewing the top cap, then unscrewing the filter cover.
- Retighten bolts, screws, and other connections after first use and as needed.

CLEANING

- Clean the unit as desired. When pressure washing motor enclosure area, keep spray at least 36" away from motor enclosures.
- Use caution if you are flushing the pumping system with water as it will accumulate in the valves and can cause damage if the water inside freezes. Use antifreeze if unit is to be stored in freezing temperatures.

END OF SEASON AND STORAGE

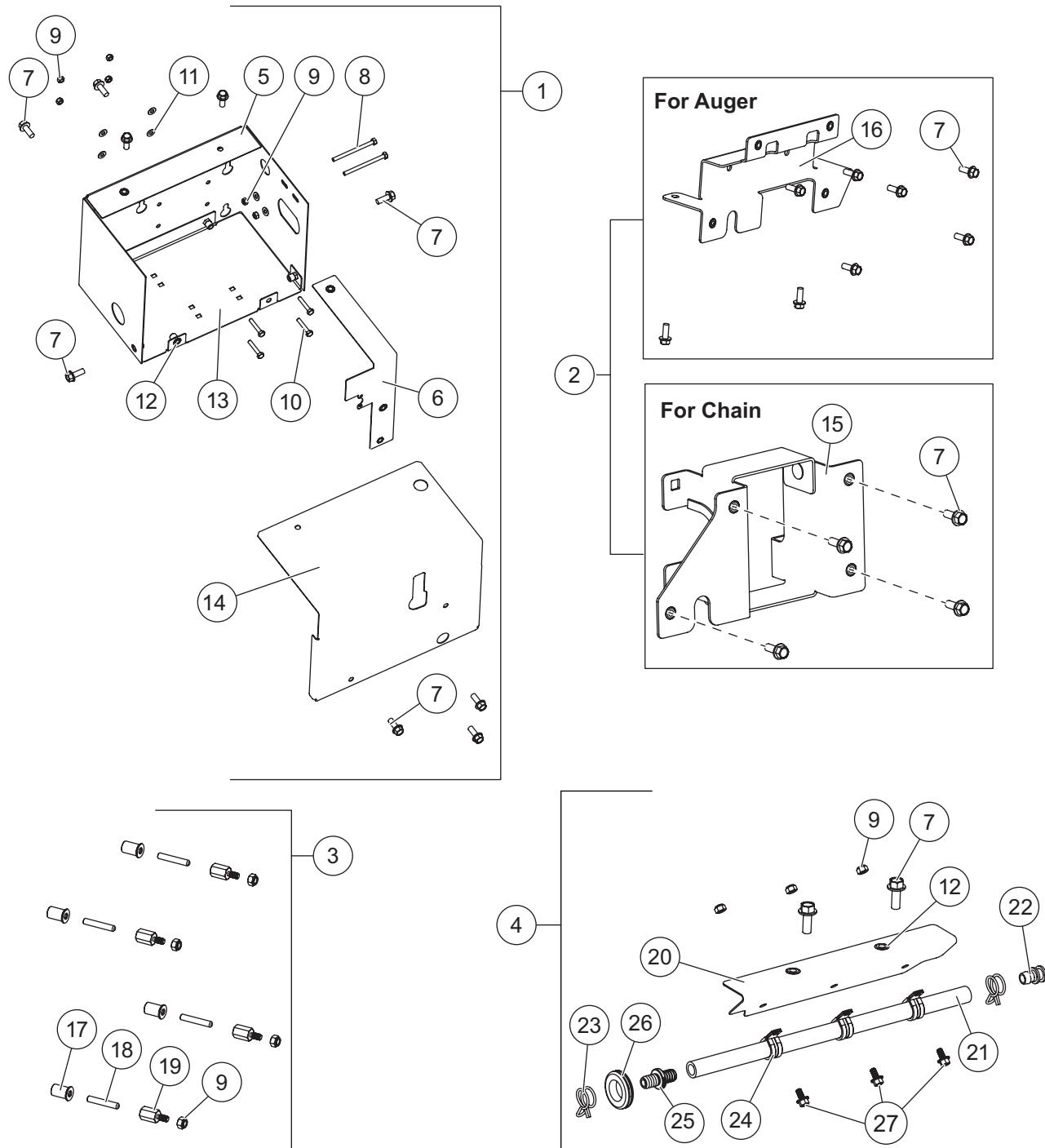
- Before long periods of storage, flush out the tanks and pumping system to remove salt build-up and prevent corrosion.
- Do not leave unused material in the unit for a prolonged period of time.
- Empty tanks before removing hopper from the vehicle.

