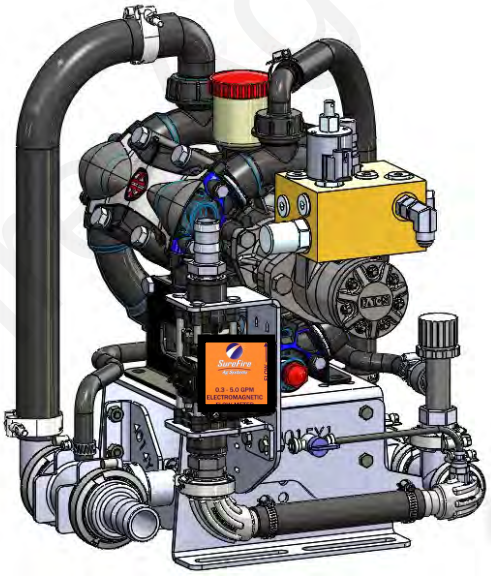
396-4509Y1

PumpRight Fertilizer System for Pro 700 and Case 2000 Series Planter UCM

PUMPRIGHT HYDRAULIC DRIVE DIAPHRAGM PUMPS for PWM Control



NOTICE

Operator should read this manual before operating the system.

Maximum Pump Flow and Application Rates

	Number of Diaphragms	Max Flow GPM	Max GPA on 40' at 6 MPH	Max GPA on 60' at 6 MPH
PR17	3	17	35	23.5
PR30	3	30	62	41
PR40	4	40	82	55
D250	6	55		75

SureFire Ag Systems

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Safety

TAKE NOTE! THIS SAFETY ALERT SYMBOL FOUND THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY AND THE SAFETY OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.

THIS SYMBOL MEANS ATTENTION!

BECOME ALERT!

YOUR SAFETY IS INVOLVED!

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The appropriate signal word for each has been selected using the following guidelines:

DANGER: Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations typically for machine components which, for functional purposes, cannot be guarded.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

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.

NOTICE is used to address safety practices not related to personal safety.

SureFire Ag Systems

Hydraulic Fluid and Equipment Safety

This system uses hydraulic equipment with hydraulic fluid under extremely high pressure.

Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin causing serious injury. Keep all hoses and connections in good serviceable condition. Failure to heed may result in serious personal injury or death. Avoid the hazard by relieving the pressure before disconnecting lines or performing work on the system.

Make sure hydraulic fluid connections are tight and all hydraulic hoses and lines are in good condition before applying pressure to the system. Use a piece of paper or cardboard, NOT BODY PARTS, to check for suspected leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems. DO NOT DELAY!

Check hydraulic hoses and fittings frequently. Loose, broken, and missing hardware can cause equipment to not perform properly and can result in serious injury or death.
Hydraulic systems can be hot and cause burns. Before working on any system, wait until the fluid has cooled.

If an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin or eyes must be treated within a few hours or gangrene may result.

A Word to the Operator

SAFETY IS YOUR RESPONSIBILITY.

YOU are the key to safety.

It is YOUR responsibility to read and understand the safety messages in this manual.

This system may be used to apply many different kinds of agricultural liquid products. Read and follow all label information and instructions related to the handling, storage, and application of the product you are using.

All electrical harnessing should be checked regularly and should be routed and secured so it will not be pinched, cut, or stretched.

SureFire Ag Systems

SureFire Ag Systems

General Description

A
Introduction

You have purchased a SureFire fertilizer system for your equipment. This system will be controlled by your Pro 700 on a Case 2000 Series Planter with the UCM Software. The rate controller will adjust the speed of the SureFire PumpRight hydraulic pump based on feedback from the flowmeter and vehicle speed. The system will have 3 sections to minimize overlap areas with section valves.

Basic Installation Steps

1. Open the packages and familiarize yourself with the components. Refer to manual sections B, C & D for component information.
2. Mount the PumpRight pump and make hydraulic connections. See section E for hydraulic plumbing information. The preferred hydraulic plumbing is to connect the liquid pump to its own remote. If that is not possible, the pump can be plumbed into the hydraulic valve on the left wing of the planter (2150).
3. Plumb the tank to the PumpRight inlet. See section E for details.
4. Install the plumbing kit including section valves, flow indicator columns / manifolds, check valves, plumbing to each row unit delivery point. See section B for information on these components.
5. Attach the flowmeter outlet to section valve or manifold inlet. Attach section valve outlets to flow indicator inlets.
6. Attach harnesses as shown in Section D.
7. Setup Controller for SureFire fertilizer system as shown in Section F.
8. Fill system with water, conduct initial operation and tests per Section F.
9. Winterize system with RV Antifreeze if freezing temperatures are expected.
10. Do preseason service and checks each year as described at the end of this manual.

Consult your Pro 700 Display Software and Case Planter Manual (Case 2000 Series Early Riser Planter Software Operating Guide) for more information on the setup and operation of your system.

TIP: Be sure your planter UCM and Pro 700 Display are running the latest software versions. Case dealers should be able to update those for you.

NOTICE

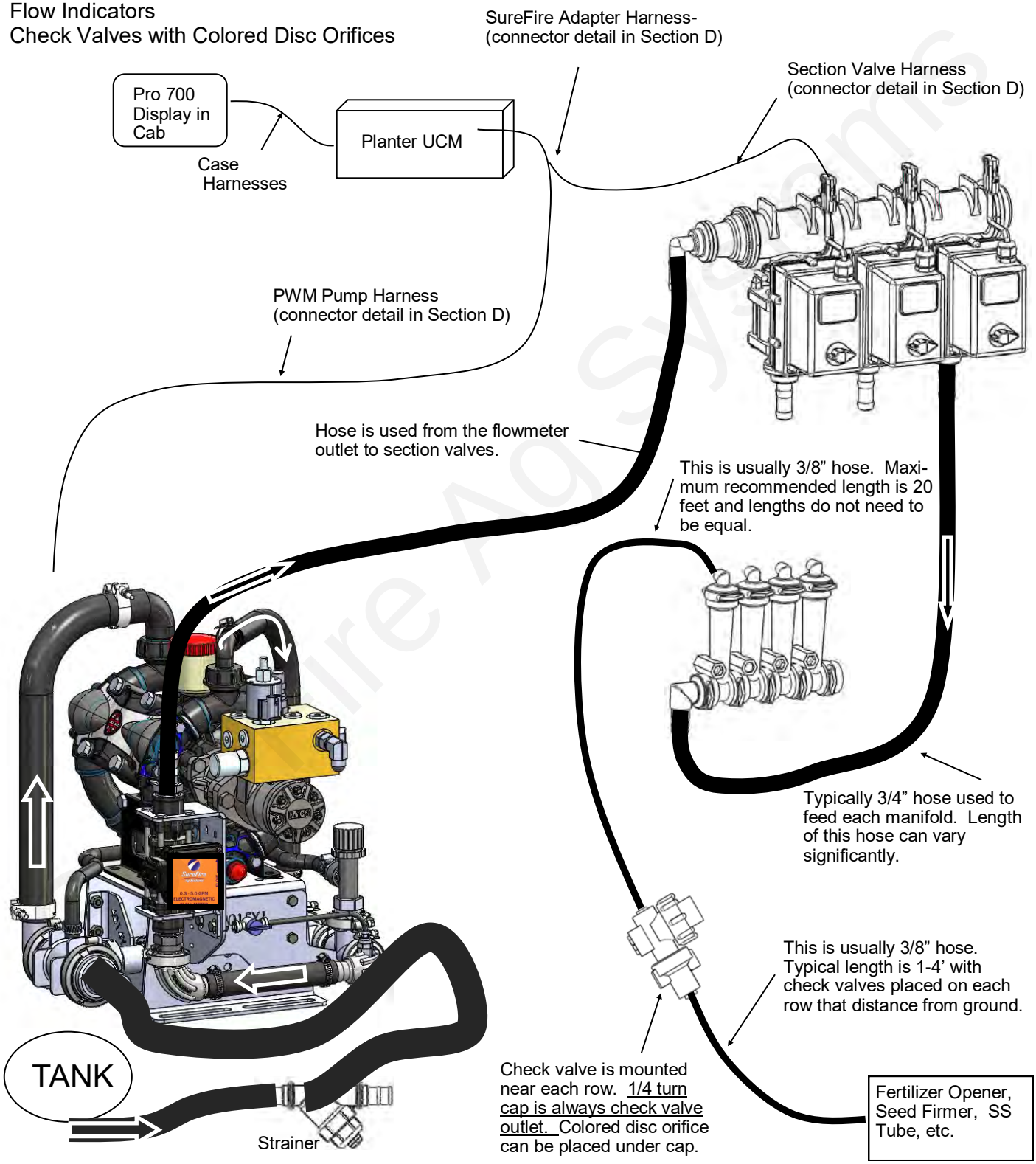
Operator must read this manual before operating the system.

SureFire Ag Systems

System Overview Example

The following gives an example of a complete SureFire Fertilizer system with these components:

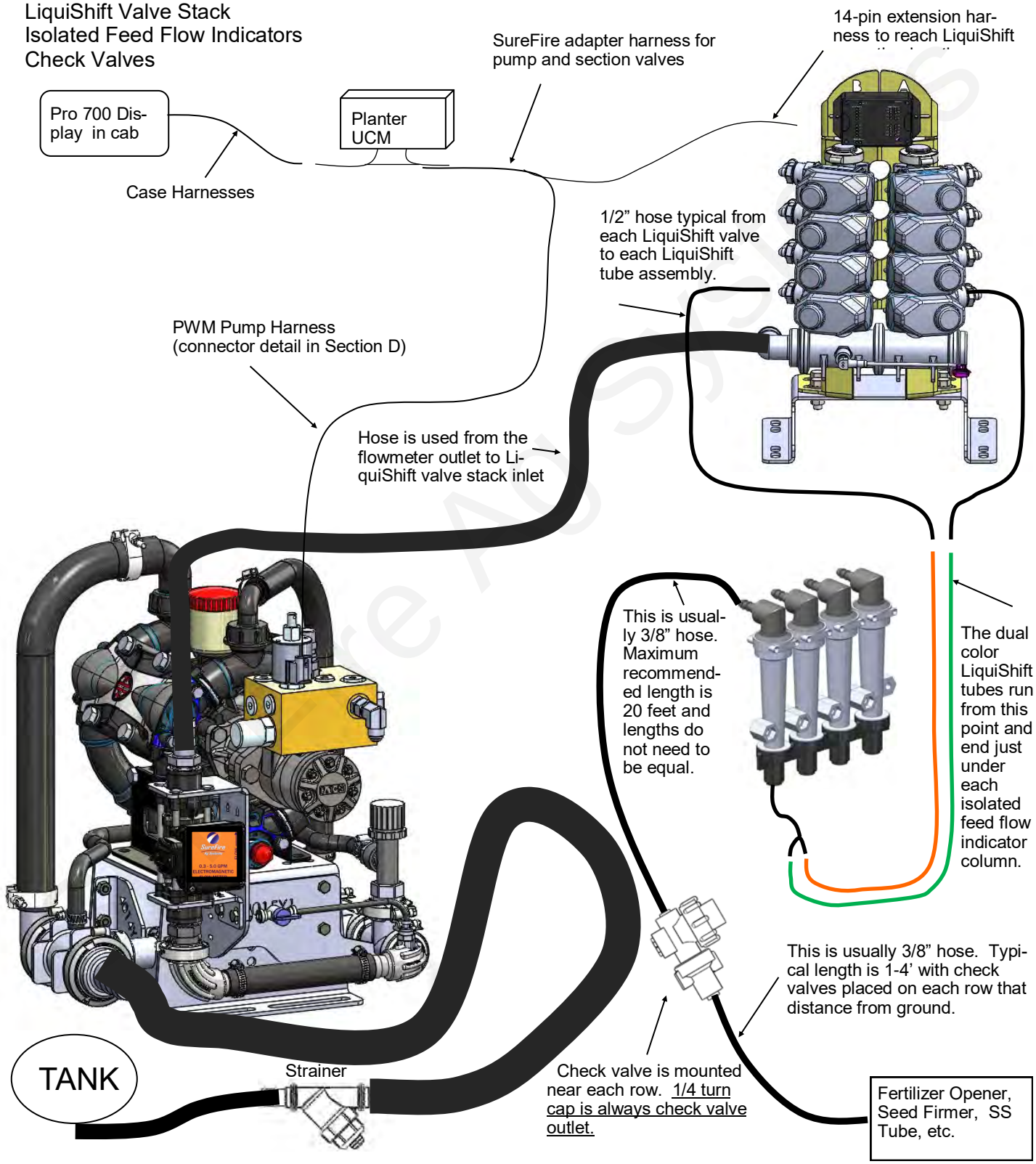
- Pro 700 Display
- Case 2000 Series Planter UCM
- PumpRight PR17
- Section Valves
- Flow Indicators
- Check Valves with Colored Disc Orifices



System Overview Example

The following gives an example of a complete SureFire Fertilizer system with LiquiShift and these components:

- Pro 700 Display
- 2000 Series Planter UCM
- PumpRight PR17
- LiquiShift Valve Stack
- Isolated Feed Flow Indicators
- Check Valves



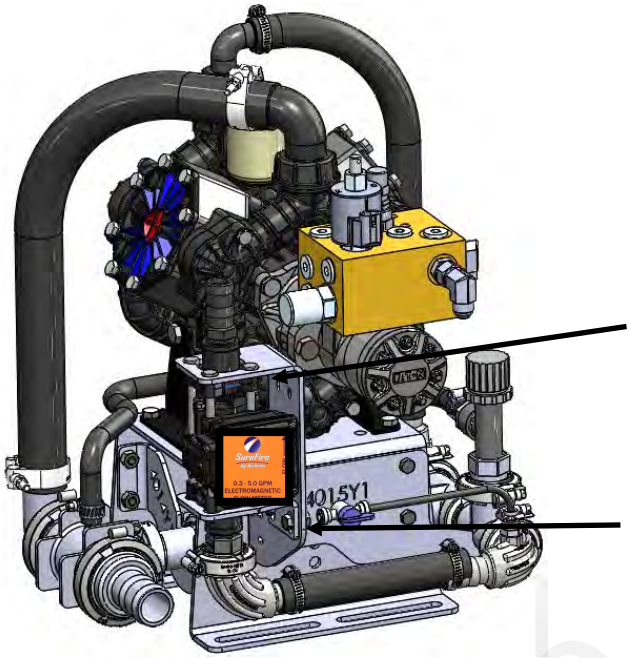
PR17 & PR30 Electromagnetic Flowmeter Kits

B
Components
Liquid

0.13 - 2.6 GPM Item Number 500-02-2082 (PR17) (Very Low Flow)
0.3 - 5 GPM Item Number 500-02-2085 (PR17) (Low Flow)
0.6 - 13 GPM Item Number 500-02-2090 (PR17 & PR30)
1.3 - 26 GPM Item Number 500-02-2095 (PR30)
Kits include flowmeter, adapter harness, mounting bracket, hose barb fittings & hose clamps.

-Before doing any arc welding on the implement, unplug the cable to the flowmeter, or damage to the flowmeter may result.

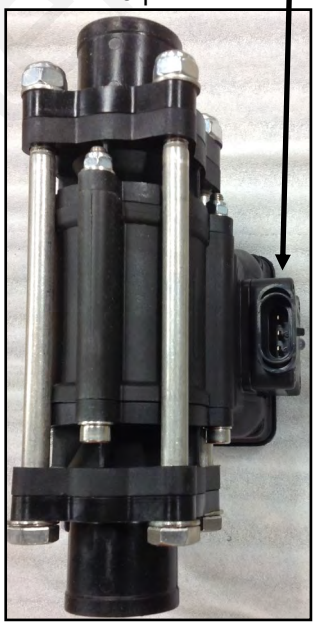
-Do not power wash the flowmeter. High pressure spray directed at the back edge of the face plate or at the wire connector may allow water into the flowmeter electronics.



