

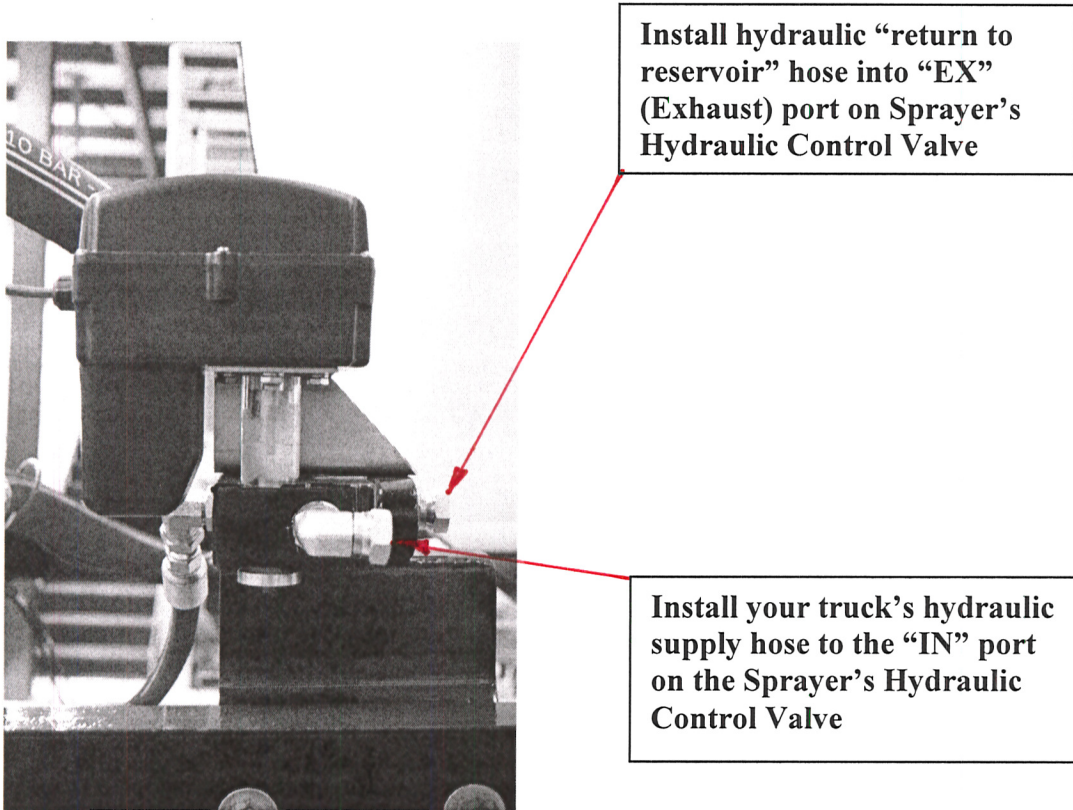
IMPORTANT –SEE POST-SPRAY FLUSH PROCEDURES & ALSO MAINTENANCE PROCEDURES AT END!

SET-UP INSTRUCTIONS FOR DULTMEIER SALES SELF-LOADING ANTI- ICE/DE-ICE/DUST CONTROL SPRAYING SYSTEMS 1,065 AND 1,800 GALLON WITH HYDRAULIC-DRIVE PUMP