TROUBLESHOOTING GUIDE

Problem	Possible Cause	Suggested Solution
Pump is not operating.	1. Loose electrical connection. 2. Blown fuse. 3. Pump seized.	1. Check all electrical connections for corrosion. 2. Replace the fuse. 3. Replace the pump.
Control shut down.	1. Loose electrical connection. 2. Electrical short. 3. Control failure. 4. Blown fuse.	1. Check all electrical connections for corrosion. 2. Check for bare or burned wires. 3. Replace the control. 4. Replace the fuse.
Material being spread is not wet.	1. Liquid system is not running. 2. Spray hose is misaligned. 3. Flow rate is set too low.	1. See Troubleshooting – Pump is not operating. 2. See "Mounting the Spray Bracket" page 7. 3. See ""Adjusting the Flow" on page 23.
Spray is uneven.	1. Spray hose is clogged. 2. Spray hose is damaged.	1. Clean spray hose with fresh water. 2. Replace the spray hose.
Pump is leaking.	1. O-ring fittings are loose. 2. O-rings are damaged or worn. 3. Pump housing is damaged.	1. Verify that O-ring fittings are fully installed. 2. Replace the O-rings. 3. Replace the pump.

PARTS LIST

PUMP BOX COMPONENTS

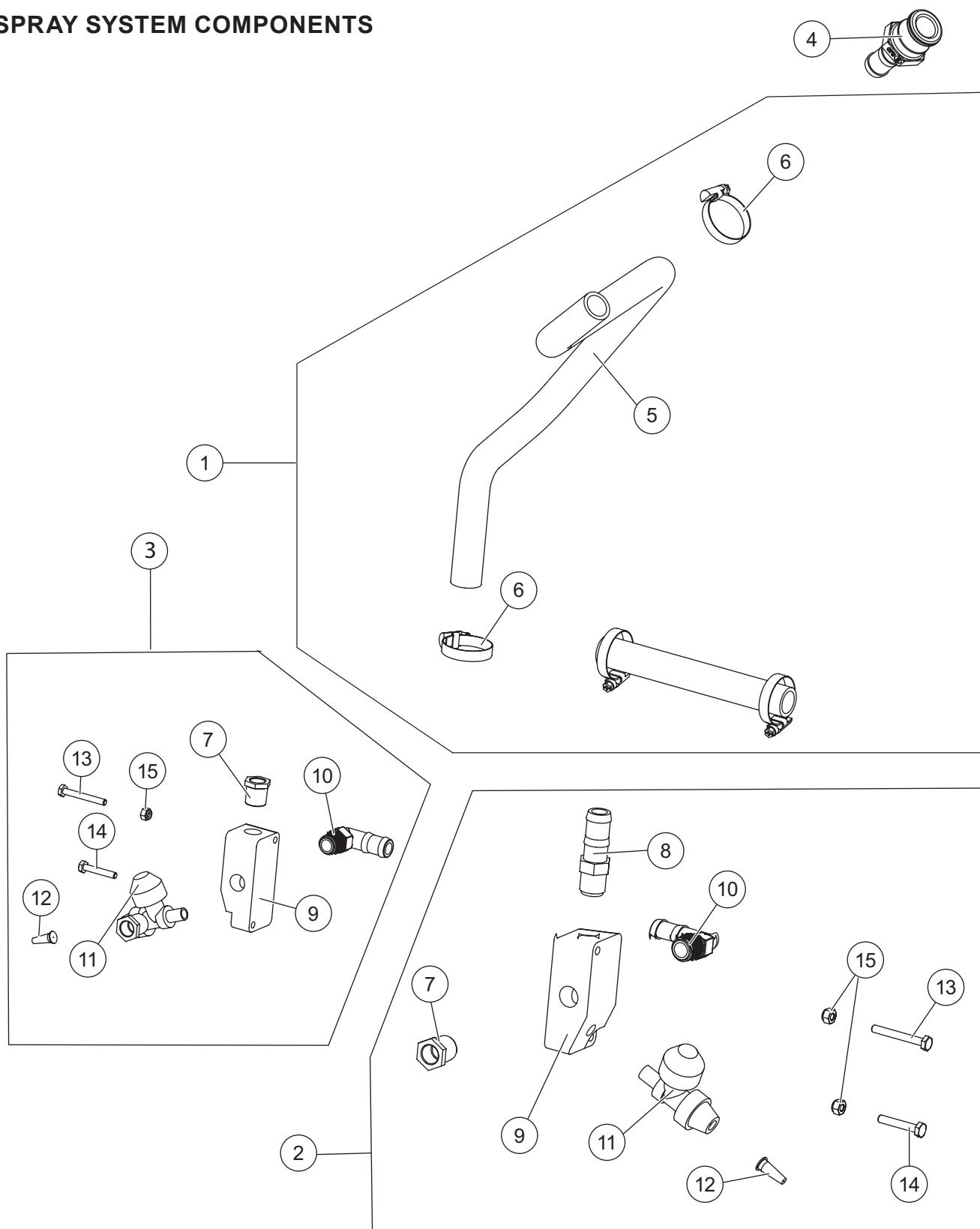


PARTS LIST

Pump Box Components							
Item	Part	Qty	Description	Item	Part	Qty	Description
1	32815	1	50 Gallon Pump Box Enclosure Kit	3	32920	1	Pump Box Mount Kit, Poly