Mounting Bracket, 410-4015Y1 (QTY 1) (not used for PR40 and D250 Pump)

Mounting Bracket, 400-3826Y1 (QTY 1) (not used for PR40 and D250 Pump)

Amp SuperSeal 3-pin connector
Use adapter 201-17842
to connect to 3-pin MP harness



Troubleshooting Tip:

Remove red guard to reach pins. Be careful so you don't break red side keepers.

3-pin MP Tower A- Signal B- 12V Power C- Ground *(See the next page for more flowmeter tips)*
3-pin AMP SuperSeal 1– Ground 2– 12V Power 3– Signal

Electromagnetic flowmeters are superior to traditional turbine flowmeters in two basic ways. First, they have no moving parts. There are no wear items or potential for contaminants to jam a spinning turbine.

Second, electromagnetic flowmeters detect the flow by electrically measuring the velocity of the liquid, which makes them independent of viscosity or density of the fluid measured. They are extremely accurate using the standard calibration number. **SureFire still recommends you perform a catch test to verify the system is properly installed and configured.**

Flowmeter Model (black meter with orange label)	Field-IQ Flow Calibration	FPT Size	Hose Barb In kit
0.13 - 2.6 GPM	3000	3/4"	1"
0.3 - 5 GPM	3000	3/4"	1"
0.6 - 13 GPM	**2000**	**3/4"**	**1"**
1.3 - 26 GPM	**2000**	**1"**	**1"**

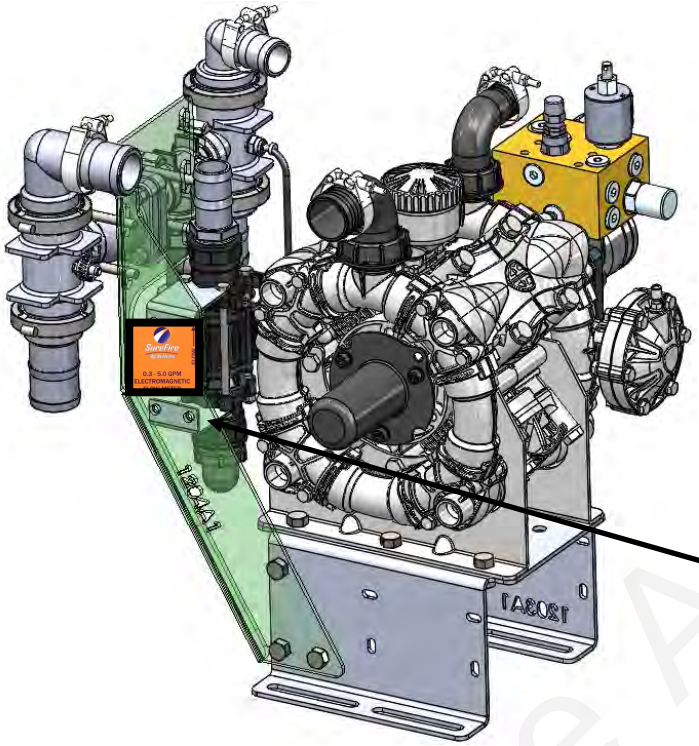
PR40 & D250 Electromagnetic Flowmeter Kit

2.6 - 53 GPM Item Number 500-02-2080

Kits include flowmeter, adapter harness, mounting bracket, hose barb fittings & hose clamps.

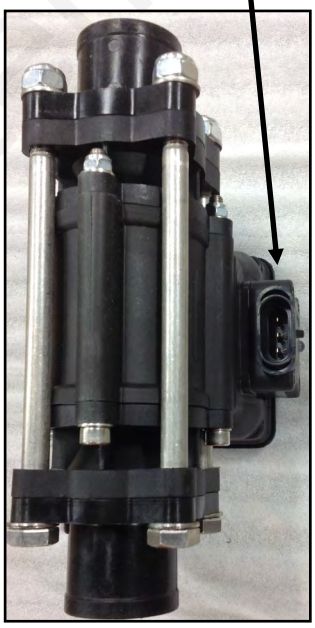
B
Components Liquid

-Before doing any arc welding on the implement, unplug the cable to the flowmeter, or damage to the flowmeter may result.
-Do not power wash the flowmeter. High pressure spray directed at the back edge of the face plate or at the wire connector may allow water into the flowmeter electronics.



Mounting Bracket, 400-3335Y1 (QTY 2) (used for PR40 and D250 Pump only)

Amp SuperSeal 3-pin connector
Use adapter 201-17842
to connect to 3-pin MP harness



1 2 3

Remove red guard to reach pins. Be careful so you don't break red side keepers.

Troubleshooting Tip:

3-pin AMP SuperSeal 1– Ground 2– 12V Power 3– Signal

Power to Ground should be 12 volts.
Signal to Ground should be 4.5 to 5 volts
Do Tap Test between Signal and Ground to test harnessing.

3-pin MP Tower A- Signal B- 12V Power C- Ground

Additional Tip:

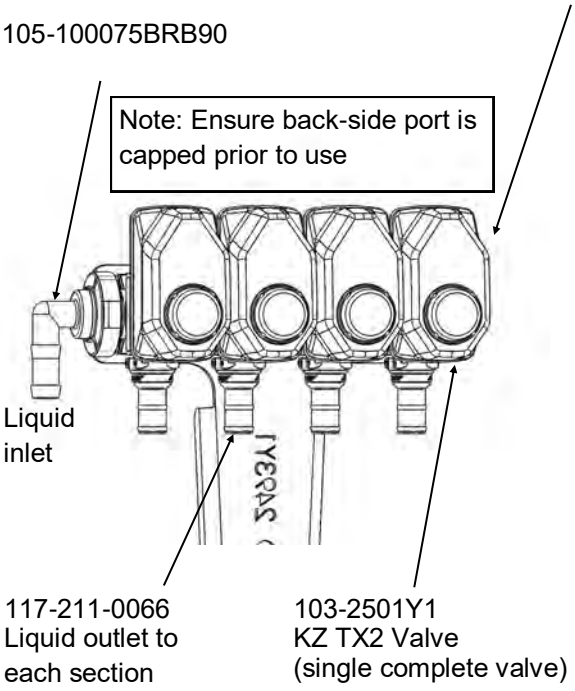
If flowmeter is not reading and the harnessing has checked out OK with voltage readings and tap test, try cleaning the inside tube of flowmeter with warm soapy water and a soft brush. Sometimes, a film builds up on the electrodes.

Flowmeter Model (black meter with orange label)	JDRC 2000 Flow Calibration	FPT Size	Hose Barb In kit
2.6—53 GPM	2000	1-1/4"	1-1/2"
1.3—26 GPM	2000	1"	1"

Section Valves and LiquiShift Valves

105-100PLG (alternate
105-100PLG025 includes 1/4" pipe
thread for gauge)

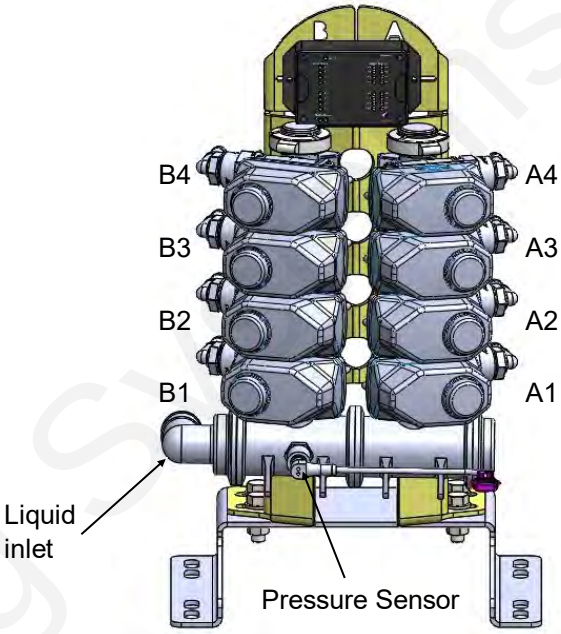
105-100075BRB90



Additional Parts:

1" Gasket	105-100G-H
1" Clamp	105-FC100

LIQUISHIFT
Variable Rate Technology



4-section LiquiShift shown.
2000 Series planter will have 3 sections.

How section valves work

Section valves can be assembled into groups with a common inlet to control flow to each section. Common assemblies use up to 5-6 valves, however, more can be used where practical. Many alternate fittings can be used to accommodate different hose sizes and configurations.

The valves have a 3-pin weather pack electrical connector. This has a power, ground, and switched wire. The power measured to ground should have 12 volts when the controller is on. The switched wire will have 12 volts to turn the valve on, and 0 volts to turn the valve off.

Wiring Connector:
Pin A—Red, 12 Volts +
Pin B—Black, Ground -
Pin C—White, Signal
12V=on ; 0V=off

Mounting Hardware:
2 Valve Bolt Kit
384-1100

Mounting Bracket
400-2493Y1

How LiquiShift Works

LiquiShift is a section valve manifold specifically built and controlled to provide the operator a very wide flow range for variable rate application. It is valuable for variable rate prescription application or variable rate between different fields. Each section has an A and B valve that are opened based on the section status, current rate and system pressure. Therefore, a 4– section LiquiShift (shown above) will have 8 total valves.

The valves themselves are identical to a regular section valve (KZ TX2) and have a 3-pin weather pack electrical connector.

The 2000 Series planter will have 3 sections.

Gen 2 LiquiShift systems connect to the Adapter Harness with a 14-pin round connector.

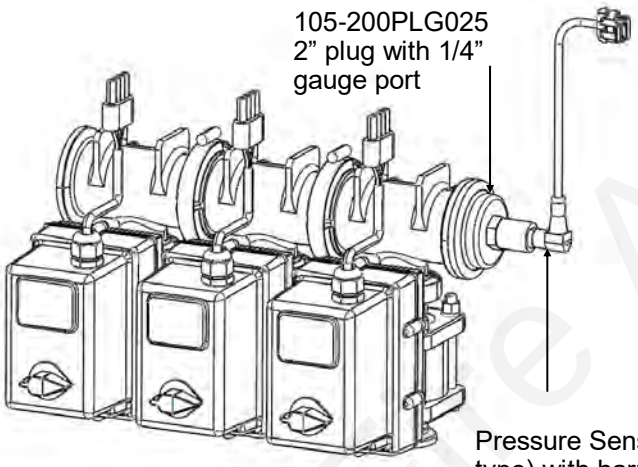
Pressure Sensor
3 Wire Sensor with 2” Manifold x 1/4” MPT Fitting

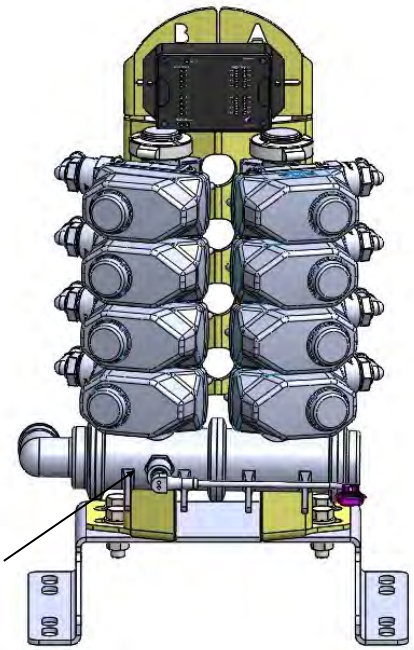
The Pro 700 display on the 2000 series planter has the ability to show fertilizer system pressure on the display. The pressure sensor is most often mounted on electric section valves when used in PumpRight systems. The SureFire harnesses have a Pressure connector on both the pump harness (207-4190Y1) and the section harness (207-3463Y1).
The pressure sensor is a 1 to 5 volt, 100 psi, 3-wire type sensor. The sensor has a 1/4” MPT fitting.

The pressure reading is only for informational purposes and is NOT used in the flow control process. Flow control uses the flowmeter feedback only.

The pressure sensor is very helpful to optimize system performance and troubleshoot any issues.

The pressure transducer is factory calibrated and will display a very accurate pressure reading on the display. No manual gauge is required.





Pressure Sensor for LiquiShift is mounted at the base of the valve stack. This is a 0 to 5 volt sensor for LiquiShift.
A separate 1 to 5 volt sensor is used for the Pro 700 display.

SureFire Ag Systems

Pump Priming and Air Bleed Valve

An air bleed valve is included with each pump to aid in system priming. It is shipped in the pump accessories bag and must be installed during system installation.

Why use an air bleed valve:

Most fertilizer systems are equipped with a 4 or 10 lb. check valve on the end of each hose delivering fertilizer to the ground. These valves do not let air escape from the system, unless it is pressurized. PumpRight liquid pumps are not good air compressors. Therefore, the pump can struggle to prime due to air trapped on the outlet side of the pump.

The air bleed valve is a small 1/4" valve that when opened lets air escape from the pump outlet at zero pressure. Open until liquid comes out and then close the valve.

Be sure the air bleed valve tube does not become plugged with dirt or it will not allow air to bleed.

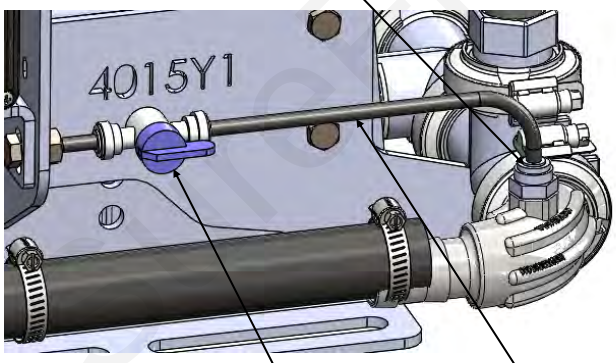
How to install the air bleed valve:

Remove the 1/4" plug from the quick connect fitting on the pump outlet side (see pictures below). Next, insert the 1/4" tubing in the quick connect fitting. Run the 1/4" tubing to an easily accessible spot on your equipment. Next, cut the tubing and push the 1/4" valve onto the tubing. Finally, run the tubing to a low location where any fertilizer that escapes will run on the ground.

Be sure the air bleed valve tube does not become plugged with dirt or it will not allow air to bleed.

PR17 & PR30

Attach 1/4" tubing to 1/4" QC on the 90 deg HB sweep gauge port

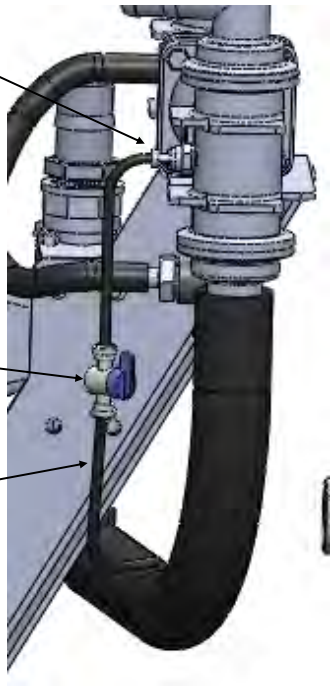


1/4" air bleed valve

1/4" Tubing

PR40 & D250

Attach 1/4" tubing to 1/4" QC on back side of 1" x 2" tee on outlet side of pump



1/4" air bleed valve

Recirculation & Agitation

A recirculation valve is standard on all 4 PumpRight models outlet plumbing assemblies.