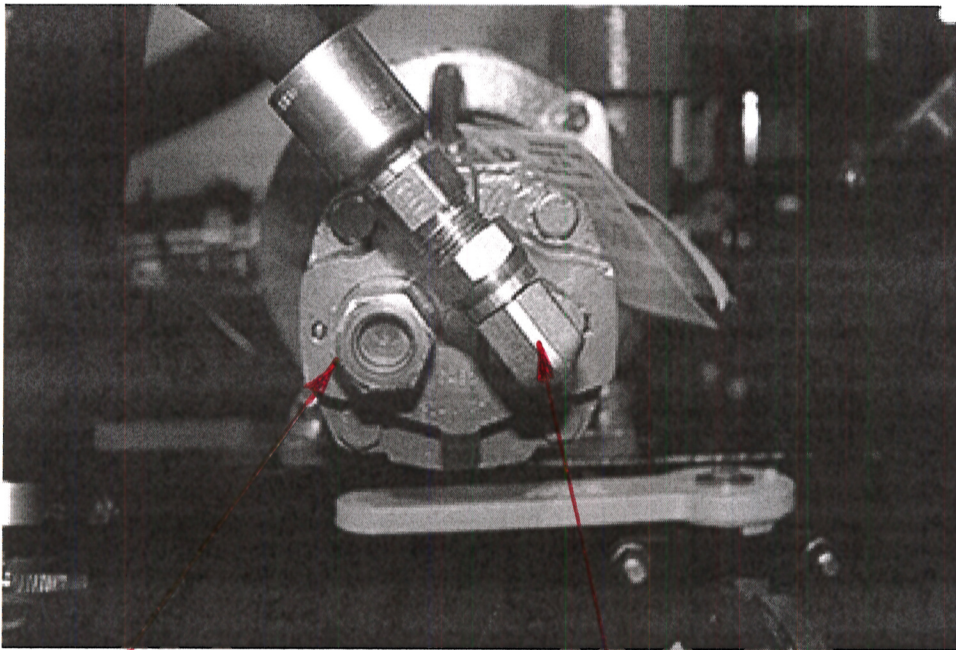
1. Always ensure the **tank(s) is completely empty** before loading or unloading the system from the dump truck. The frame is not designed to support liquid weight when free-standing.
2. Always **install and tighten the locking pins (bolts) on the front legs when the system is free-standing**. This will help prevent lateral wind forces from tipping or sliding the system, or putting undue stress on the front leg's main bolts.
3. **Important: After the tank(s) are filled for the first time, be sure to check all J-bolts which hold the tank(s) to the frame, and re-tighten them as necessary (filling the tank causes settlement which will very likely loosen these bolts).**
4. **To Load/Unload the System:**
 - A. First move & set the telescoping rear legs so that the REAR height from ground to underside of main frame channels is approximately 2-4" less than the dump truck's bed height above the ground. This may take some trial and error to work initially to find the best rear leg height setting for your particular dump truck. At this point, the system will not be level and that is fine; this step is necessary in order to be able to load the system properly.
 - B. Back up the dump truck squarely towards the unit (use spotters) so the front frame guides are inside the bed walls on each side. Once dump bed rear is under the system's front wheels by 2'6" to 3', then rotate the bed up until the system's front wheels contact the dump bed. This will take weight off the system's front legs so that the locking pins can be removed and the legs become free to rotate up (Note: depending upon the dump bed height, the bed's rotation angle may need to be 30-40 degrees during this step to remove weight from the system's front legs). Store front leg lock pins for later use.
 - C. Now, rotate dump bed back down to approximately 10 degrees and drive the truck backwards slowly so that the unit rolls into the dump

- bed. Have a spotter on each side watch the front legs rotating back and up towards the system's main side channels and pull the legs out slightly if necessary to avoid legs catching on the side channels.
- D. Stop backing when front-most portion of tank dome is approximately 6" from the closest projection of the bed's front end (this allows some room for tank movement due to liquid sloshing when stopping/starting/bumps, etc.).
- E. Then install 4" square tube and tailgate "latch pins" (included, but shipped separately) along bottom side of system to securely hold system in the dump bed. Weld this square tube to the bottom side of system's main 6" side channels and then weld the latch pins near the end of the 4" square tube (each side). The latch pins must be locked into the tailgate's latch pin groove. Load binders must also be installed at each rear corner before driving the truck (load binders supplied by owner; these provide extra protection in the event of a latch pin release).
- F. Follow steps A-D in reverse to unload the system.
5. **Raven Console Cable Connection Notes:** Once the system is loaded on the dump truck, attach the console cable to the console and the other end to the flow control cable. Then attach the leads at the end of the flow control cable to the hydraulic control valve, the flow meter and the boom control valves. Then install the red (12V) and white (Ground) wires coming off the console cable to the truck's 12V battery source (See the Raven DCS400 Installation and Service Manual section on battery connection before proceeding with this step). Then check to be sure that all of the boom on-off valves open and close properly by switching the power switch on and the master boom switch on, then switching the left, center and right boom switches on and off (have another person watch the valve indicators which show open and close). Note: The "Master" Boom Switch must be ON in order to activate the left, center and right boom switches).
6. **Hydraulic Hose Connection Details:** Use at least 3/4" hoses (with reducers at ports as necessary) to "supply" the sprayer's hydraulic control valve and also to "return" from the sprayer's hydraulic control valve and pump. The hose from the hydraulic control valve's "controlled flow" port (labeled "CF") will already have been pre-installed to the sprayer's liquid pump hydraulic motor "IN" port. You will need to run a 3/4" hydraulic hose from your hydraulic system's "supply" port to the sprayer's hydraulic control valve "inlet" port (labeled "IN"). You will also need to run a "return" hydraulic hose from the sprayer's liquid pump hydraulic motor "O" (OUT) port back to the truck's hydraulic reservoir (note" this return hose should tee into the hose which is returning back to the reservoir from the hydraulic control valve's "EX" (Exhaust) port, providing you with one "return"

hose running back to your truck's hydraulic reservoir from the sprayer. Be sure you have sufficient hydraulic oil flow and pressure to the spray system's hydraulic control valve (12 GPM at 2300 PSI hydraulic oil is required; if you are not sure, then check the flow and pressure with a hydraulic flow meter). See photo of Hydraulic Control Valve below:



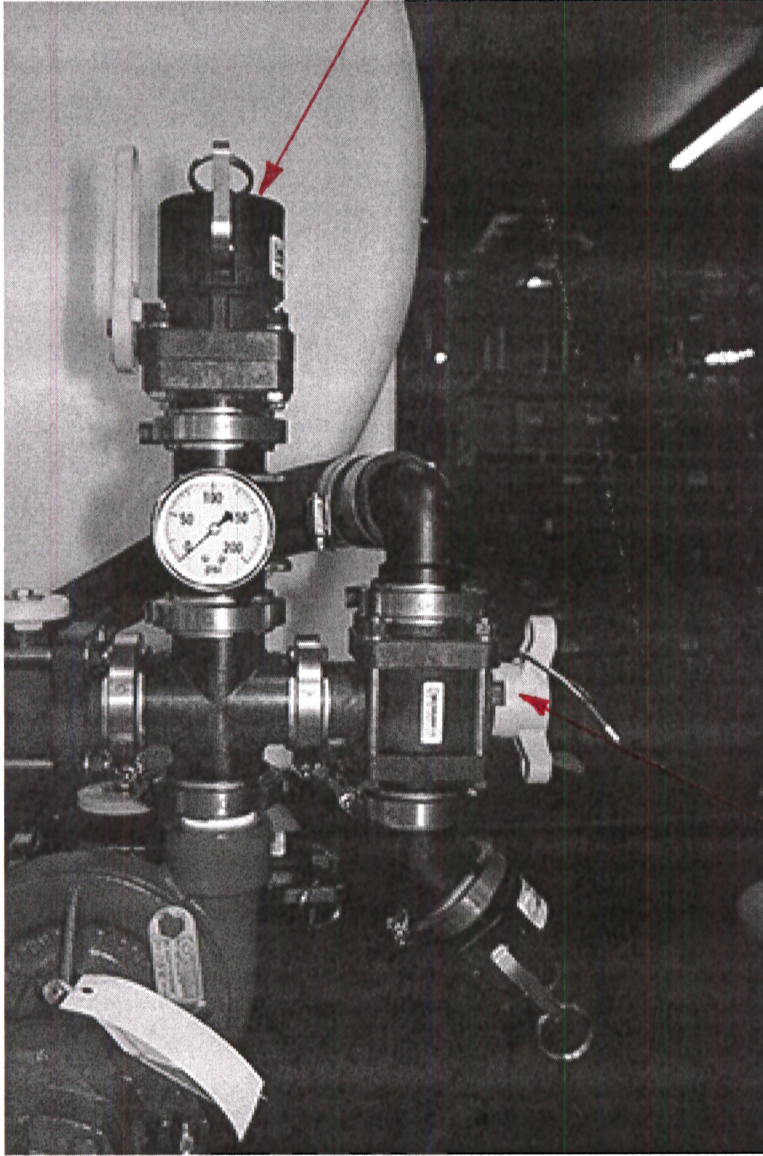
7. **Ace Liquid Sprayer Pump Notes:** Do not change the bypass screw setting on the sprayer pump's hydraulic motor (pre-set at factory) since the sprayer's hydraulic control valve will automatically regulate the correct hydraulic oil flow to the sprayer pump's motor for the speed and liquid spray rate you are applying (if you are running the DCS400 console in the cab in “automatic” mode, which should be done in most all cases to keep you applying the liquid spray rate you have programmed and selected). Likewise, do not install the “restrictor” orifice which is cable-tied to the sprayer pump's hydraulic motor (not needed due to the sprayer's hydraulic control valve). See photo and notes below for other hydraulic “return to reservoir” hose connection details:



Install your truck's hydraulic "return to reservoir" hose into "O" (Out) port on Sprayer's Liquid Pump Hydraulic Motor (and Tee it into the "return to reservoir" hose coming off the "EX" port on Sprayer's Hydraulic Control Valve).

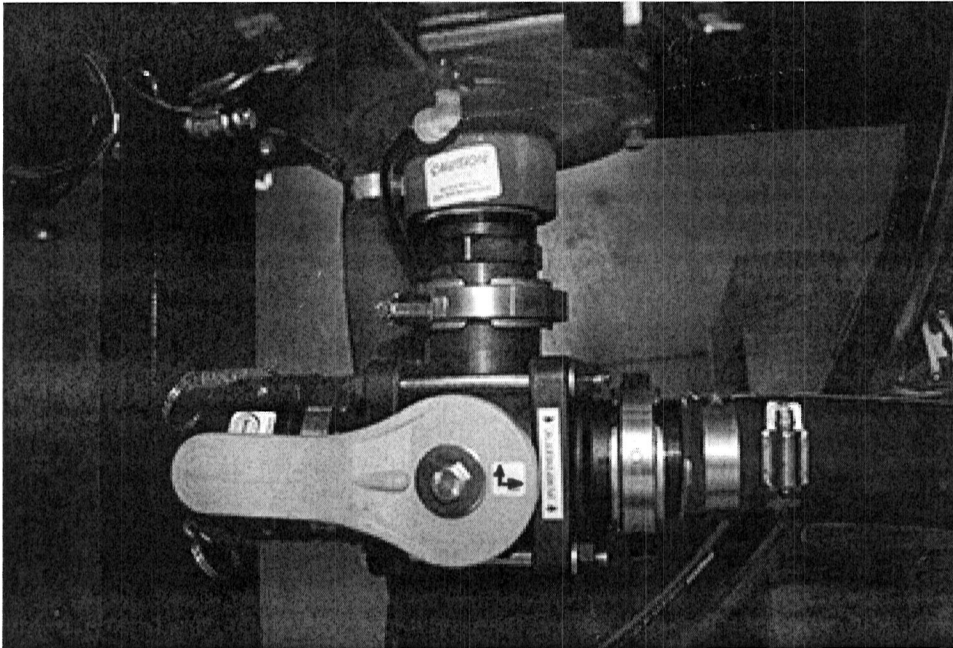
Hydraulic hose from Sprayer's Hydraulic Control Valve has been pre-installed to the "I" (IN) port on the Sprayer's Liquid Pump Hydr. Motor.