2	31625	1	Pump Box Mount Kit, SS	4	31651	1	Liquid Spray Bar Kit
Item 1	32815 50 Gallon Pump Box Enclosure Kit						
5	ns 99195	1	Pre-Wet Box Walls – 50 Gal	10		4	1/4-20 x 1-1/2 Hex Cap Screw SS
		1	Break-Thru Plug	11		6	1/4 Flat Washer Type A Narrow
ns		1	Hose Grommet, 1/2" Hose	12		9	3/8-16 Rivnut
6		1	Pre-Wet Box Valve Bracket – 50 Gal	13		1	Pre-Wet Box Bottom – 50 Gal
7		9	3/8-16 x 1 Serrated Flanged Cap Screw SS	14		1	Pre-Wet Box Cover – 50 Gal
8		2	1/4-20 x 3-1/2 Hex Cap Screw	ns		2	10-24 x 5/16 SS Button Head Socket Cap Screw
9		6	1/4-20 Hex Locknut				
Item 2	31625 Pump Box Mount Kit, SS						
7		8	3/8-16 x 1 Serrated Flange Cap Screw SS	15		1	Mounting Bracket, Chain
				16		1	Mounting Bracket, Auger
Item 3	32920 Pump Box Mount Kit, Poly						
9		4	1/4-20 Hex Locknut	18		4	1/4-20 Set Screw
17		4	1/4-20 Well Nut	19		4	1/4-20 Standoff
Item 4	31651 Liquid Spray Bar Kit						
7		2	3/8-16 x 1 Serrated Flanged Cap Screw SS	23	F51638	4	Double Spring Clamp, 1/2
9		3	1/4-20 Hex Locknut	24		3	7/8 ID Loop Clamp SS
12		2	3/8-16 Rivnut	25		1	Hose Mender Barb
20		1	Hose Bracket	26		1	Grommet
21		1	Slit Rubber Tubing, 11-1/2	27		3	1/4-20 x 1/2 Serrated Flange Hex Cap Screw SS
22		1	1/2 Barb Plug	ns			1/2 x 24 Clear PVC Hose
ns = not shown				SS = Stainless Steel			