B
Components
Liquid

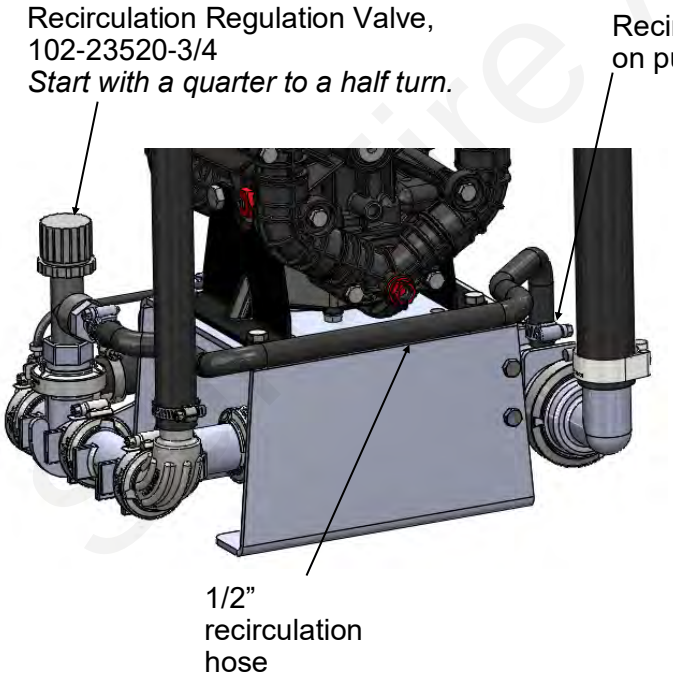
How Recirculation Works:

When running a PumpRight pump at less than 20% of it's maximum flow, it sometimes improves system stability to allow the pump to run faster. Opening the recirculation valve diverts some pump flow before the flowmeter, causing the pump to run faster. The application rate is still measured by the flowmeter and everything that passes through the flowmeter is applied to the ground. If the pump is surging at a low flow rate, open the recirculation regulation valve until the pump runs smoothly. *Start with a quarter to a half turn.* OPENING THE VALVE LOWERS THE MAXIMUM RATE THAT CAN BE APPLIED TO THE GROUND. Close the valve if a higher rate is required.

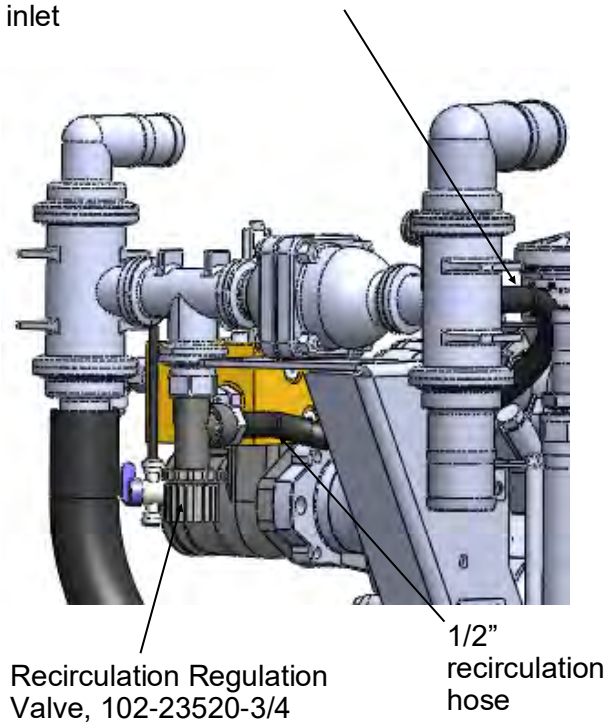
How to modify for tank agitation:

If tank agitation is required, the recirculation valve can be re-plumbed to divert flow to the tank. All that is required is to remove the 1/2" recirculation hose from the pump. Then replace the 3/8" MPT x 1/2" HB on the inlet side of the pump with a 3/8" plug which is included in your PumpRight accessories bag. Finally, install a longer 1/2" hose from the recirculation valve back to the tank.

PR17 & PR30



PR40 & D250



Product Distribution

<u>To assure proper and even distribution to each row, the product being applied must be metered to each individual row.</u> This metering is done by one of the 3 following methods which create back pressure so an equal amount of liquid is applied to each row:

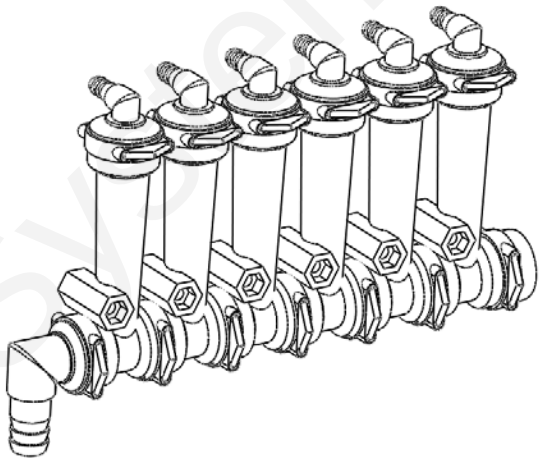
1. A metering orifice may be placed in the check valve cap in the line that leads to each row. (See photo on page 13)
2. A dual metering tube kit with dual check valves may be used. (See pages 18-21)
3. A LiquiShift valve stack may be used that automatically selects which metering tube to use based on system pressure.

Floating Ball Flow Indicator & Manifold System

Flow indicators give a clear visual signal that a fertilizer system is working. These indicators use an o-ring and wire clip connection to snap together in any configuration necessary.

SureFire has simple tee brackets and U-bolts that will mount these to a variety of bar sizes.

Two main types of flow indicators are used. On 30" row spacing, the low flow column with 1/4" push to connect outlet is recommended for rates under 10 GPA. For rates over 10 GPA the full flow column with 3/8" hose barb outlet is preferred.



Parts List

Complete Columns

701-20460-950	Single Full Flow Column with 3/8" HB - 90 Degree Outlet
701-20460-940	Single Full Flow Column with 3/8" QC - 90 Degree Outlet
701-20460-960	Single Full Flow Column with 1/2" HB - 90 Degree Outlet
701-20460-935	Single Low Flow Column with 3/8" QC - 90 Degree Outlet
701-20460-920	Single Low Flow Column with 1/4" QC - 90 Degree Outlet

Fittings

701-20503-00	ORS x 3/4" HB - Straight
701-20511-00	ORS x 3/8" HB - 90 Degree
701-20512-00	ORS x 1/2" HB - 90 Degree
701-20513-00	ORS x 3/4" HB - 90 Degree
701-20516-00	ORS x 1/4" QC - 90 Degree
701-20517-00	ORS x 3/8" QC - 90 Degree
701-20518-00	ORS x 1/4" FPT - 90 Degree
701-20519-00	ORS x 1/4" FPT - Straight
701-20520-00	ORS Male x ORS Female - 90 degree
701-20521-00	Wilger End Cap
701-20523-00	ORS Male x ORS Female x 3/8" FPT - Isolator
701-20525-00	ORS Male x ORS Male x 1" FPT - Tee

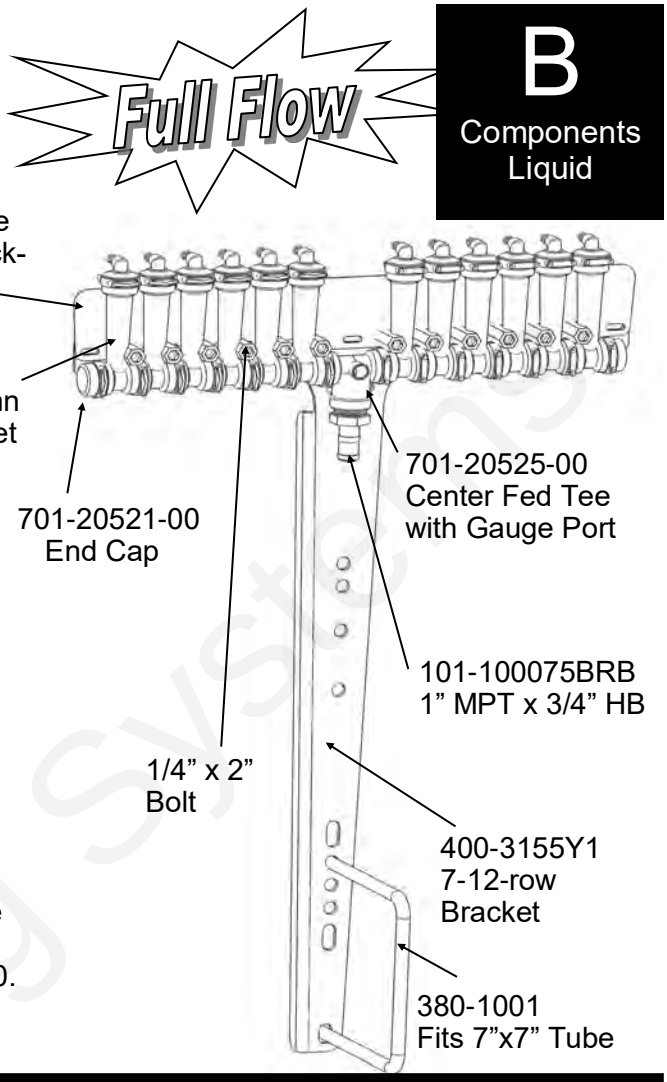
Service Parts Only

701-20460-02	Wilger Flow Indicator Ball Retainer
701-20460-03	FKM O-Ring for indicator body & fittings
701-20460-04	Wilger Lock U-clip
701-20460-05	Flow Indicator Ball - 1/2" SS Ball
701-20460-06	Flow Indicator Ball - Maroon Glass
701-20460-07	Flow Indicator Ball - Red Celcon
701-20460-08	Flow Indicator Ball - Green Poly
701-20460-09	Flow Indicator Ball - Black Poly
701-20460-15	Viton O-Ring for column & fittings
701-40225-05	Viton O-Ring for Orifice

Brackets & U-Bolts

400-1037A1	3-6 Row Bracket
400-3155Y1	7-12 Row Bracket
400-2011A1	White Backer Plate for 3-6 Row Bracket
400-2010A1	White Backer Plate for 7-12 Row Bracket
400-1315A2	Flow Indicator Bracket, 6-8 in wide hitch mount

Floating Ball Flow Indicators- Full Flow Column (mostly 3/8" HB)



The **full flow column** is typically used with rates **over 10 GPA on 30" rows**. For rates **less than 10 GPA** SureFire recommends the **low flow columns** with 1/4" push to connect outlet fittings.

The full flow columns are most often assembled with 3/8" hose barb outlets. See the low flow info below for the difference between full and low flow columns.

Full Flow Indicators w/ 3/8" Hose Barb Outlet

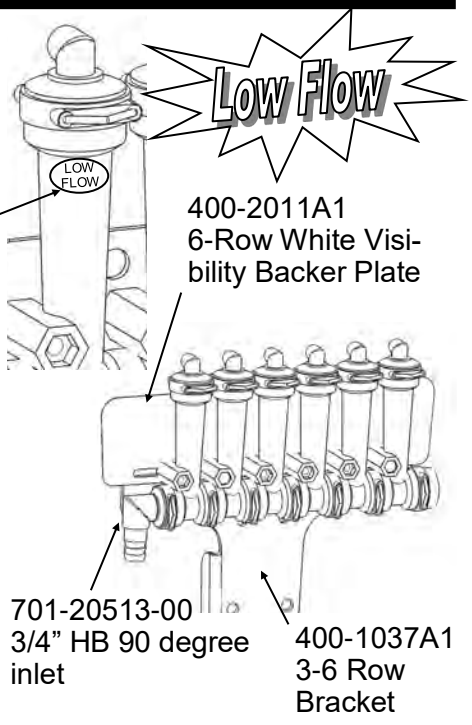
Column Flow (GPM): .05-2.70 GPM
Equivalent Application Rate
On 30" Rows at 6 MPH: 2-70 GPA

Ball Selection for 30" Rows

GPM	GPA	Ball
.05-.18	2-6 *	Green Plastic*
.09-.30	3-10 *	Red Plastic*
.31-.72	10-20	Maroon Glass
.40-2.1	13-70	Stainless Steel (1/2")

* SureFire recommends using the low flow column for these flow rates.
Plastic balls may float on heavier fertilizers, such as 10-34-0.

Low Flow Column (mostly 1/4" QC or 3/8"QC)



The low flow column has a smaller internal diameter. This means a heavier ball can be used to monitor a smaller flow.

SureFire uses the low flow columns with 1/4" push to connect outlet fittings. **The flow capability of 1/4" tubing and the low flow column are a great pair for rates on 30" rows under 10 GPA.**

Externally, the low flow column can only be identified by "Low Flow" molded into one side of the column. All the same fittings work with low flow and full flow columns.

Low Flow Indicators w/ 1/4" Push to Connect Outlet

Column Flow (GPM): .03-.30 GPM
*** Low Flow Column with 3/8" hose barb .03 - .70 GPM
Equivalent Application Rate
On 30" Rows at 6 MPH (1/4" QC): 1-10 GPA

Ball Selection for 30" Rows

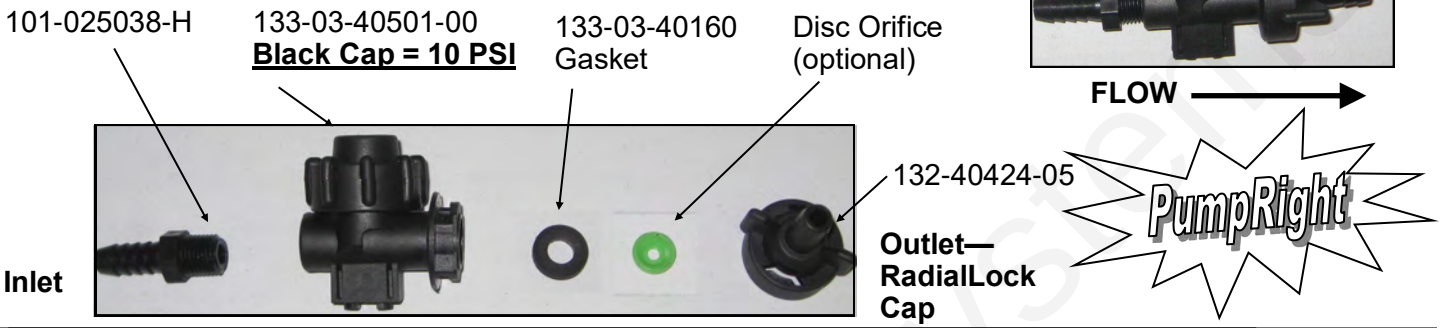
GPM	GPA	Ball
.03-.09	1-3	Green Plastic*
.05-.14	2-4	Red Plastic*
.10-.18	3-6	Maroon Glass
.15-.70	5-10	Stainless Steel (1/2")

*These balls may float on heavier fertilizers, such as 10-34-0. Use Maroon Glass in this case.

Check Valves

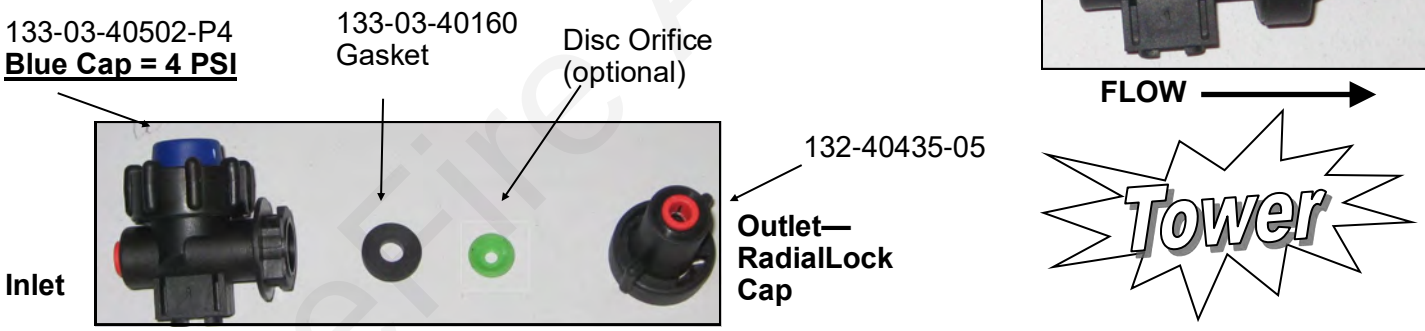
10 lb check valve with 3/8” hose barbs

The recommended check valve for most **PumpRight installations** is the 10 lb check with 3/8” hose barbs. This works with 3/8” rubber hose which SureFire recommends for most applications over 10 GPA on 30” rows. The recommended minimum system operating pressure for this check is 20 psi, to ensure all checks open fully.