8. Sprayer Liquid Valve Photos with Notes:

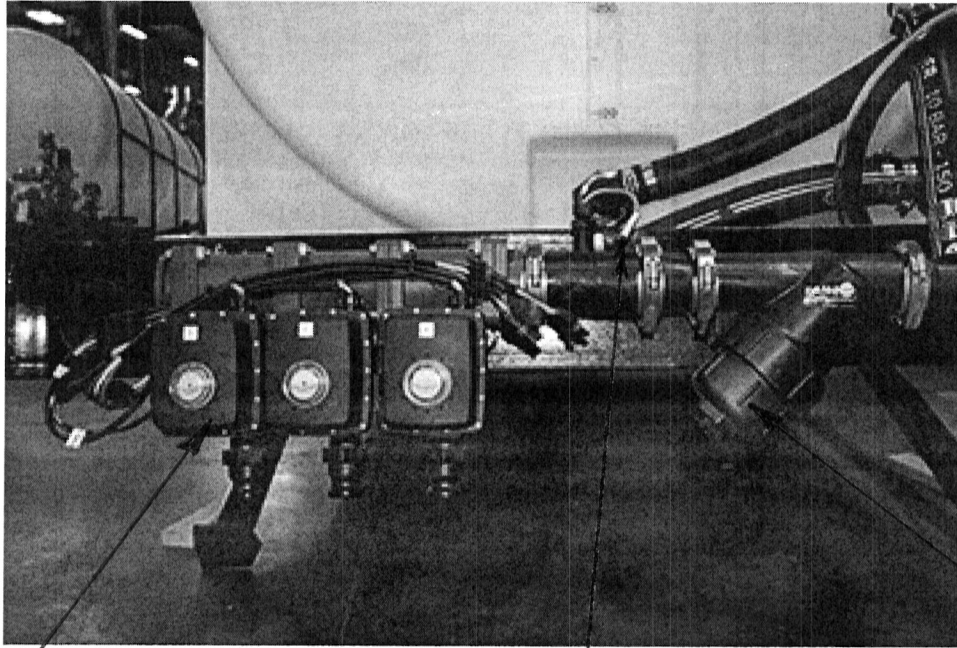


Top Valve (and Cap): Keep closed whenever pump is running. Only use to fill Sprayer Pump and Plumbing with RV Anti-freeze when done spraying. Keep pump and plumbing full of RV Anti-freeze in off-season.

3 Way Valve: Keep Valve closed when Spraying. Only use when Recirculating product in tank (up position) or when off-loading product back to your storage tank when done spraying (down



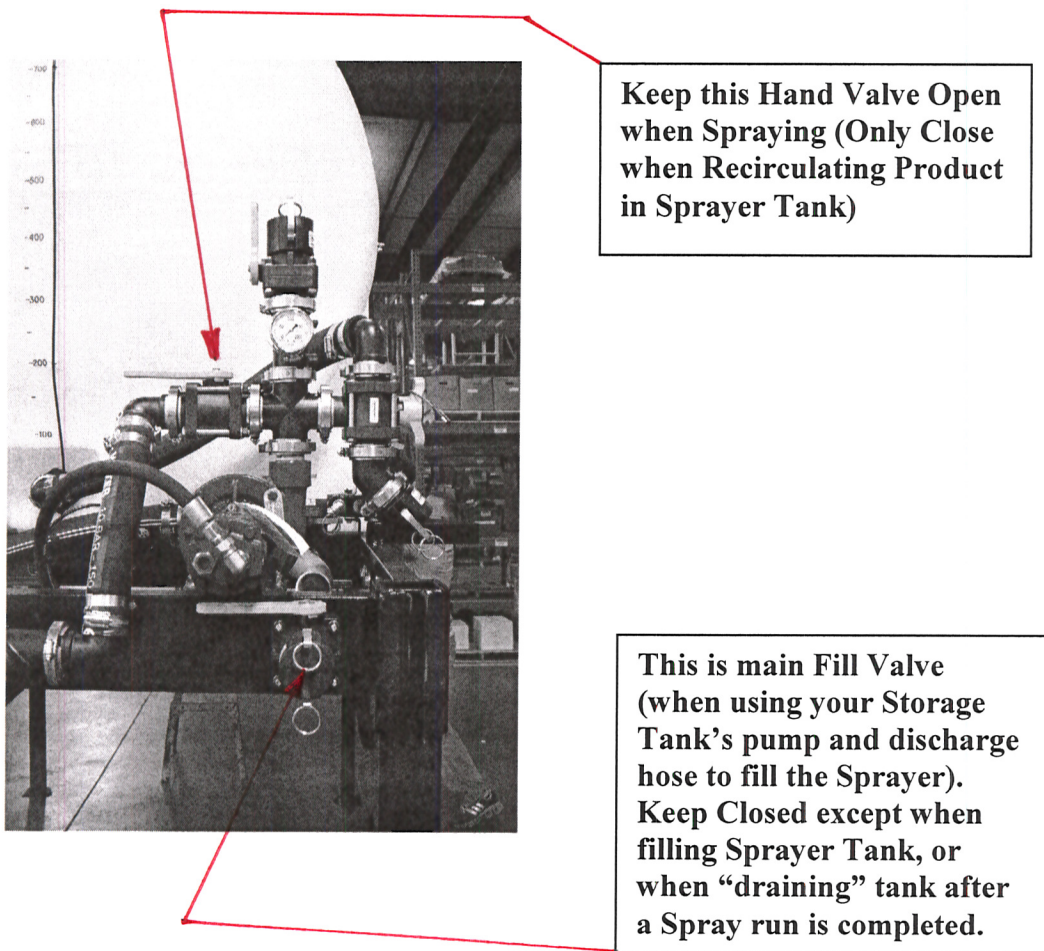
Suction Valve: Keep this 3 Way Hand Valve in position shown when Spraying (will pull product from Tank Sumps and into Pump Suction Port). Only turn this Valve to opposite position than shown when needing to use Sprayer Pump to pull product from your Storage Tank.