PARTS LIST

SPRAY SYSTEM COMPONENTS



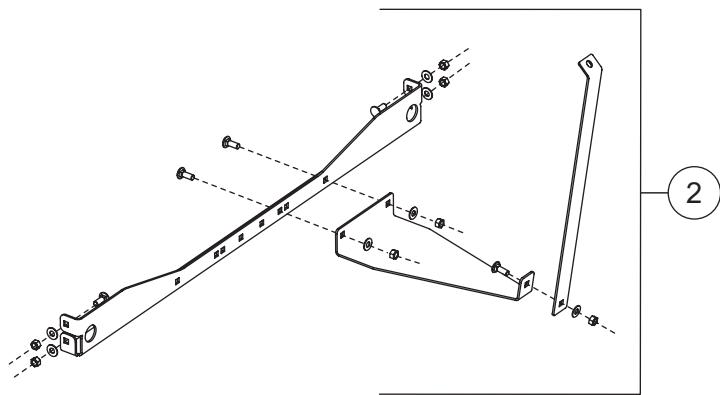
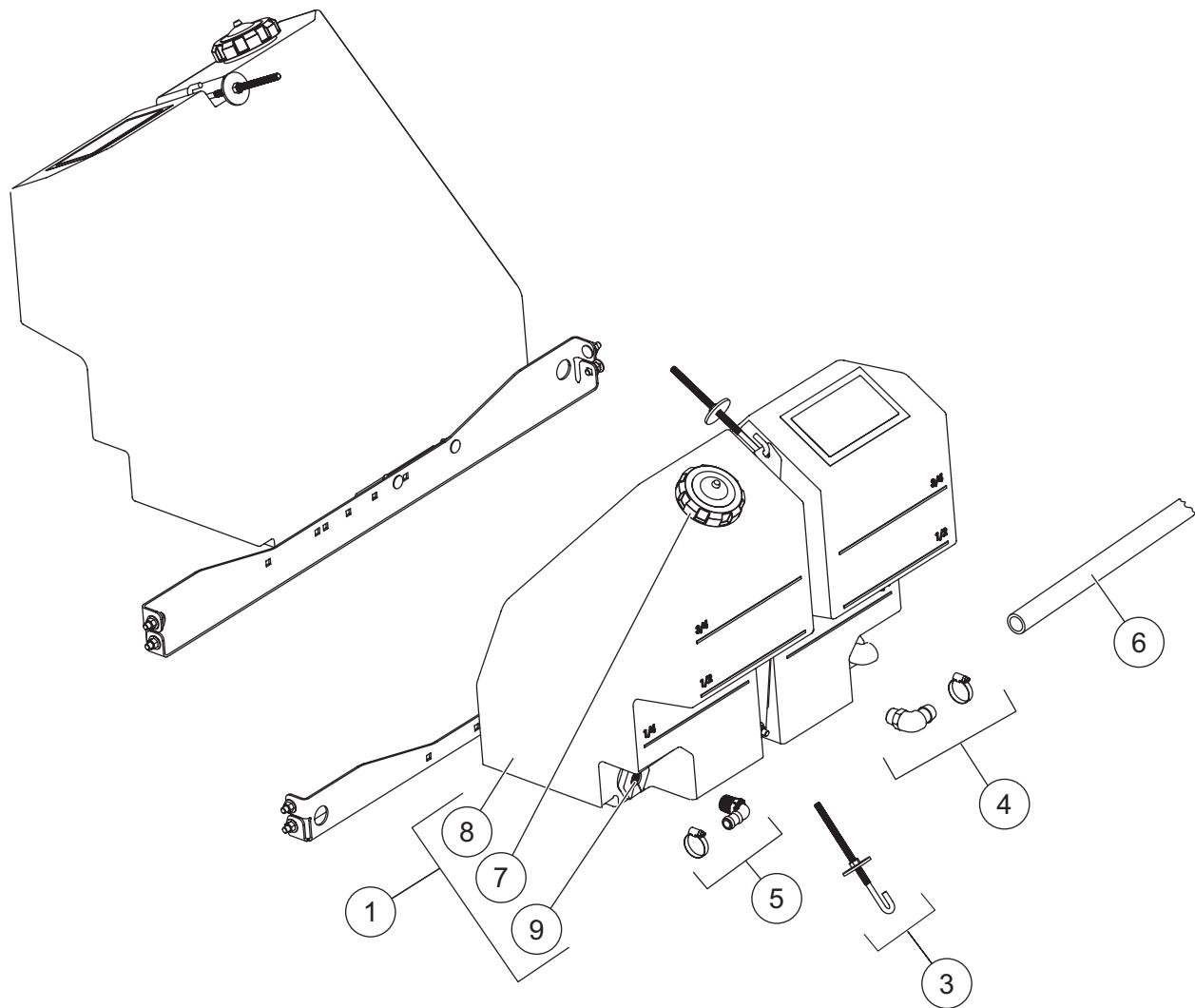
PARTS LIST