4 lb check valve with 1/4” quick connect fittings

4 lb check valves are typically used with **electric pump systems**. Sure-Fire recommends this valve for use with 1/4” tubing applying up to 10 GPA on 30” rows. The recommended minimum system operating pressure for this check is 10 psi, to ensure all checks open fully.



Special Purpose Check Valve Assemblies

Assembly Part Number	Description	Suggested Uses (30” rows)
136-10-04QC04QC	1/4" QC x 1/4" QC 10 lb	< 10 GPA with **PumpRight** & 1/4” Tubing
136-10-06QC06QC	3/8" QC x 3/8" QC 10 lb	With 3/8” tubing plumbing
136-04-06HB06HB	3/8" HB x 3/8" HB 4 lb	> 10 GPA with **Electric Pumps**
136-04-08HB08HB	1/2" HB x 1/2" HB 4 lb	> 50 GPA with **PumpRight**
136-10-08HB08HB	1/2" HB x 1/2" HB 10 lb	> 50 GPA with **PumpRight**

SureFire Ag Systems

Colored Disc Orifice Chart for 30” rows

Download the SureFire Flow Calculator App for iPad

30” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	1.62	1.44	1.30	1.18	1.08	1.00	0.93
	20	0.046	2.28	2.02	1.82	1.66	1.52	1.40	1.30
	30	0.057	2.80	2.49	2.24	2.04	1.87	1.73	1.60
	40	0.065	3.24	2.88	2.59	2.36	2.16	1.99	1.85
	50	0.073	3.64	3.23	2.91	2.64	2.42	2.24	2.08
	60	0.081	3.99	3.54	3.19	2.90	2.66	2.45	2.28
Gray (30)	10	0.050	2.50	2.22	2.00	1.82	1.66	1.54	1.43
	20	0.072	3.55	3.15	2.84	2.58	2.37	2.18	2.03
	30	0.088	4.34	3.85	3.47	3.15	2.89	2.67	2.48
	40	0.101	4.99	4.44	4.00	3.63	3.33	3.07	2.85
	50	0.112	5.56	4.95	4.45	4.05	3.71	3.42	3.18
	60	0.124	6.13	5.45	4.91	4.46	4.09	3.77	3.50
Black (35)	10	0.070	3.46	3.08	2.77	2.52	2.31	2.13	1.98
	20	0.098	4.86	4.32	3.89	3.54	3.24	2.99	2.78
	30	0.120	5.96	5.30	4.77	4.33	3.97	3.67	3.40
	40	0.139	6.88	6.11	5.50	5.00	4.58	4.23	3.93
	50	0.156	7.71	6.85	6.17	5.61	5.14	4.74	4.41
	60	0.170	8.41	7.48	6.73	6.12	5.61	5.18	4.81
Brown (41)	10	0.094	4.64	4.13	3.71	3.38	3.10	2.86	2.65
	20	0.132	6.53	5.80	5.22	4.75	4.35	4.02	3.73
	30	0.162	8.02	7.13	6.41	5.83	5.34	4.93	4.58
	40	0.187	9.24	8.22	7.39	6.72	6.16	5.69	5.28
	50	0.209	10.34	9.19	8.27	7.52	6.89	6.36	5.91
	60	0.228	11.30	10.05	9.04	8.22	7.53	6.95	6.46
Orange (46)	10	0.119	5.91	5.26	4.73	4.30	3.94	3.64	3.38
	20	0.169	8.37	7.44	6.69	6.08	5.58	5.15	4.78
	30	0.207	10.25	9.11	8.20	7.45	6.83	6.31	5.86
	40	0.239	11.83	10.51	9.46	8.60	7.88	7.28	6.76
	50	0.267	13.23	11.76	10.58	9.62	8.82	8.14	7.56
	60	0.293	14.50	12.89	11.60	10.55	9.67	8.92	8.29
Maroon (52)	10	0.149	7.36	6.54	5.89	5.35	4.91	4.53	4.21
	20	0.210	10.38	9.23	8.31	7.55	6.92	6.39	5.93
	30	0.257	12.70	11.29	10.16	9.24	8.47	7.82	7.26
	40	0.296	14.67	13.04	11.74	10.67	9.78	9.03	8.39
	50	0.332	16.43	14.60	13.14	11.95	10.95	10.11	9.39
	60	0.363	17.96	15.96	14.37	13.06	11.97	11.05	10.26
Red (63)	10	0.218	10.78	9.58	8.62	7.84	7.18	6.63	6.16
	20	0.307	15.20	13.51	12.16	11.05	10.13	9.35	8.69
	30	0.376	18.62	16.55	14.89	13.54	12.41	11.46	10.64
	40	0.435	21.51	19.12	17.21	15.64	14.34	13.24	12.29
	50	0.486	24.05	21.38	19.24	17.49	16.03	14.80	13.74
	60	0.532	26.33	23.40	21.06	19.15	17.55	16.20	15.04
Blue (80)	10	0.351	17.39	15.46	13.91	12.65	11.59	10.70	9.94
	20	0.496	24.57	21.84	19.66	17.87	16.38	15.12	14.04
	30	0.608	30.09	26.75	24.08	21.89	20.06	18.52	17.20
	40	0.702	34.74	30.88	27.79	25.26	23.16	21.38	19.85
	50	0.785	38.86	34.54	31.08	28.26	25.90	23.91	22.20
	60	0.859	42.53	37.81	34.03	30.93	28.36	26.18	24.31
Yellow (95)	10	0.506	25.06	22.27	20.05	18.22	16.70	15.42	14.32
	20	0.715	35.39	31.46	28.32	25.74	23.60	21.78	20.23
	30	0.876	43.37	38.55	34.69	31.54	28.91	26.69	24.78
	40	1.009	49.94	44.39	39.95	36.32	33.29	30.73	28.54
	50	1.133	56.07	49.84	44.86	40.78	37.38	34.51	32.04
	60	1.239	61.33	54.51	49.06	44.60	40.88	37.74	35.04
Green (110)	10	0.686	33.95	30.18	27.16	24.69	22.63	20.89	19.40
	20	0.973	48.19	42.83	38.55	35.04	32.12	29.65	27.53
	30	1.186	58.70	52.18	46.96	42.69	39.13	36.12	33.54
	40	1.372	67.90	60.35	54.32	49.38	45.27	41.78	38.80
	50	1.531	75.78	67.36	60.63	55.12	50.52	46.64	43.30
	60	1.681	83.23	73.98	66.58	60.53	55.49	51.22	47.56

PumpRight Pressure Recommendations (with 10 lb check valves):

- Minimum 20 PSI
- Maximum 80 PSI

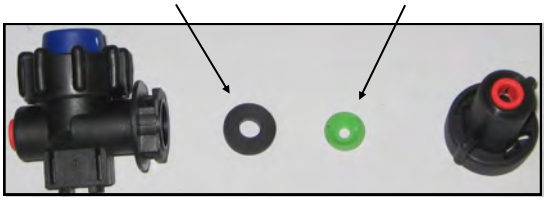
Tower Electric Pump Pressure Recommendations (with 4 lb check valves):

- Minimum 10 PSI
- Maximum 30 PSI

Chart is for 28-0-0 Fertilizer @ 70°

- Heavier fertilizers (like 10-34-0) will have 5-15% less flow than chart indicates for a certain pressure
- Cold fertilizers will cause system pressure to increase at a given application rate.
- Tower Electric Pump Systems will have reduced flow and increased electrical current draw due to cold fertilizer increasing operating pressure. **Use the largest orifice possible for cold weather operation.**

Colored Disc Orifice assembles under the check valve cap in most cases. (Drop the orifice with the hole down into the cap, then put the gasket on top of it.) The orifice can also be installed in a manifold (common on grain drills).



FLOW → 1/4 Turn Cap is Outlet

Colored Disc Orifice Chart
Common Grain Drill Row Spacings

7.5” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	6.5	5.8	5.2	4.7	4.3	4.0	3.7
	20	0.046	9.1	8.1	7.3	6.6	6.1	5.6	5.2
	30	0.057	11.2	10.0	9.0	8.2	7.5	6.9	6.4
	40	0.065	13.0	11.5	10.4	9.4	8.6	8.0	7.4
	50	0.073	14.5	12.9	11.6	10.6	9.7	8.9	8.3
	60	0.081	15.9	14.2	12.8	11.6	10.6	9.8	9.1
Gray (30)	10	0.050	10.0	8.9	8.0	7.3	6.7	6.1	5.7
	20	0.072	14.2	12.6	11.4	10.3	9.5	8.7	8.1
	30	0.088	17.3	15.4	13.9	12.6	11.6	10.7	9.9
	40	0.101	20.0	17.8	16.0	14.5	13.3	12.3	11.4
	50	0.112	22.3	19.8	17.8	16.2	14.8	13.7	12.7
	60	0.124	24.5	21.8	19.6	17.8	16.4	15.1	14.0
Black (35)	10	0.070	13.8	12.3	11.1	10.1	9.2	8.5	7.9
	20	0.098	19.4	17.3	15.6	14.1	13.0	12.0	11.1
	30	0.120	23.8	21.2	19.1	17.3	15.9	14.7	13.6
	40	0.139	27.5	24.5	22.0	20.0	18.3	16.9	15.7
	50	0.156	30.8	27.4	24.7	22.4	20.6	19.0	17.6
	60	0.170	33.6	29.9	26.9	24.5	22.4	20.7	19.2
Brown (41)	10	0.094	19	17	15	14	12	11	11
	20	0.132	26	23	21	19	17	16	15
	30	0.162	32	29	26	23	21	20	18
	40	0.187	37	33	30	27	25	23	21
	50	0.209	41	37	33	30	28	25	24
	60	0.228	45	40	36	33	30	28	26
Orange (46)	10	0.119	24	21	19	17	16	15	14
	20	0.169	33	30	27	24	22	21	19
	30	0.207	41	36	33	30	27	25	23
	40	0.239	47	42	38	34	32	29	27
	50	0.267	53	47	42	38	35	33	30
	60	0.293	58	52	46	42	39	36	33
Maroon (52)	10	0.149	29	26	24	21	20	18	17
	20	0.210	42	37	33	30	28	26	24
	30	0.257	51	45	41	37	34	31	29
	40	0.296	59	52	47	43	39	36	34
	50	0.332	66	58	53	48	44	40	38
	60	0.363	72	64	57	52	48	44	41
Red (63)	10	0.218	43	38	34	31	29	27	25
	20	0.307	61	54	49	44	41	37	35
	30	0.376	74	66	60	54	50	46	43
	40	0.435	86	76	69	63	57	53	49
	50	0.486	96	86	77	70	64	59	55
	60	0.532	105	94	84	77	70	65	60
Blue (80)	10	0.351	70	62	56	51	46	43	40
	20	0.496	98	87	79	71	66	60	56
	30	0.608	120	107	96	88	80	74	69
	40	0.702	139	124	111	101	93	86	79
	50	0.785	155	138	124	113	104	96	89
	60	0.859	170	151	136	124	113	105	97
Yellow (95)	10	0.506	100	89	80	73	67	62	57
	20	0.715	142	126	113	103	94	87	81
	30	0.876	173	154	139	126	116	107	99
	40	1.009	200	178	160	145	133	123	114
	50	1.133	224	199	179	163	150	138	128
	60	1.239	245	218	196	178	164	151	140

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F

10” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	4.9	4.3	3.9	3.5	3.2	3.0	2.8
	20	0.046	6.8	6.1	5.5	5.0	4.6	4.2	3.9
	30	0.057	8.4	7.5	6.7	6.1	5.6	5.2	4.8
	40	0.065	9.7	8.6	7.8	7.1	6.5	6.0	5.6
	50	0.073	10.9	9.7	8.7	7.9	7.3	6.7	6.2
	60	0.081	12.0	10.6	9.6	8.7	8.0	7.4	6.8
Gray (30)	10	0.050	7.5	6.7	6.0	5.4	5.0	4.6	4.3
	20	0.072	10.6	9.5	8.5	7.7	7.1	6.6	6.1
	30	0.088	13.0	11.6	10.4	9.5	8.7	8.0	7.4
	40	0.101	15.0	13.3	12.0	10.9	10.0	9.2	8.6
	50	0.112	16.7	14.8	13.4	12.1	11.1	10.3	9.5
	60	0.124	18.4	16.4	14.7	13.4	12.3	11.3	10.5
Black (35)	10	0.070	10.4	9.2	8.3	7.6	6.9	6.4	5.9
	20	0.098	14.6	13.0	11.7	10.6	9.7	9.0	8.3
	30	0.120	17.9	15.9	14.3	13.0	11.9	11.0	10.2
	40	0.139	20.6	18.3	16.5	15.0	13.8	12.7	11.8
	50	0.156	23.1	20.6	18.5	16.8	15.4	14.2	13.2
	60	0.170	25.2	22.4	20.2	18.4	16.8	15.5	14.4
Brown (41)	10	0.094	14	12	11	10	9	9	8
	20	0.132	20	17	16	14	13	12	11
	30	0.162	24	21	19	17	16	15	14
	40	0.187	28	25	22	20	18	17	16
	50	0.209	31	28	25	23	21	19	18
	60	0.228	34	30	27	25	23	21	19
Orange (46)	10	0.119	18	16	14	13	12	11	10
	20	0.169	25	22	20	18	17	15	14
	30	0.207	31	27	25	22	21	19	18
	40	0.239	35	32	28	26	24	22	20
	50	0.267	40	35	32	29	26	24	23
	60	0.293	43	39	35	32	29	27	25
Maroon (52)	10	0.149	22	20	18	16	15	14	13
	20	0.210	31	28	25	23	21	19	18
	30	0.257	38	34	30	28	25	23	22
	40	0.296	44	39	35	32	29	27	25
	50	0.332	49	44	39	36	33	30	28
	60	0.363	54	48	43	39	36	33	31
Red (63)	10	0.218	32	29	26	24	22	20	18
	20	0.307	46	41	36	33	30	28	26
	30	0.376	56	50	45	41	37	34	32
	40	0.435	65	57	52	47	43	40	37
	50	0.486	72	64	58	52	48	44	41
	60	0.532	79	70	63	57	53	49	45
Blue (80)	10	0.351	52	46	42	38	35	32	30
	20	0.496	74	66	59	54	49	45	42
	30	0.608	90	80	72	66	60	56	52
	40	0.702	104	93	83	76	69	64	60
	50	0.785	117	104	93	85	78	72	67
	60	0.859	128	113	102	93	85	79	73
Yellow (95)	10	0.506	75	67	60	55	50	46	43
	20	0.715	106	94	85	77	71	65	61
	30	0.876	130	116	104	95	87	80	74
	40	1.009	150	133	120	109	100	92	86
	50	1.133	168	150	135	122	112	104	96
	60	1.239	184	164	147	134	123	113	105