**3-12V Boom Valves;
Camlock the 3 Boom
Section Hoses to these
Valves**

**Raven Flowmeter:
Attach 3 Pin
Connector to 3 Pin
Connector on Rear
Cable Harness. Also,
Meter Calibration # is
shown on White Tag
on Meter Cable**

**Strainer: Remove
& Clean Screen
before each major
spray run**



9. **Preparing the Boom for Spraying:** Turn the 3 way ball valve located atop the boom's center tee so liquid is diverted to the solid stream nozzles located under the main boom for anti-icing & de-icing (most product suppliers prefer solid stream nozzles for both anti-icing (pre-treating dry pavement) and deicing. Note: You may need to install larger orifice nozzles if you will be doing liquid deicing since those rates are generally 2 to 5 times greater than Anti-icing rates). Check application rates for both Anti-icing and Deicing with your Operations Manager (and possibly your product supplier) and then call us if you have questions on the best nozzle sizes for the speed range and application rates you will be spraying. Additional Note: for summer dust control spraying, watering sub-grades, etc: you can turn this 3-way valve to direct flow to the flooding nozzles mounted atop the boom pipe (again, this is for the center boom section only).

10. **Skytrack GPS Velocity Sensor:** This GPS based speed sensor should mount on the roof of your truck where it has a clear “view” of the sky (satellites). It has a magnet plate to make mounting simple and quick. After mounting, simply run the 3-pin connector cable from the GPS sensor module into the back of the Raven DCS400 console in the cab of your truck. (Note: These systems take 10-15 minutes on the first setup to download data from the satellites; after that, warmup takes only one minute or so after being powered up).
11. **Raven Control System:** You are now ready to program the DCS400 (or DCS410) controller. Below is a summary of programming the DCS400 for roadway Anti-icing or Deicing. The DCS 410 controller programs similarly. See the DCS400 (or DCS410) Installation & Operating Manual for more details on programming and other features of the controllers:

Some “Suggested Settings” for Raven DCS400 Controller for DU 1A045 and 1A054 Anti-Ice and Deice Spray Systems; Keep in cab.

US, SP2, CF-C

Note: Above 3 Settings are for US (English) units, Skytrack Speed Sensor, and for the Spray System’s Adjustable Hydraulic Control Valve,. They should normally not be changed (to change them, hold down the “CE” button while turning on the Power switch at the same time; this clears the console program entirely so you can enter these three settings again if you are changing them). See DCS400 (or DCS410) Installation & Service Manual for additional details if needing to make changes to these values.

Check the following settings periodically to be sure they haven’t been accidentally changed by someone (Controller memory will retain them indefinitely even when Power switch is shut off).

Programming (or Checking) or Programmable Buttons:

Remember to check and change only if necessary as follows: Push the desired button and be sure its light comes on, then press the “E” button so you see an “E” in the right display screen, (This indicates that the console is ready for you to “Enter” a value) then press the new number you want, then press “E” again:

Lane = 12 (This is lane width in feet).
B-L = 144 (Boom width left side in inches).
B-C = 144 (Boom width center in inches).
B-R = 144 (Boom width right side in inches).

Note: Use the arrow keys on the left to toggle between Width, B-L, BC & B-R.

Speed Cal = 598 (Check after programming with a test drive; see below).

Meter Cal: Should match the “Meter Cal #” on the Meter’s Label Tag
Valve Cal = 743 (for the Adjustable Hydraulic Control Valve; 2123 for a Liquid Control Valve; the Valve Cal. # is shown clearly on the Valve Label; input the number stamped on that label).