Spray System Components							
Item	Part	Qty	Description	Item	Part	Qty	Description
1	31646	1	3/4 x 48 Hose Kit	3	31630	1	Nozzle Manifold Kit – DS
2	31629	1	Nozzle Manifold Kit – PS	4	31143	1	Cam Lever Coupling, Male End
Item 1		31646 3/4 x 48 Hose Kit					
5		1	3/4 x 48 PVC Clear Hose	6		4	Band Clamp, 11/16-1-1/2
Item 2		31629 Nozzle Manifold Kit – PS					
7		1	1/2 Pipe Plug	12	D5215	1	Nozzle
8	D5609	1	1/2 M NPT to 3/4 Barb Fitting	13		1	1/4-20 x 2 Hex Cap Screw
9	11971	1	Manifold	14		1	1/4-20 x 1-1/2 Hex Cap Screw
10	D5328	1	90° Hose Barb, 3/4 x 1/2 Male Thread	15		2	1/4-20 Locknut SS
11	D5241	1	Check Valve				
Item 3		31630 Nozzle Manifold Kit – DS					
7		2	1/2 Pipe Plug	12	D5215	1	Nozzle
9	11971	1	Manifold	13		1	1/4-20 x 2 Hex Cap Screw
10	D5328	1	90° Hose Barb, 3/4 x 1/2 Male Thread	14		1	1/4-20 x 1-1/2 Hex Cap Screw
11	D5241	1	Check Valve	15		2	1/4-20 Locknut SS