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F

Colored Disc Orifice Chart

15” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	3.2	2.9	2.6	2.4	2.2	2.0	1.9
	20	0.046	4.6	4.0	3.6	3.3	3.0	2.8	2.6
	30	0.057	5.6	5.0	4.5	4.1	3.7	3.5	3.2
	40	0.065	6.5	5.8	5.2	4.7	4.3	4.0	3.7
	50	0.073	7.3	6.5	5.8	5.3	4.8	4.5	4.2
	60	0.081	8.0	7.1	6.4	5.8	5.3	4.9	4.6
Gray (30)	10	0.050	5.0	4.4	4.0	3.6	3.3	3.1	2.9
	20	0.072	7.1	6.3	5.7	5.2	4.7	4.4	4.1
	30	0.088	8.7	7.7	6.9	6.3	5.8	5.3	5.0
	40	0.101	10.0	8.9	8.0	7.3	6.7	6.1	5.7
	50	0.112	11.1	9.9	8.9	8.1	7.4	6.8	6.4
	60	0.124	12.3	10.9	9.8	8.9	8.2	7.5	7.0
Black (35)	10	0.070	6.9	6.2	5.5	5.0	4.6	4.3	4.0
	20	0.098	9.7	8.6	7.8	7.1	6.5	6.0	5.6
	30	0.120	11.9	10.6	9.5	8.7	7.9	7.3	6.8
	40	0.139	13.8	12.2	11.0	10.0	9.2	8.5	7.9
	50	0.156	15.4	13.7	12.3	11.2	10.3	9.5	8.8
	60	0.170	16.8	15.0	13.5	12.2	11.2	10.4	9.6
Brown (41)	10	0.094	9.3	8.3	7.4	6.8	6.2	5.7	5.3
	20	0.132	13.1	11.6	10.4	9.5	8.7	8.0	7.5
	30	0.162	16.0	14.3	12.8	11.7	10.7	9.9	9.2
	40	0.187	18.5	16.4	14.8	13.4	12.3	11.4	10.6
	50	0.209	20.7	18.4	16.5	15.0	13.8	12.7	11.8
	60	0.228	22.6	20.1	18.1	16.4	15.1	13.9	12.9
Orange (46)	10	0.119	11.8	10.5	9.5	8.6	7.9	7.3	6.8
	20	0.169	16.7	14.9	13.4	12.2	11.2	10.3	9.6
	30	0.207	20.5	18.2	16.4	14.9	13.7	12.6	11.7
	40	0.239	23.7	21.0	18.9	17.2	15.8	14.6	13.5
	50	0.267	26.5	23.5	21.2	19.2	17.6	16.3	15.1
	60	0.293	29.0	25.8	23.2	21.1	19.3	17.8	16.6
Maroon (52)	10	0.149	15	13	12	11	10	9	8
	20	0.210	21	18	17	15	14	13	12
	30	0.257	25	23	20	18	17	16	15
	40	0.296	29	26	23	21	20	18	17
	50	0.332	33	29	26	24	22	20	19
	60	0.363	36	32	29	26	24	22	21
Red (63)	10	0.218	22	19	17	16	14	13	12
	20	0.307	30	27	24	22	20	19	17
	30	0.376	37	33	30	27	25	23	21
	40	0.435	43	38	34	31	29	26	25
	50	0.486	48	43	38	35	32	30	27
	60	0.532	53	47	42	38	35	32	30
Blue (80)	10	0.351	35	31	28	25	23	21	20
	20	0.496	49	44	39	36	33	30	28
	30	0.608	60	54	48	44	40	37	34
	40	0.702	69	62	56	51	46	43	40
	50	0.785	78	69	62	57	52	48	44
	60	0.859	85	76	68	62	57	52	49
Yellow (95)	10	0.506	50	45	40	36	33	31	29
	20	0.715	71	63	57	51	47	44	40
	30	0.876	87	77	69	63	58	53	50
	40	1.009	100	89	80	73	67	61	57
	50	1.133	112	100	90	82	75	69	64
	60	1.239	123	109	98	89	82	75	70
Green (110)	10	0.686	68	60	54	49	45	42	39
	20	0.973	96	86	77	70	64	59	55
	30	1.186	117	104	94	85	78	72	67
	40	1.372	136	121	109	99	91	84	78
	50	1.531	152	135	121	110	101	93	87
	60	1.681	166	148	133	121	111	102	95
White (125)	10	0.867	86	76	69	62	57	53	49
	20	1.230	122	108	97	89	81	75	70
	30	1.504	149	132	119	108	99	92	85
	40	1.735	172	153	137	125	114	106	98
	50	1.938	192	171	153	140	128	118	110
	60	2.124	210	187	168	153	140	129	120
Lime Green (156)	10	1.372	136	121	109	99	91	84	78
	20	1.947	193	171	154	140	128	119	110
	30	2.381	236	209	189	171	157	145	135
	40	2.752	272	242	218	198	182	168	156
	50	3.071	304	270	243	221	203	187	174
	60	3.363	333	296	266	242	222	205	190

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

20” Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	2.4	2.2	1.9	1.8	1.6	1.5	1.4
	20	0.046	3.4	3.0	2.7	2.5	2.3	2.1	2.0
	30	0.057	4.2	3.7	3.4	3.1	2.8	2.6	2.4
	40	0.065	4.9	4.3	3.9	3.5	3.2	3.0	2.8
	50	0.073	5.5	4.8	4.4	4.0	3.6	3.4	3.1
	60	0.081	6.0	5.3	4.8	4.3	4.0	3.7	3.4
Gray (30)	10	0.050	3.7	3.3	3.0	2.7	2.5	2.3	2.1
	20	0.072	5.3	4.7	4.3	3.9	3.5	3.3	3.0
	30	0.088	6.5	5.8	5.2	4.7	4.3	4.0	3.7
	40	0.101	7.5	6.7	6.0	5.4	5.0	4.6	4.3
	50	0.112	8.3	7.4	6.7	6.1	5.6	5.1	4.8
	60	0.124	9.2	8.2	7.4	6.7	6.1	5.7	5.3
Black (35)	10	0.070	5.2	4.6	4.2	3.8	3.5	3.2	3.0
	20	0.098	7.3	6.5	5.8	5.3	4.9	4.5	4.2
	30	0.120	8.9	7.9	7.1	6.5	6.0	5.5	5.1
	40	0.139	10.3	9.2	8.3	7.5	6.9	6.3	5.9
	50	0.156	11.6	10.3	9.3	8.4	7.7	7.1	6.6
	60	0.170	12.6	11.2	10.1	9.2	8.4	7.8	7.2
Brown (41)	10	0.094	7.0	6.2	5.6	5.1	4.6	4.3	4.0
	20	0.132	9.8	8.7	7.8	7.1	6.5	6.0	5.6
	30	0.162	12.0	10.7	9.6	8.7	8.0	7.4	6.9
	40	0.187	13.9	12.3	11.1	10.1	9.2	8.5	7.9
	50	0.209	15.5	13.8	12.4	11.3	10.3	9.5	8.9
	60	0.228	17.0	15.1	13.6	12.3	11.3	10.4	9.7
Orange (46)	10	0.119	8.9	7.9	7.1	6.5	5.9	5.5	5.1
	20	0.169	12.6	11.2	10.0	9.1	8.4	7.7	7.2
	30	0.207	15.4	13.7	12.3	11.2	10.3	9.5	8.8
	40	0.239	17.7	15.8	14.2	12.9	11.8	10.9	10.1
	50	0.267	19.8	17.6	15.9	14.4	13.2	12.2	11.3
	60	0.293	21.7	19.3	17.4	15.8	14.5	13.4	12.4
Maroon (52)	10	0.149	11	10	9	8	7	7	6
	20	0.210	16	14	12	11	10	10	9
	30	0.257	19	17	15	14	13	12	11
	40	0.296	22	20	18	16	15	14	13
	50	0.332	25	22	20	18	16	15	14
	60	0.363	27	24	22	20	18	17	15
Red (63)	10	0.218	16	14	13	12	11	10	9
	20	0.307	23	20	18	17	15	14	13
	30	0.376	28	25	22	20	19	17	16
	40	0.435	32	29	26	23	22	20	18
	50	0.486	36	32	29	26	24	22	21
	60	0.532	39	35	32	29	26	24	23
Blue (80)	10	0.351	26	23	21	19	17	16	15
	20	0.496	37	33	29	27	25	23	21
	30	0.608	45	40	36	33	30	28	26
	40	0.702	52	46	42	38	35	32	30
	50	0.785	58	52	47	42	39	36	33
	60	0.859	64	57	51	46	43	39	36
Yellow (95)	10	0.506	38	33	30	27	25	23	21
	20	0.715	53	47	42	39	35	33	30
	30	0.876	65	58	52	47	43	40	37
	40	1.009	75	67	60	54	50	46	43
	50	1.133	84	75	67	61	56	52	48
	60	1.239	92	82	74	67	61	57	53
Green (110)	10	0.686	51	45	41	37	34	31	29
	20	0.973	72	64	58	53	48	44	41
	30	1.186	88	78	70	64	59	54	50
	40	1.372	102	91	81	74	68	63	58
	50	1.531	114	101	91	83	76	70	65
	60	1.681	125	111	100	91	83	77	71
White (125)	10	0.867	64	57	52	47	43	40	37
	20	1.230	91	81	73	66	61	56	52
	30	1.504	112	99	89	81	74	69	64
	40	1.735	129	114	103	94	86	79	74
	50	1.938	144	128	115	105	96	89	82
	60	2.124	158	140	126	115	105	97	90
Lime Green (156)	10	1.372	102	91	81	74	68	63	58
	20	1.947	145	128	116	105	96	89	83
	30	2.381	177	157	141	129	118	109	101
	40	2.752	204	182	163	149	136	126	117
	50	3.071	228	203	182	166	152	140	130
	60	3.363	250	222	200	182	166	154	143

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

Colored Disc Orifice Chart

22" Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	2.2	2.0	1.8	1.6	1.5	1.4	1.3
	20	0.046	3.1	2.8	2.5	2.3	2.1	1.9	1.8
	30	0.057	3.8	3.4	3.1	2.8	2.5	2.4	2.2
	40	0.065	4.4	3.9	3.5	3.2	2.9	2.7	2.5
	50	0.073	5.0	4.4	4.0	3.6	3.3	3.1	2.8
	60	0.081	5.4	4.8	4.3	4.0	3.6	3.3	3.1
Gray (30)	10	0.050	3.4	3.0	2.7	2.5	2.3	2.1	1.9
	20	0.072	4.8	4.3	3.9	3.5	3.2	3.0	2.8
	30	0.088	5.9	5.3	4.7	4.3	3.9	3.6	3.4
	40	0.101	6.8	6.1	5.4	5.0	4.5	4.2	3.9
	50	0.112	7.6	6.7	6.1	5.5	5.1	4.7	4.3
	60	0.124	8.4	7.4	6.7	6.1	5.6	5.1	4.8
Black (35)	10	0.070	4.7	4.2	3.8	3.4	3.1	2.9	2.7
	20	0.098	6.6	5.9	5.3	4.8	4.4	4.1	3.8
	30	0.120	8.1	7.2	6.5	5.9	5.4	5.0	4.6
	40	0.139	9.4	8.3	7.5	6.8	6.3	5.8	5.4
	50	0.156	10.5	9.3	8.4	7.6	7.0	6.5	6.0
	60	0.170	11.5	10.2	9.2	8.3	7.6	7.1	6.6
Brown (41)	10	0.094	6.3	5.6	5.1	4.6	4.2	3.9	3.6
	20	0.132	8.9	7.9	7.1	6.5	5.9	5.5	5.1
	30	0.162	10.9	9.7	8.7	8.0	7.3	6.7	6.2
	40	0.187	12.6	11.2	10.1	9.2	8.4	7.8	7.2
	50	0.209	14.1	12.5	11.3	10.3	9.4	8.7	8.1
	60	0.228	15.4	13.7	12.3	11.2	10.3	9.5	8.8
Orange (46)	10	0.119	8.1	7.2	6.5	5.9	5.4	5.0	4.6
	20	0.169	11.4	10.1	9.1	8.3	7.6	7.0	6.5
	30	0.207	14.0	12.4	11.2	10.2	9.3	8.6	8.0
	40	0.239	16.1	14.3	12.9	11.7	10.8	9.9	9.2
	50	0.267	18.0	16.0	14.4	13.1	12.0	11.1	10.3
	60	0.293	19.8	17.6	15.8	14.4	13.2	12.2	11.3
Maroon (52)	10	0.149	10	9	8	7	7	6	6
	20	0.210	14	13	11	10	9	9	8
	30	0.257	17	15	14	13	12	11	10
	40	0.296	20	18	16	15	13	12	11
	50	0.332	22	20	18	16	15	14	13
	60	0.363	24	22	20	18	16	15	14
Red (63)	10	0.218	15	13	12	11	10	9	8
	20	0.307	21	18	17	15	14	13	12
	30	0.376	25	23	20	18	17	16	15
	40	0.435	29	26	23	21	20	18	17
	50	0.486	33	29	26	24	22	20	19
	60	0.532	36	32	29	26	24	22	21
Blue (80)	10	0.351	24	21	19	17	16	15	14
	20	0.496	34	30	27	24	22	21	19
	30	0.608	41	36	33	30	27	25	23
	40	0.702	47	42	38	34	32	29	27
	50	0.785	53	47	42	39	35	33	30
	60	0.859	58	52	46	42	39	36	33
Yellow (95)	10	0.506	34	30	27	25	23	21	20
	20	0.715	48	43	39	35	32	30	28
	30	0.876	59	53	47	43	39	36	34
	40	1.009	68	61	54	50	45	42	39
	50	1.133	76	68	61	56	51	47	44
	60	1.239	84	74	67	61	56	51	48
Green (110)	10	0.686	46	41	37	34	31	28	26
	20	0.973	66	58	53	48	44	40	38
	30	1.186	80	71	64	58	53	49	46
	40	1.372	93	82	74	67	62	57	53
	50	1.531	103	92	83	75	69	64	59
	60	1.681	113	101	91	83	76	70	65
White (125)	10	0.867	59	52	47	43	39	36	33
	20	1.230	83	74	66	60	55	51	47
	30	1.504	102	90	81	74	68	62	58
	40	1.735	117	104	94	85	78	72	67
	50	1.938	131	116	105	95	87	81	75
	60	2.124	143	127	115	104	96	88	82
Lime Green (156)	10	1.372	93	82	74	67	62	57	53
	20	1.947	131	117	105	96	88	81	75
	30	2.381	161	143	129	117	107	99	92
	40	2.752	186	165	149	135	124	114	106
	50	3.071	207	184	166	151	138	128	118
	60	3.363	227	202	182	165	151	140	130