Note: Check Speed Cal and Meter Cal settings at least once per month (to ensure no one has changed them).

Rate Cal Settings (you may change these periodically; these are always entered in GALS PER LANE MILE). Enter up to 6 different rates and use the round “rate selector switch” at the top center of the Controller to select the rate you want on that spray run. The System will automatically maintain the rate setting you select (IN GALLONS PER LANE MILE) regardless of speed changes and regardless of whether you are spraying one, two or three lanes at a time.

Some Possible Anti-icing/De-icing rate settings (GALLONS PER LANE MILE) ALWAYS determine actual rate settings with your Chief of Snow Control Operations.

Rate 1 = 20, Rate 2 = 30, Rate 3 = 40, Rate 4 = 50, Rate 5 = 60, Rate 6 = 70

Remember, you can set rates wherever you need/want to (confer with your Product Suppliers and your Chief of Snow Control Operations). Push the “Rate Cal” button and be sure its light comes on, then press the “E” button so you see an “E” in the right display screen, then press the new number you want for each rate, 1, 2, 3, 4, 5, and 6 then press “E” again (as you do this, use the arrow keys on the far left to toggle up/down from rates 1-6).

Note: If you need to apply rates at less than 20 GPLM or are driving at slow speeds, then your nozzles may need to be smaller; otherwise the standard large nozzles may “gravity” flow more product out than you are desiring; in that case the controller alarm may go off and your spray “pattern” will be diminished. Call our Tech Sales support for smaller nozzles in that case.

“Blast” Button Possible Settings (This is also in Gallons per Lane-Mile; may use for Bridge Decks, etc; Always determine actual Blast Settings with your Chief of Snow Control Operations. Also note that you do NOT need to use the Blast Button at all which is generally recommended by most product suppliers; however, you must PROGRAM this button with some values (see below to “disable”).

B-R = 60 (Blast Rate in Gallons per Lane Mile; This may be higher than you want; do not over-apply products, especially when Anti-icing; check with your Product Supplier and Chief of Snow Control). **B-S = 5** (Blast Time in Seconds; depends on the bridge length. Note: If you want to effectively “disable” the blast button (strongly recommended), then enter a B-S = 1 (one second) and enter B-R = 1

The Flashing “Cal” light in left display screen should now go off since you are done programming:

You are now ready to check the Speed Cal button (was set to 598 during initial programming). To do this effectively, follow the procedures in the “Calculating Speed Cal” section of the DCS400 (or DCS410) Installation & Service Manual. To do this properly, you will need to drive a known mile distance (using accurate mile markers, etc.) and have the manual (formula in manual) and a calculator with you. Please call if you have any questions on proper Speed Calibration for the sprayer; this is an important step to have done properly or your spray application rates will be off.

12. You are now ready to test the sprayer with an initial “Self-Test” and Road Test Initial Spray Run. Follow the procedures in the DCS400 (or DCS410) Installation & Service Manual titled “Initial System Setup” and “Initial System Road Test” (note: you have a centrifugal sprayer pump so ignore any comments on Positive Displacement pumps and associated pressure relief valves).
13. Important Note: You will need to remove air from the suction hose the first time so you do not run the sprayer pump dry and burn up its seal. To do this, crack open the 2” discharge valve on top of pump’s discharge port (and remove cam-lock cap), then run the sprayer pump (truck hydraulic system on, rotary knob on DCS400 (or DCS410) controller set to “manual” and pushing “increase/decrease” knob up (increase). This will purge the air out of the suction hose, then close this valve and re-install cap.

Contact Dultmeier Sales – Engineering Department with Programming, Speed Cal or Nozzle Sizing Questions (Omaha: 800-228-9666 ext. 5536 or ext. 5792).

IMPORTANT: POST-SPRAY RUN FLUSHING PROCEDURES:

- A. First, flush the entire system plumbing and pump thoroughly with water when spraying work is completed to remove salts and other corrosive liquids (after each spray event). Otherwise, in a short period, salts can crystallize into solids causing clogging of valves, nozzles, etc. **(Note: If you are using a non-corrosive liquid, you may skip steps A-C here and simply keep the system fully “charge” with liquid, as long as the liquid will not “gum” up or crystallize in cold weather; otherwise, proceed with A-C here after each spray event).**
- B. Second, Drain the entire system plumbing and pump thoroughly to remove all flushing water:
 1. Drain the pump; unscrew drain plug at bottom of pump to drain.
 2. Remove strainer cap to drain strainer, suction and discharge plumbing (open the “Drain-Fill” Valve, Boom On-Off Valves, valve feeding to hose reel and hose end gun (if you have a hose reel) when doing this to let air in and to be

sure all suction and discharge plumbing including the boom itself are fully drained out).