SS = Stainless Steel

PARTS LIST

TANK COMPONENTS

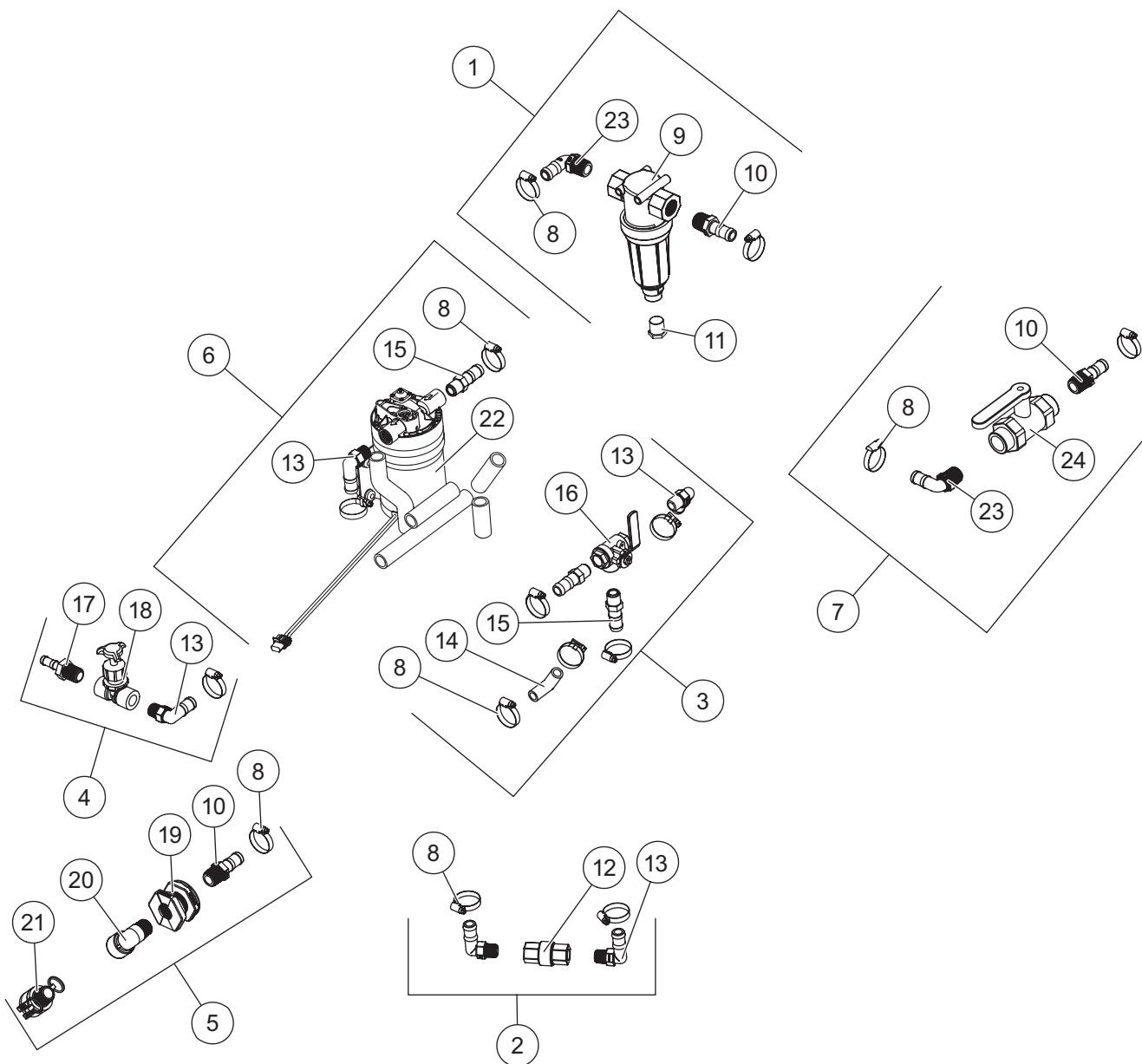


PARTS LIST

Tank Components							
Item	Part	Qty	Description	Item	Part	Qty	Description
1	31988	2	25 Gallon Tank	5	31611	1	Tank to 3/4 Hose Kit
2	31631	2	25 Gallon Strap Kit	6	76424	1	1" Hose Kit – 15'
3	76421	2	J-Bolt Kit	ns	76431	1	3/4 M NPT Plug
4	76422	2	Add-a-Tank Fitting Kit				
Item 1				31988 25 Gallon Tank			
7	76430	1	Pre-Wet Tank Cap	9	76447	2	3/4 Bulkhead Fitting
8	31988	1	25 Gallon Tank				
Item 2				31631 25 Gallon Strap Kit			
	1	25G Tray SS			7	3/8-16 x 1 Carriage Bolt	
	1	25G Support Strap SS			7	3/8 Flat Washer SS	
	1	25G Tank Mount Runner			7	Hex Locknut 3/8-16 GB SS	
Item 3				76421 J-Bolt Kit			
	1	3/8-16 x 8 J-Bolt SS			1	Hex Locknut 3/8-16 GB SS	
	1	3/8 x 2 Fender Washer SS					
Item 4				76422 Add-a-Tank Fitting Kit			
	1	1 x 3/4 M NPT Barb Elbow			1	11/16-1-1/2 Band Clamp	
ns	76431	1	3/4 M NPT Plug				
Item 5				31611 Tank to 3/4" Hose Kit			
	1	3/4 M NPT x 3/4 Hose Barb 90°			1	11/16-1-1/2 Band Clamp	
Item 6				76424 1" Hose Kit – 15'			
	1	1" ID x 15' PVC Clear Hose			2	11/16-1-1/2 Band Clamp	
	ns = not shown				SS = Stainless Steel		