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

36" Spacing

Orifice Color (Approx Size)	PSI	Gal/Min 28-0-0	MPH 4.0	4.5	5.0	5.5	6.0	6.5	7.0
Pink (24)	10	0.033	1.4	1.2	1.1	1.0	0.9	0.8	0.8
	20	0.046	1.9	1.7	1.5	1.4	1.3	1.2	1.1
	30	0.057	2.3	2.1	1.9	1.7	1.6	1.4	1.3
	40	0.065	2.7	2.4	2.2	2.0	1.8	1.7	1.5
	50	0.073	3.0	2.7	2.4	2.2	2.0	1.9	1.7
	60	0.081	3.3	3.0	2.7	2.4	2.2	2.0	1.9
Gray (30)	10	0.050	2.1	1.8	1.7	1.5	1.4	1.3	1.2
	20	0.072	3.0	2.6	2.4	2.2	2.0	1.8	1.7
	30	0.088	3.6	3.2	2.9	2.6	2.4	2.2	2.1
	40	0.101	4.2	3.7	3.3	3.0	2.8	2.6	2.4
	50	0.112	4.6	4.1	3.7	3.4	3.1	2.9	2.6
	60	0.124	5.1	4.5	4.1	3.7	3.4	3.1	2.9
Black (35)	10	0.070	2.9	2.6	2.3	2.1	1.9	1.8	1.6
	20	0.098	4.1	3.6	3.2	2.9	2.7	2.5	2.3
	30	0.120	5.0	4.4	4.0	3.6	3.3	3.1	2.8
	40	0.139	5.7	5.1	4.6	4.2	3.8	3.5	3.3
	50	0.156	6.4	5.7	5.1	4.7	4.3	4.0	3.7
	60	0.170	7.0	6.2	5.6	5.1	4.7	4.3	4.0
Brown (41)	10	0.094	3.9	3.4	3.1	2.8	2.6	2.4	2.2
	20	0.132	5.4	4.8	4.4	4.0	3.6	3.3	3.1
	30	0.162	6.7	5.9	5.3	4.9	4.5	4.1	3.8
	40	0.187	7.7	6.8	6.2	5.6	5.1	4.7	4.4
	50	0.209	8.6	7.7	6.9	6.3	5.7	5.3	4.9
	60	0.228	9.4	8.4	7.5	6.8	6.3	5.8	5.4
Orange (46)	10	0.119	4.9	4.4	3.9	3.6	3.3	3.0	2.8
	20	0.169	7.0	6.2	5.6	5.1	4.6	4.3	4.0
	30	0.207	8.5	7.6	6.8	6.2	5.7	5.3	4.9
	40	0.239	9.9	8.8	7.9	7.2	6.6	6.1	5.6
	50	0.267	11.0	9.8	8.8	8.0	7.3	6.8	6.3
	60	0.293	12.1	10.7	9.7	8.8	8.1	7.4	6.9
Maroon (52)	10	0.149	6	5	5	4	4	4	4
	20	0.210	9	8	7	6	6	5	5
	30	0.257	11	9	8	8	7	7	6
	40	0.296	12	11	10	9	8	8	7
	50	0.332	14	12	11	10	9	8	8
	60	0.363	15	13	12	11	10	9	9
Red (63)	10	0.218	9	8	7	7	6	6	5
	20	0.307	13	11	10	9	8	8	7
	30	0.376	16	14	12	11	10	10	9
	40	0.435	18	16	14	13	12	11	10
	50	0.486	20	18	16	15	13	12	11
	60	0.532	22	20	18	16	15	14	13
Blue (80)	10	0.351	14	13	12	11	10	9	8
	20	0.496	20	18	16	15	14	13	12
	30	0.608	25	22	20	18	17	15	14
	40	0.702	29	26	23	21	19	18	17
	50	0.785	32	29	26	24	22	20	19
	60	0.859	35	32	28	26	24	22	20
Yellow (95)	10	0.506	21	19	17	15	14	13	12
	20	0.715	29	26	24	21	20	18	17
	30	0.876	36	32	29	26	24	22	21
	40	1.009	42	37	33	30	28	26	24
	50	1.133	47	42	37	34	31	29	27
	60	1.239	51	45	41	37	34	31	29
Green (110)	10	0.686	28	25	23	21	19	17	16
	20	0.973	40	36	32	29	27	25	23
	30	1.186	49	43	39	36	33	30	28
	40	1.372	57	50	45	41	38	35	32
	50	1.531	63	56	51	46	42	39	36
	60	1.681	69	62	55	50	46	43	40
White (125)	10	0.867	36	32	29	26	24	22	20
	20	1.230	51	45	41	37	34	31	29
	30	1.504	62	55	50	45	41	38	35
	40	1.735	72	64	57	52	48	44	41
	50	1.938	80	71	64	58	53	49	46
	60	2.124	88	78	70	64	58	54	50
Lime Green (156)	10	1.372	57	50	45	41	38	35	32
	20	1.947	80	71	64	58	54	49	46
	30	2.381	98	87	79	71	65	60	56
	40	2.752	114	101	91	83	76	70	65
	50	3.071	127	113	101	92	84	78	72
	60	3.363	139	123	111	101	92	85	79

All application rates (gallons/acres) are estimates based on 0-28-0 (10.65 lbs/gallon) at 70 degrees F.

Dual Metering Tube Plumbing Kits with Dual Check Valve

B
Components
Liquid

For more information, read Navigating the Metering Tube Maze or Metering Tube / LiquiShiftTube Charts.

SureFire dual metering tube plumbing kits are a great way to apply fertilizer.

These plumbing kits will contain everything you need to distribute fertilizer from the flowmeter outlet down to the ground application device of your choice (not included).

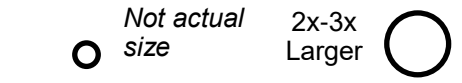
These instructions will show you where all the pieces go. It will provide guidance on how much metering tube to use. There are some optional fittings included in each plumbing kit. These instructions will show you where and why you'd want to use the optional pieces.

The dual check valve assembly is a key piece in the dual metering tube design. In addition to a check valve to stop fertilizer from draining when the system is shut off, **each check valve has an on/off valve on top of it. These on / off valves allow the operator to turn on only tube 1, only tube 2, or both tube 1 and 2**. This provides for three different application ranges, which is especially helpful when using a fertilizer which has a highly variable viscosity based on temperature changes or when changing rates from field to field.

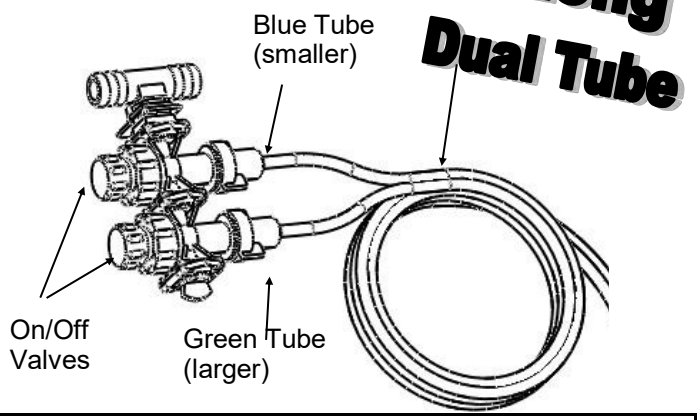
Dual Advantage of Dual Metering Tube

Metering tube provides a larger passage way diameter than a comparable orifice. For a 5 GPA rate on 30" rows, a size 0.046" orifice would be used. For the same rate a 0.110" meter tube that is 8' long would be used. This 8' tube with more than twice the diameter creates a fertilizer system resistant to plugging while providing excellent row to row distribution.

By using two metering tubes, the fertilizer system can handle a wider range of rates and provide the proper system pressure as the fertilizer properties change due to temperature, mixtures and other factors.



Field Operation of Dual Metering Tube - Dual Check Valve System



The dual metering tube allows for three application rate ranges. Some fertilizers have a widely variable viscosity. Therefore, based on temperature, tank mixing and fertilizer batch, the best tube to use will change.

SureFire recommends you start with the larger tube ON only. This is the middle size and is a good starting point. Conduct a test using the Nozzle Flow Check with fertilizer to determine your system pressure. If pressure is below 15 psi, some check valves may not open and row to row distribution will be uneven.

Start with larger tube ON, smaller tube OFF:

- **Pressure below 15 PSI: Turn larger tube OFF and smaller tube ON.**
- **Pressure over 50 PSI: Turn BOTH tubes ON.**

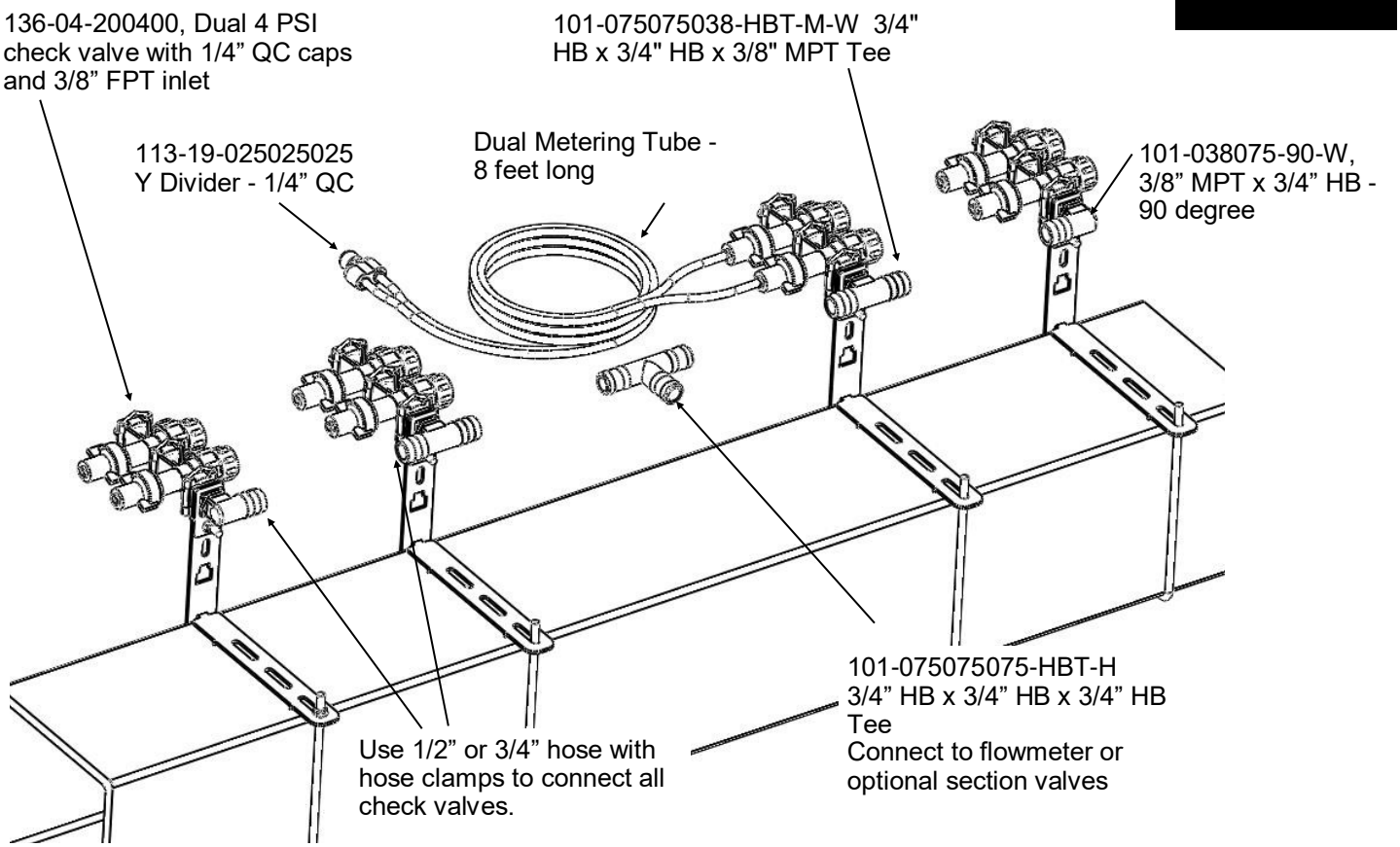
	GPA on 30" rows (approx, will vary)
Blue Tube	1.5 - 3
Green Tube	3 - 6
Blue & Green Tube	6 - 10
Minimum Recommended flow for Blue Tube (8 ft)	4 - 5 oz/min

Other tubes are available if needed for different application rates.

** Ultra Low Rate Application –For rates from 2-5 oz/min/row use a 12 foot length of metering tube.
To calculate oz/min/row: Oz/min/row = (GPA x MPH x spacing (inches)) ÷ 46.4

Dual Check Valve Plumbing Diagram

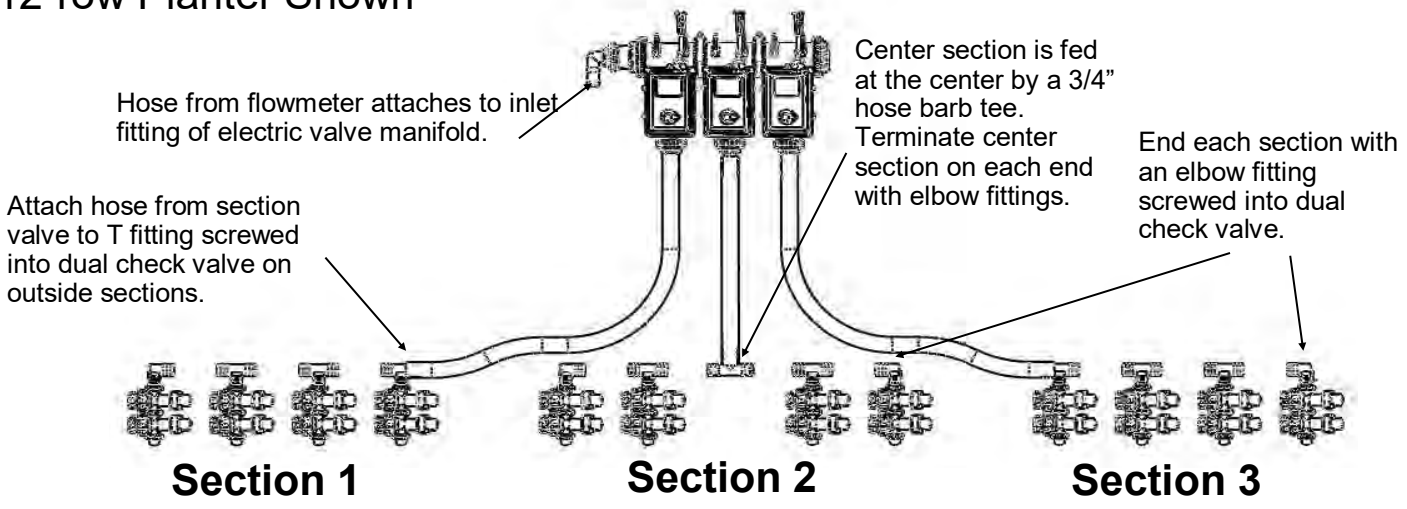
4 Row Planter Shown, add rows as necessary



This is a general diagram showing the dual check valve assembly mounted on a planter toolbar. The check valve and bracket are very flexible in their mounting. The check valve can mount behind, directly over, or in front of the toolbar. The check valve can be put in the bracket facing up & down or sideways (shown). In addition, the steel bracket could be rotated 90 degrees and clamp around the bar. The multiple slots in the bracket are used to mount to any tube 7x7 inches or smaller.

Sectional Plumbing Diagram with Dual Check Valves

12-row Planter Shown

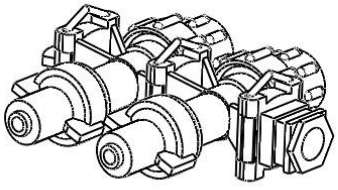


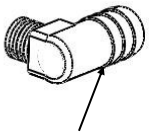
For a **2 section plumbing system**, omit the center section and plumb similar to the outside 2 sections.

Dual Check Valve Assembly Steps

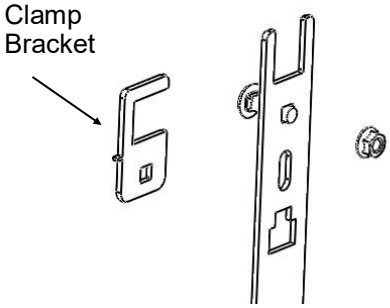
Follow these steps to mount each check valve to the steel bracket.