3. Re-install strainer cap and close all valves.
- C. Third, Fill the entire system plumbing and pump thoroughly with either RV anti-freeze or 50% Anti-freeze/ 50% Water to eliminate corrosion and prevent freezing (this last step is very important; without liquid in the pump and plumbing, air will cause corrosion to take place).
- D. Fourth, Flush the truck bed and the skid frame with a low pressure hose to remove corrosive liquids. DO NOT use a high-pressure hose nor spray water directly on the pump, electric valves or wire connections during flushing operations.

IMPORTANT: MAINTENANCE INSTRUCTIONS FOR DULTMEIER SALES SELF-LOADING ANTI-ICE/DE-ICE/DUST CONTROL SPRAYING SYTEMS

1. Perform pump hydraulic motor (or engine) maintenance in accordance with manufacturer's maintenance instructions (pump manual should be shipped with system; call if additional copies are needed).
2. **Check J-bolts holding tank hoops to steel frame periodically and tighten if necessary.**
3. Verify the Speed Calibration periodically (at least once every two months and before the start of each season) follow the procedure outlined in the DCS400 (or DCS410) Installation & Service Manual.
4. Also verify the Meter Calibration periodically (at least once every two months and before the start of each season) follow the procedure outlined in the DCS400 (or DCS410) Installation & Service Manual.
5. Check and clean the strainer screen before each spray run.
6. Before the start of each season (or if system is running well and then changes occur), check the flow meter for clogging or crystals-See DCS400 (or DCS410) Installation & Service Manual.

Parts Listing

Main Sprayer Components (See Detailed Listings Below for DU1A044 Plumbing Kit, DU1A044 Raven Auto Control Pkg, and DU 1A062B-1 Boom Plumbing Kit):

DU1A040	Pump/Plumbing Pkg Anti-Icing/1800 Gal.	0	1	EA
DU1A052-20	1800G Tank W/Xtnd Frame&Legs,1.9SG Tank	0	1	EA
ST1000R	Gps Speed Sensor W/Raven Connector,9HZ	0	1	EA
DU1A044	Raven Auto Control Pkg W/ Dcs 400	0	1	EA
1A062B-1	1-1/4 Boom Pkg Vert/3 Lane/Floods			1 EA

DU1A040 Pump/Plumbing Pkg:

TWT200	2 IN Hose Barb Tee	0	2	EA
XX2343	Miscellaneous Nuts/Bolts	0	20	EA
TKLS220	20 Mesh Screen-316Ss/Beige	0	1	EA
TKMLS200-50	2 IN Stdport Flanged Y Strainer 50M	0	1	EA
TKMV200BL	3 Way Poly Valve/Flanged 2 IN Std F	0	1	EA
TKLS250	50 Mesh Screen-316SS-Blue	0	-1	EA
MP843-250	High Torque Clamp.Quantity Is Per Cla	0	32	EA
TKV25271	90 Mounting Bracket	0	2	EA
TKM220200CPG	Flanged Reducer 2 IN Fpx2 IN	0	1	EA
TKP100F	1 IN Poly Adaptor	0	3	EA
TKM200150MPTSS	2 IN Std Port Flange X 1-1/2 IN Mpt	0	1	EA
TKM200CR	2 IN Flanged Cross	0	1	EA
TKP200CAP	2 IN Poly Camlock Cap		1	EA
TKM700D	2 IN Flange X 2 IN Mpt Adaptor	0	1	EA
KA390SD-1-1/4	Epdm Suct/Discharge Hose - Black	0	18	FT
DUSP9838	Lynch Pin 5/8 X 4 Inch	0	4	EA
HH6901-10-8	#10 Oring X 1/2Npsm 90Deg Female Swivel		1	EA

TKM200CPG45	2 IN 45 Flanged Elbow	0		1	EA
ACFMC200HYD304	2 X1-1/2 Hydraulic Centrifugal Pump	0		1	EA
GDN645-2	Epdm Suct/Discharge Hose	0		25	FT
LMELT1814	Fixed Elbow, 1/8M x 1/4T, Gray	0		2	EA
TKM201G	2 IN Epdm Flange Gasket/2"SP w/R	0		14	EA
TKMV220SL	3 Way Poly Valve/Flanged/2 IN Full I	0		1	EA
HH6900-10-8	#10 Oring X 1/2 Npsm Swivel Adapter	0		1	EA
TKM700E	2 IN Fp Flange X 2 IN Mpt Adaptor	0		1	EA
TKM200A	2 IN Male Adapterx 2 IN Flange	0		1	EA
HH4975	90 Hyd Adapter, 1/2Mxf	0		1	EA
KZ400-32IM-GLE	Qx4 Triple Valve Assy/1 IN Fpt X 2 I	0		1	EA
TKMV200CF	2 IN Valve/Flnged X Flnged	0		1	EA
TKVSF200CF	2 IN Valve/Flanged X Adaptr	0		1	EA
TKPHB200	2Mptx2Hb Poly Fitting	0		4	EA
XX3412	Molex Connector Charge	0		4	EA
TKFC220	2 IN Fp Flange Clamp	0		5	EA
KA112CL-3	Pvc Suction Hose	0		12	FT
TKM702G	90 Elbow 2 IN Flange X 2 IN Hb	0		4	EA
TKM221G	2 IN Epdm Flange Gasket/2"FP w/Ri	0		5	EA
TKM220A	2 IN Male Adaptor X 2 IN Fp Flange	0		1	EA
AH2640-70	2.5 IN 200# Back Liquid Gauge	0		1	EA
TKMVSF220FP	Valve 2 IN Fp Flange X 2 IN Adaptor	0		1	EA
TKM200100TEE	2 IN X2 IN X1 IN Sp Polyprop Tee.	0		1	EA
PA10143-8-8	43 Crimp Fitting, 1/2H X 1/2Mpt Solid	0		2	EA
TKFC200	2 IN Flange Clamp	0		14	EA
TKM100PLG025	1 IN Flange Plug W/1/4 Fpt	0		1	EA
FC75G	3/4 Epdm Gasket	0		1	EA
TKFC100	1 IN Flange Clamp	0		1	EA
PA422-8	1/2 100R1 Hydraulic Hose	0		4	FT
TKM701I	2 IN Fp Flange X 2 IN Hb	0		2	EA
BDJS208	5/8 x 2-1/4 Clamp, Each	0		3	EA
MP843-200	High Torque Clamp.Qty Is Per Clamp	0		3	EA
TF1011	1-1/4 Vinyl Tubing Per Ft	0		4	FT
TKM702G	90 Elbow 2 IN Flange X 2 IN Hb	0		4	EA