PARTS LIST

INTERNAL PUMP BOX COMPONENTS

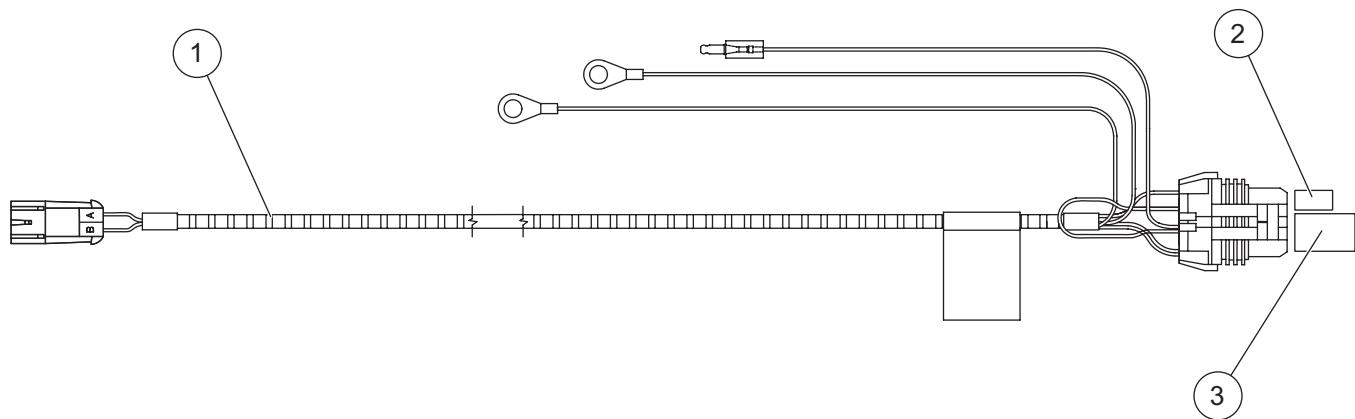


PARTS LIST

Internal Pump Box Components							
Item	Part	Qty	Description	Item	Part	Qty	Description
1	31659	1	Strainer Kit	5	31890	1	Bulkhead Kit
2	31669	1	Check Valve Kit	6	31635	1	Pump Kit
3	31713	1	3-Way Valve Kit	7	31834	1	Shut-Off Valve Kit
4	31880	1	Liquid Flow Kit				
Item 1 31659 Strainer Kit							
8		2	11/16-1-1/2 Band Clamp	11		1	Pipe Plug, 1/2 M NPT, Poly
9		1	Strainer	23		1	90° Hose Barb, 3/4 x 3/4 Male Thread
10		1	Hose Barb, 3/4 x 3/4 Male Thread				
Item 2 31669 Check Valve Kit							
8		2	11/16-1-1/2 Band Clamp	13	D5328	2	90° Hose Barb, 3/4 x 1/2 Male Thread
12	76326	1	Check Valve, 1/2 x 1/2 F NPT				
Item 3 31713 3-Way Valve Kit							
8		5	11/16-1-1/2 Band Clamp	15	D5609	2	Hose Barb, 3/4 x 1/2 Male Thread
13	D5328	1	90° Hose Barb, 3/4 x 1/2 Male Thread	16		1	1/2 Valve, 3-Way
14		1	90° Hose Barb, 3/4 x 3/4				
Item 4 31880 Liquid Flow Kit							
8		1	11/16-1-1/2 Band Clamp	17	T20119	1	Hose Barb, 1/2 x 1/2 Male Thread
13	D5328	1	90° Hose Barb, 3/4 x 1/2 Male Thread	18	76345	1	1/2 Needle Valve
Item 5 31890 Bulkhead Kit							
8		1	11/16-1-1/2 Band Clamp	20		1	90° Elbow, 3/4 NPT PP
10		1	Hose Barb, 3/4 x 3/4 Male Thread	21		1	Cam Lever Coupling
19	D6917	1	Bulkhead Fitting NPTF				
Item 6 31635 Pump Kit							
8		2	11/16-1-1/2 Band Clamp	15	D5609	1	Hose Barb, 3/4 x 1/2 Male Thread
13	D5328	1	90° Hose Barb, 3/4 x 1/2 Male Thread	22	11974	1	Pump, Diaphragm – 7 gal/min Bypass
Item 7 31834 Shut-Off Valve Kit							
8		2	11/16-1-1/2 Band Clamp	23		1	90° Hose Barb, 3/4 x 3/4 Male Thread
10		1	Hose Barb, 3/4 x 3/4 Male Thread	24		1	Shut-Off Valve 3/4 NPT

PARTS LIST

ELECTRICAL COMPONENTS



PARTS LIST

Electrical Components							
Item	Part	Qty	Description	Item	Part	Qty	Description
1	72523	1	Harness, Relay	3		1	35A Fuse, Micro Relay
2		1	30A Fuse, Mini ATM Style, Green				

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