1. Screw the 3/8” MPT x 3/4” HB tee or elbow into the check valve using blue thread sealer. Orient the hose barb to run the 3/4” hose down the planter toolbar.
2. Insert the check valve into the “C” notch in the end of the bracket, according to how you want the check valve to be mounted on your planter. Orient the wire clips up or to the side for easiest access.
3. Slide the small “C” clamp bracket around the check valve to lock it in place.
4. Install the 1/4” carriage bolt and flange nut to secure the “C” clamp plate around the check valve.
5. Now, mount the check valve on the bar. Hold the check valve and long bracket assembly on the toolbar. Slide the tab on the front of the short bracket into the upper or lower notch on the long bracket.
6. Slide the L bolt into the appropriate slots on the brackets for your tube size. Tighten the 1/4” flange nuts to hold the bracket in place.

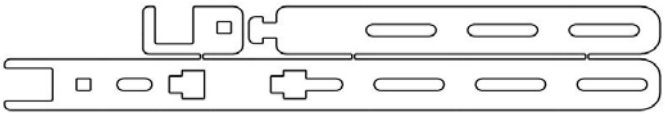




Elbow at end of section, Tee in mid-locations.



400-1966A1 Dual Check Valve Mount Bracket

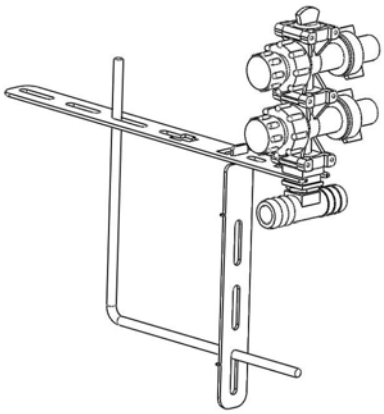


The long, short & clamp bracket come as one part connected by break-off tabs.

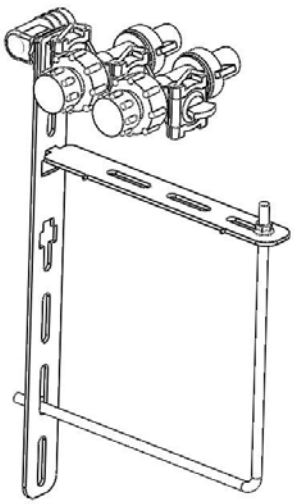
Check Valve Mounting Options

The dual check valve mounting bracket is very flexible to fit many different planter configurations. Three options are shown here to illustrate some of the possibilities.

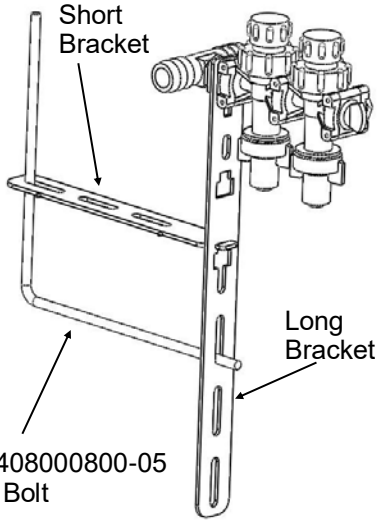
Example 1. Use the long bracket on the top of a bar. The check valve is mounted vertically. The liquid supply hose is ran directly on the front side of the bar. The U-bolt is placed in slots to clamp on a 4x6 inch tube.



Example 2. Use the long bracket on the rear of a bar. The check valve is mounted over the top of the bar. The supply line would run above and behind the bar. The short bracket is placed in the notch to mount the check valve closer to the bar.



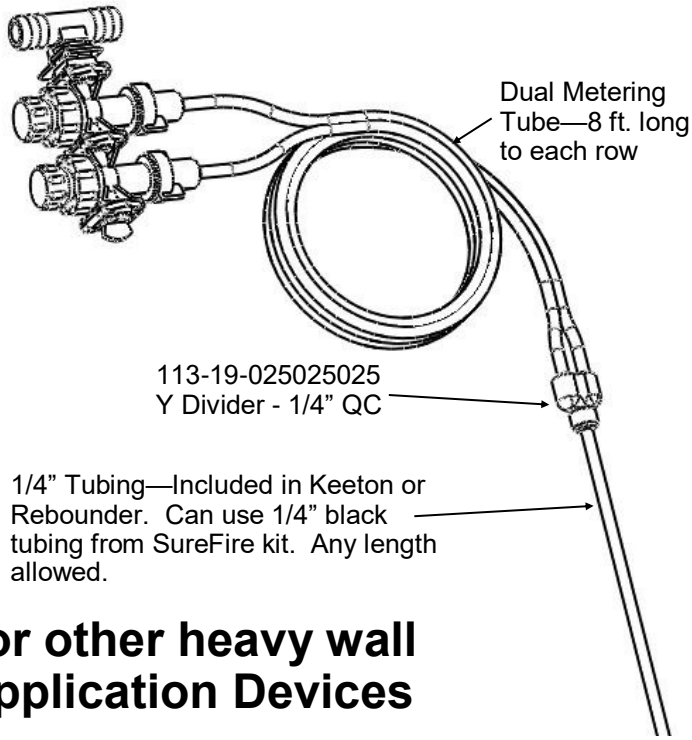
Example 3. Use the long bracket on the front of a 3x7 bar (vacuum tube on some planters). Mount the check valve hanging forward of the bar. The supply line will run directly over the bar. The excess bolt and bracket length can be cut off.



Connection to Keeton Seed Firmer, Rebounder Seed Covers or through thin wall stainless steel tubes

1. Mount the Keeton Seed Firmer or Rebounder Seed Cover.
2. Route the tube included in the above kit as instructed.
3. Attach the 1/4” tube to the 1/4” QC Y divider fitting.
4. Zip all tubing to the planter and row unit in as many locations as possible.

<u>For thin wall stainless steel tubes, you can push the 1/4” black tubing all the way through the stainless steel tube so fertilizer will run directly from the tubing onto the ground.</u>

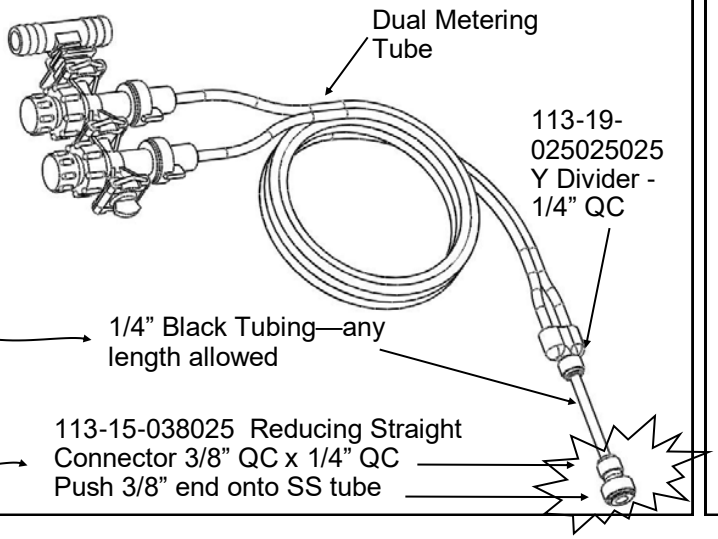


Connection to Totally Tubular or other heavy wall Stainless Steel Tube Ground Application Devices

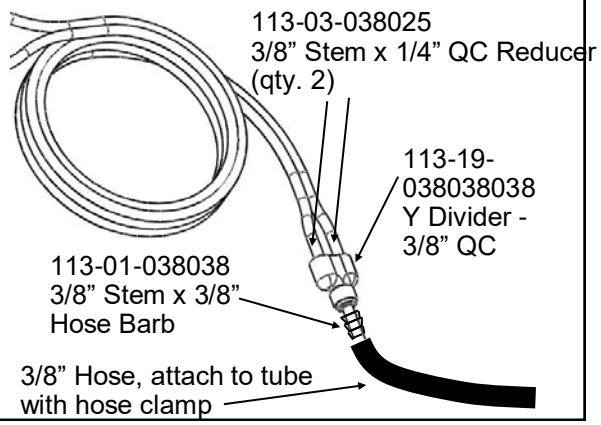
When using a 3/8” OD stainless steel tube to apply fertilizer to the ground, there are two options for the delivery tube plumbing. If the tube ID is less than 1/4” (tubing will not fit inside tube) this attachment method must be used. The description following is for Option 1. See bottom right picture for Option 2.

1. Use the 1/4” x 3/8” QC fitting shown. Push the 3/8” end onto the stainless steel tube. (Hint: if the fitting slips off the stainless steel tube, use sandpaper or a file to roughen the end of the tube slightly)
2. Use a short piece of 1/4” black tubing to connect the Y fitting to the reducer fitting on the stainless steel tube.
3. Zip all tubing to the planter and row unit in as many locations as possible.

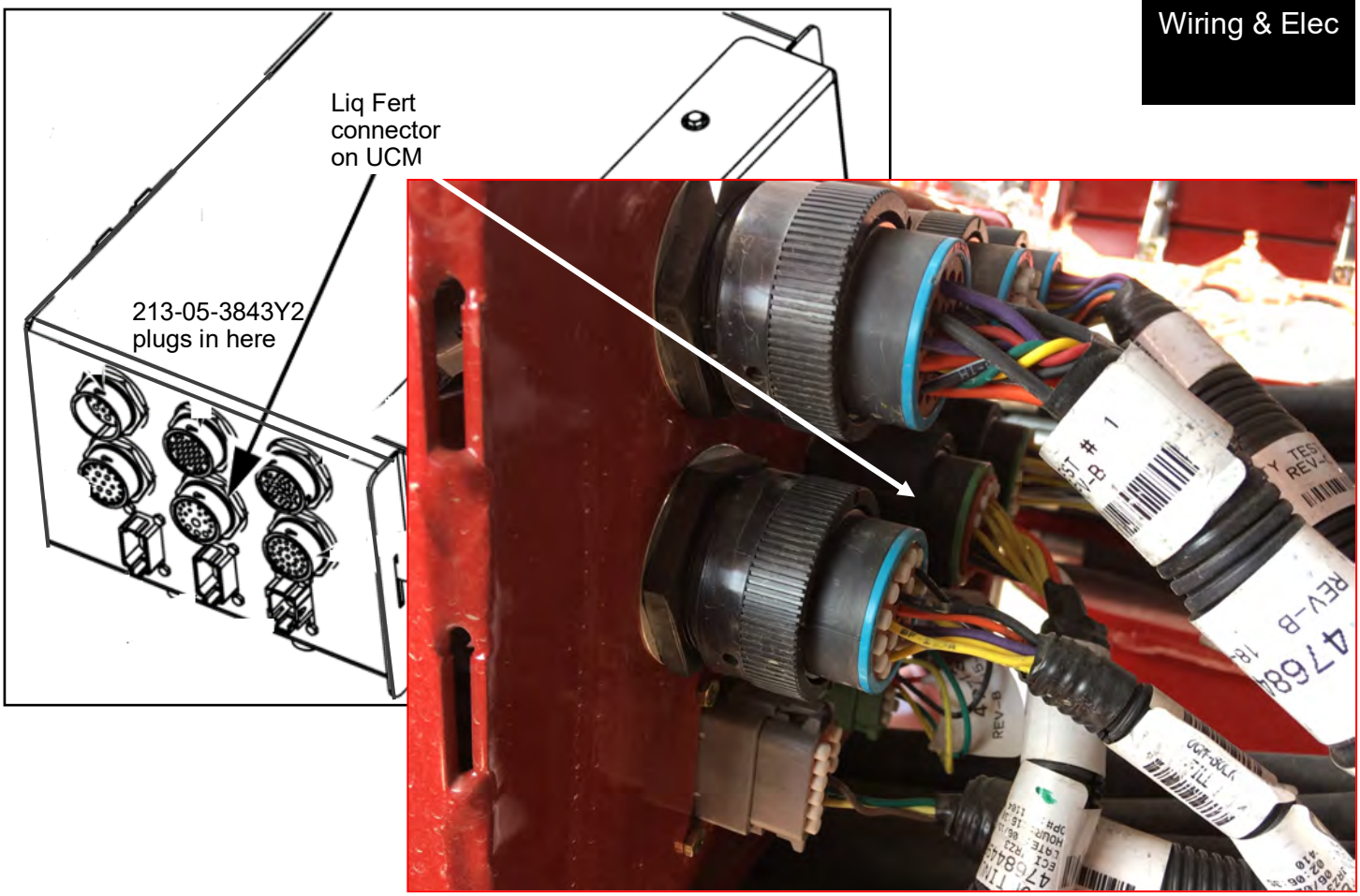
Option 1: QC Fitting attaches to SS Tube