DU 1A044 Raven Auto Control Pkg w/ DCS400:

RV115-0159-955	10 FT Product Cable F/ Dcs400/410	0	1	EA
RWPS-GRN	Weatherpack Dust Seal (Green)	0	9	EA
RV115-0171-060	Control Valve Adaptor Cable	0	1	EA
RVDCS400	Dcs400 Controller Only	0	1	EA
RV115-0159-971	31 FT Console Product Cable F/ Dcs400	0	1	EA
RVRFM100	2Inch Poly Flow Meter-2 IN FP Flange/FPT	0	1	EA
RVWPF-15	Female Weatherpack Pins (14-16G)	0	9	EA
RVWPT3	3 Port Male Weatherpack (Tower)	0	3	EA
RV063-0172-193	-Use RV063-0173-163	0	1	EA
RV063-0173-163	Hydraulic Control Fast Valve,16 GPM	0	1	EA

DU 1A062B-1 1-1/4 Boom Pkg/Vert/3 Lane/Floods:

SSCP25607-1	Black Qj Cap	0	19	EA
CT304-1/4XCL	1/4Xclose 304Ss Nipple, Sch40	0	2	EA
TKPEL114	1-1/4Mptx1-1/4Hb Poly Elbow	0	2	EA
CT7SE14	1/4 304SS 90 Street Ell, 150Lb	0	4	EA
CT7TT14	1/4 304SS Tee, 150Lb	0	2	EA
JK1205-125	1-1/4 IN Pvc Adj Checkvalve	0	3	EA
TKP125C	1 IN Poly Coupler X 1-1/4 Hb	0	3	EA
XX3400	Assembly Labor Charge	0	150	MN
SSH1/4USS0060	Ss Veejet Nozzle, Solid	0	12	EA
TK900-1-1/4XCL	1-1/4XCL Polypro Nipple	0	1	EA
SSCP20582-1/4PP	Ball Nozzle For 37235, 1/4 FPT	0	12	EA
SS20570D-1-1/4	1-1/4 Clip Body with Cap	0	12	EA
DU1-1/4X18BM	18 IN Vertical Pipes For 3 Lane Boom	0	1	EA
TKPHB125	1-1/4Mptx1-1/4Hb Poly Fitting	0	3	EA
SS19438EPR	Single EPDM Cap Gasket, Each	0	19	EA
MP843-200	High Torque Clamp.Qty Is Per Clamp	0	7	EA
DU1-1/4BOOM	1-1/4 SSBoom, Anti-Ice Bare.	0	1	EA
SSSS0020	Stainless Teejet Nozzle	0	19	EA
SSQJ-1/4TTNYB	1/4Mpt Male Qj Body	0	19	EA
ZSUB1-1/4PA6	1-1/4 IN 316Ss U-Bolt Clamp W/Cushion	0	2	EA
TKPEL10114	1Mptx1-1/4Hb Poly Elbow	0	2	EA
DU1A062K	Coupler Kit For 1-1/4Boom 1-Pair	0	1	PR
TK906-1-1/4	1-1/4 Polypro Tee	0	1	EA
TK900-1-1/4XCL	1-1/4XCL Polypro Nipple	0	3	EA
TK908-1-1/4	1-1/4 90 Polypro St Ell	0	1	EA
KA390SD-1-1/4	Epdm Suct/Discharge Hose - Black	0	4	FT
TKP075B	3/4 Poly Coupler W/Guide Lck	0	2	EA
TK901-1X3/4	1X3/4 Polypro Bushing	0	2	EA
SSQCKSS150	Brown Floodjet Nozzle	0	2	EA
TKV125BL	1-1/4 IN 3Way Valve/Bottom	0	1	EA