Option 2: 3/8” Hose attaches to SS Tube

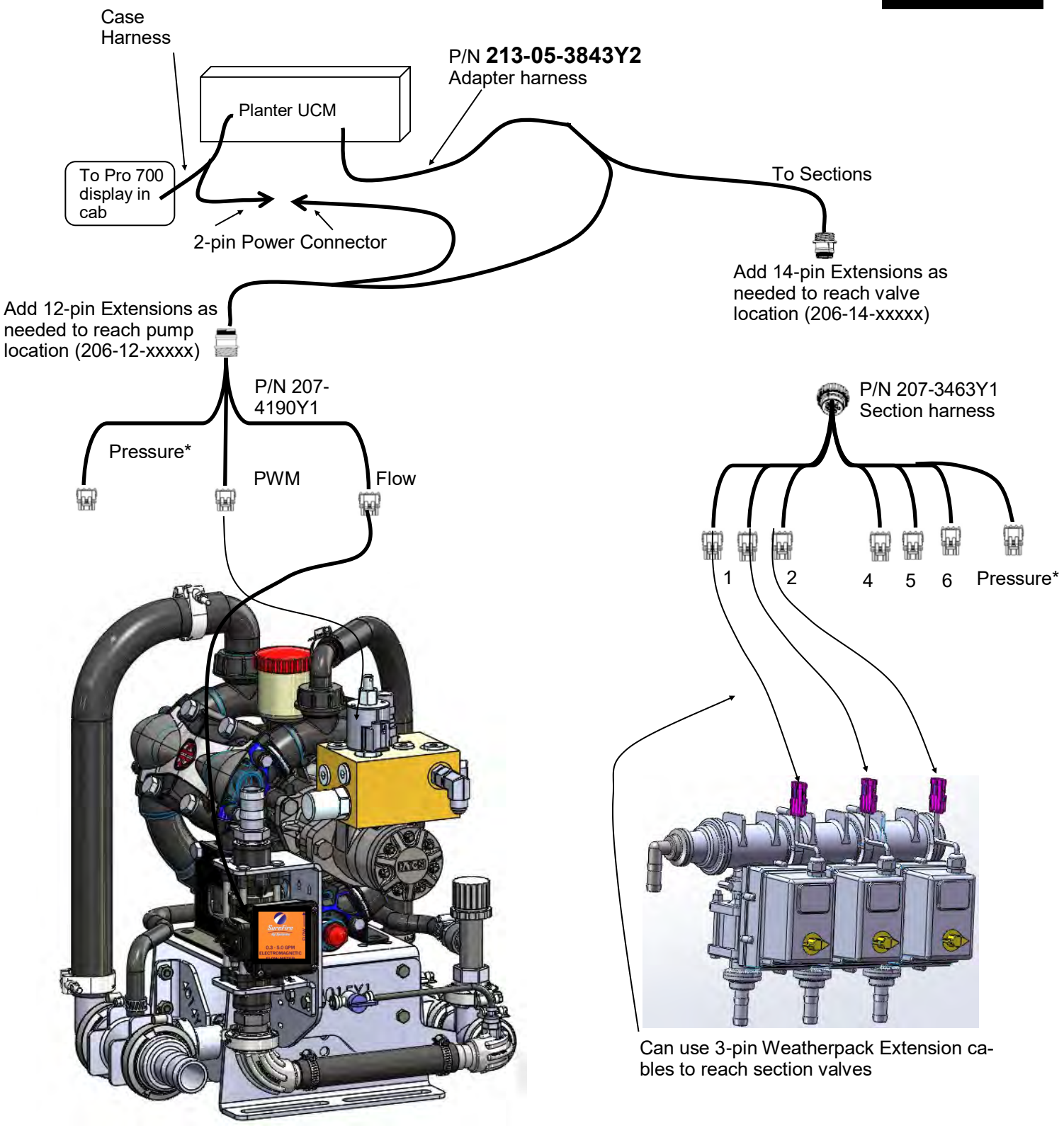


Case 2000 Series Planter UCM



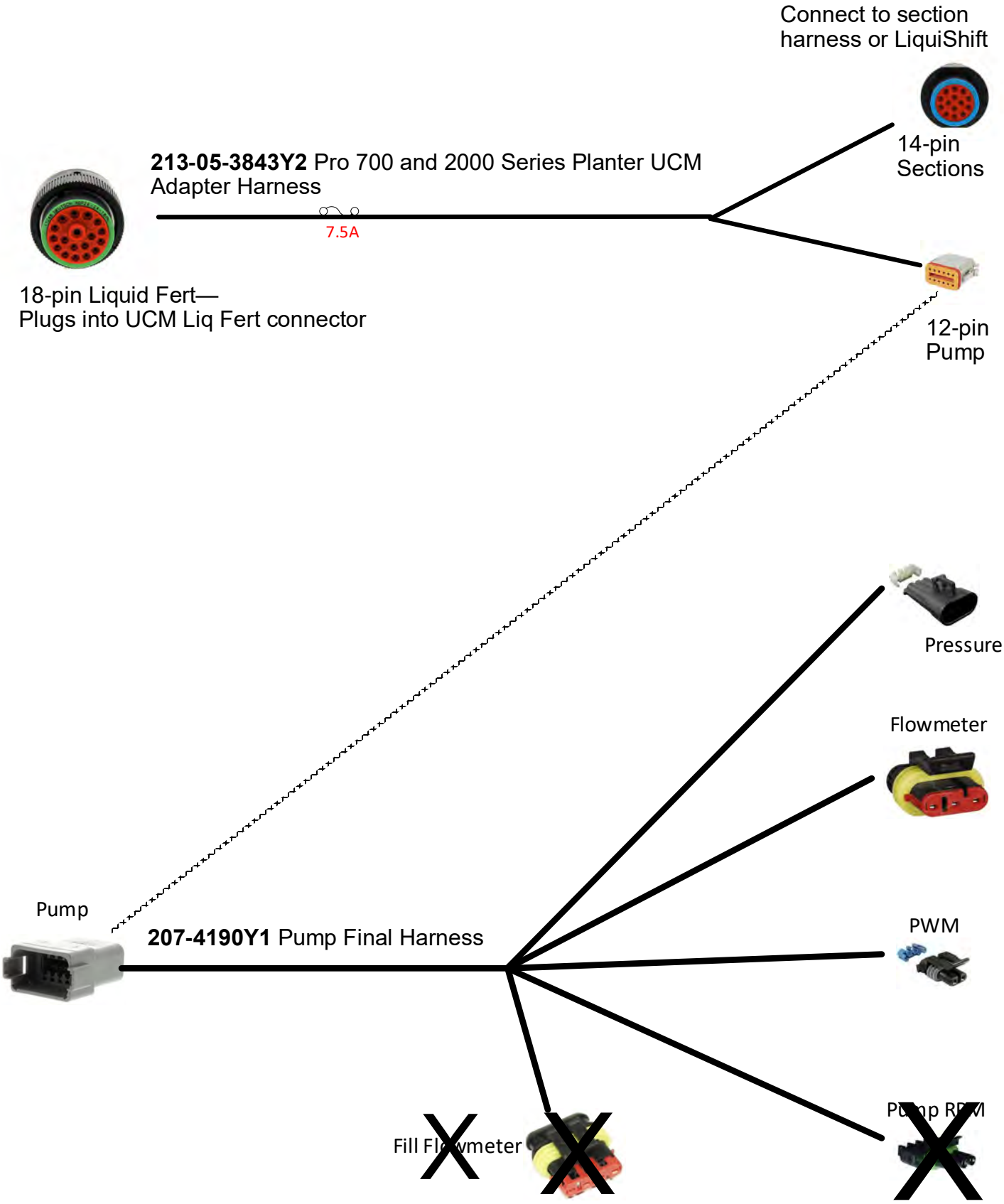
Main Adapter Harness 213-05-3843Y2 plugs into the 18-pin round connector on the UCM on the planter.

Pro 700 & 2000 Series Planter UCM with PWM Wiring Schematic
3 Sections for PumpRight Hydraulic Pump

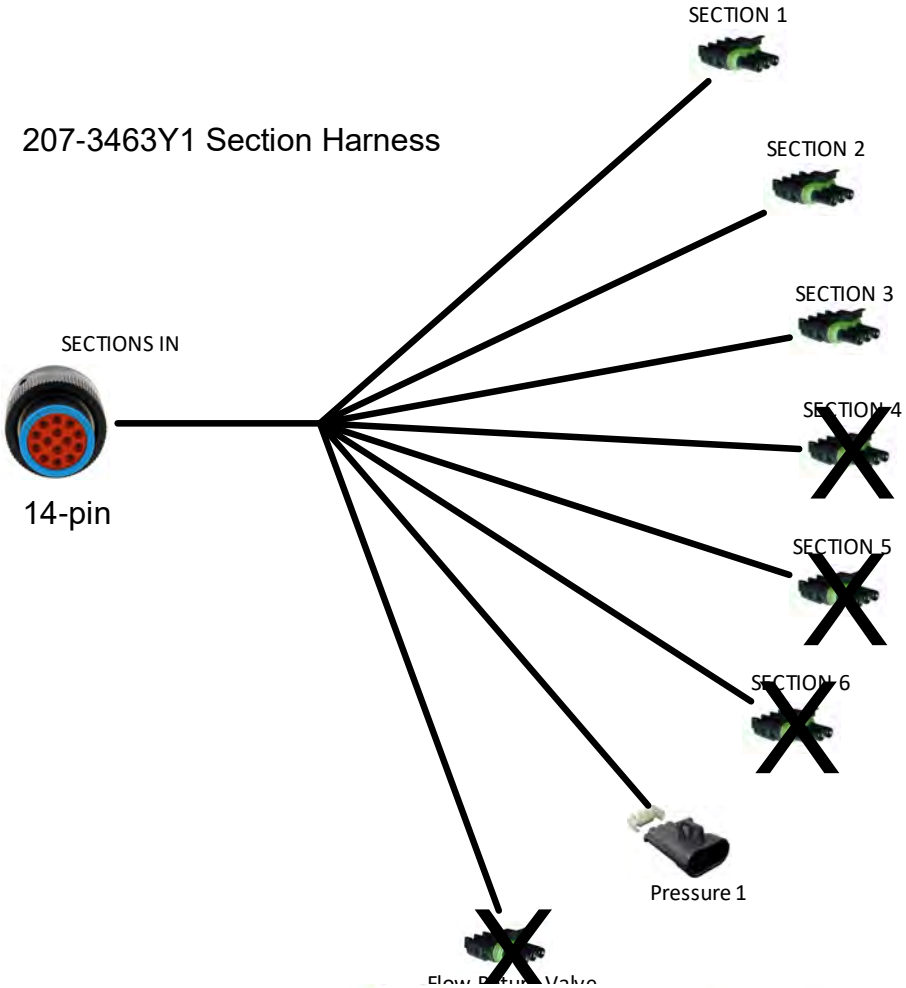


* The PUMP final harness has a Pressure connector. Section 1-6 also has a Pressure connector.

Harness Layout



Harness Layout—Sections



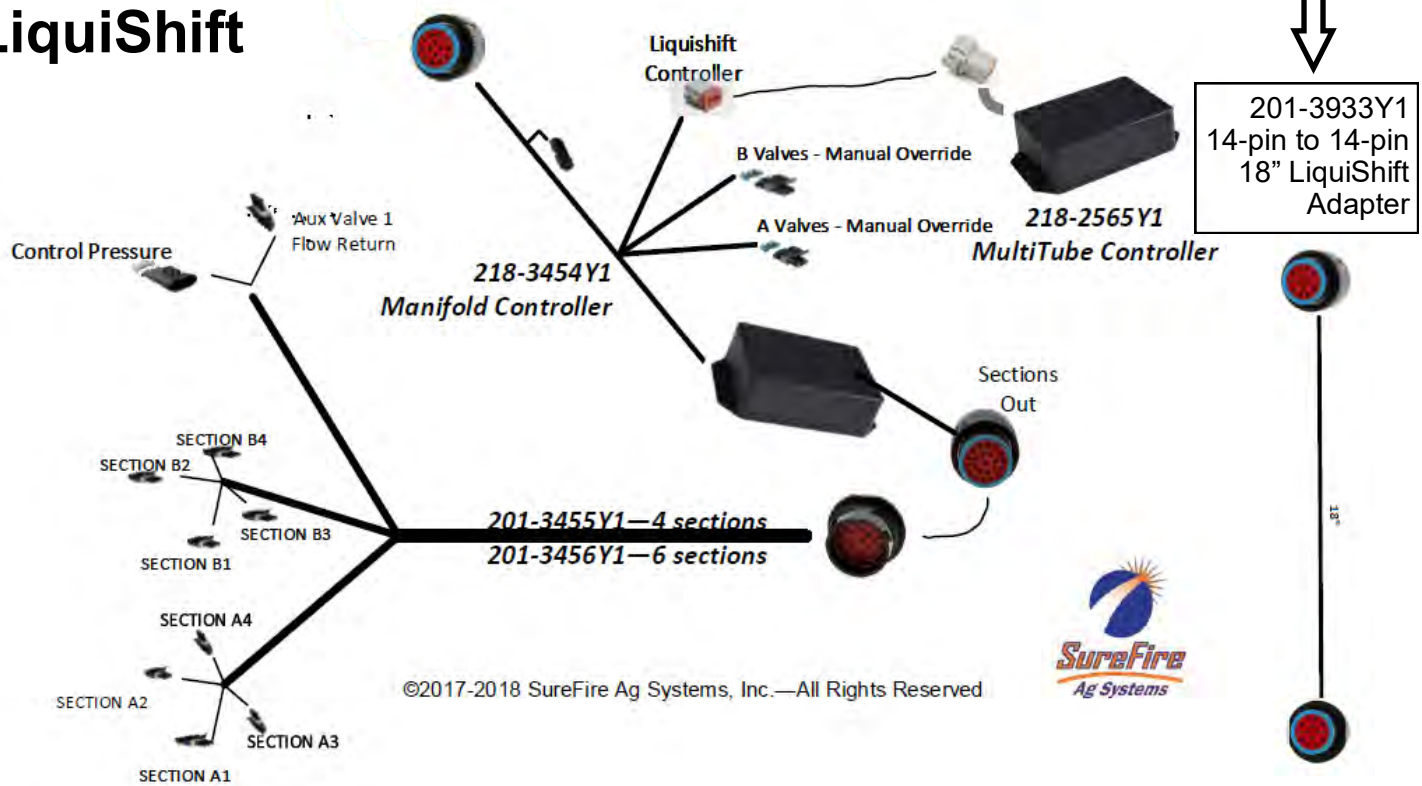
When the planter has a LiquiShift system, the harness on the left will not be used.

The harnesses below will connect the section valves for the LiquiShift system.

In addition, the LiquiShift system will have an 18” adapter harness that plugs in to the 14-pin section connector before the LiquiShift connects.

201-3933Y1
14-pin to 14-pin
18” LiquiShift
Adapter

LiquiShift



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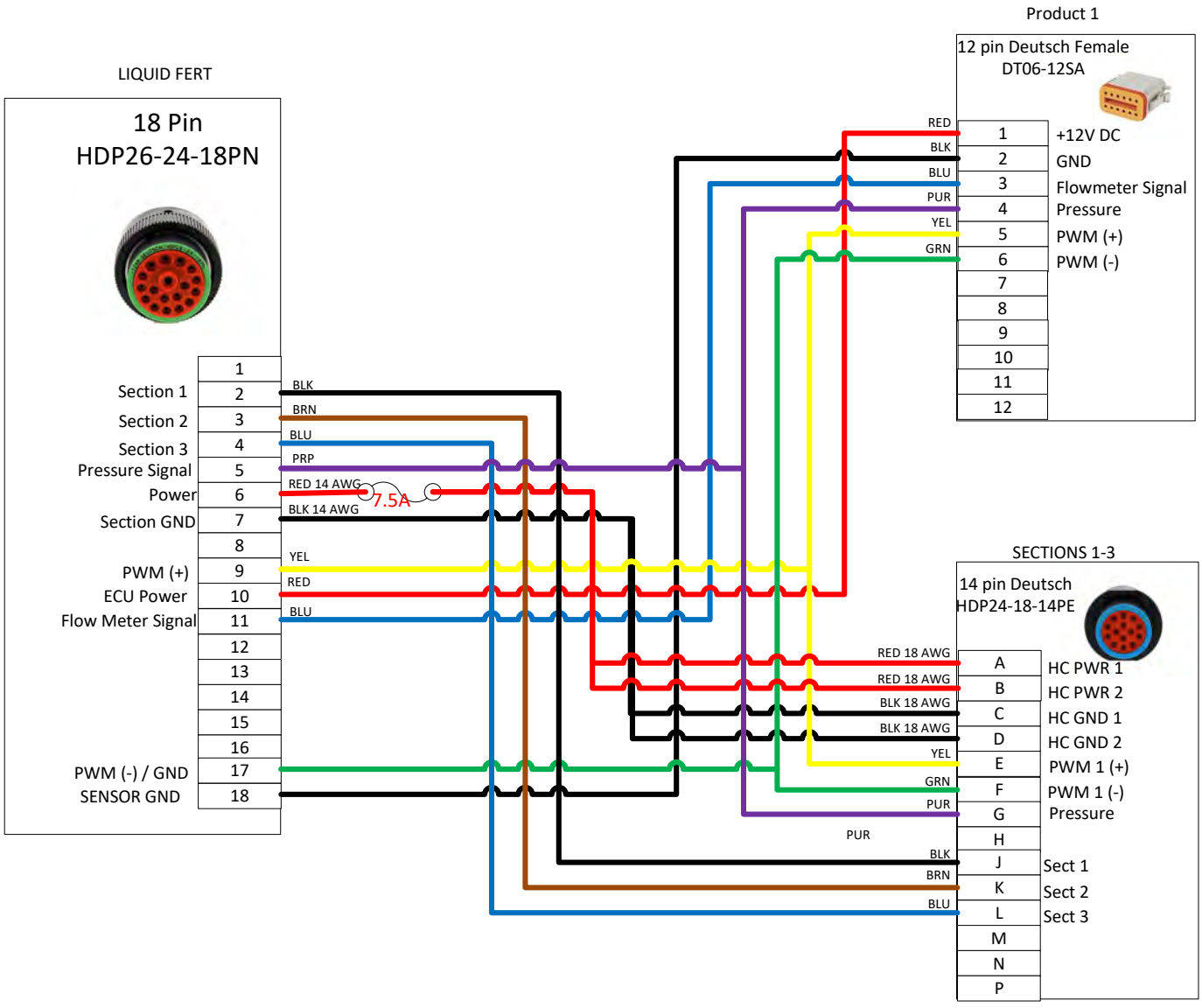
213-05-3843Y2

Pro 700 and 2150 Planter ECU adapter harness w 12-pin Product and 14-pin Section

Wire 18AWG unless otherwise specified

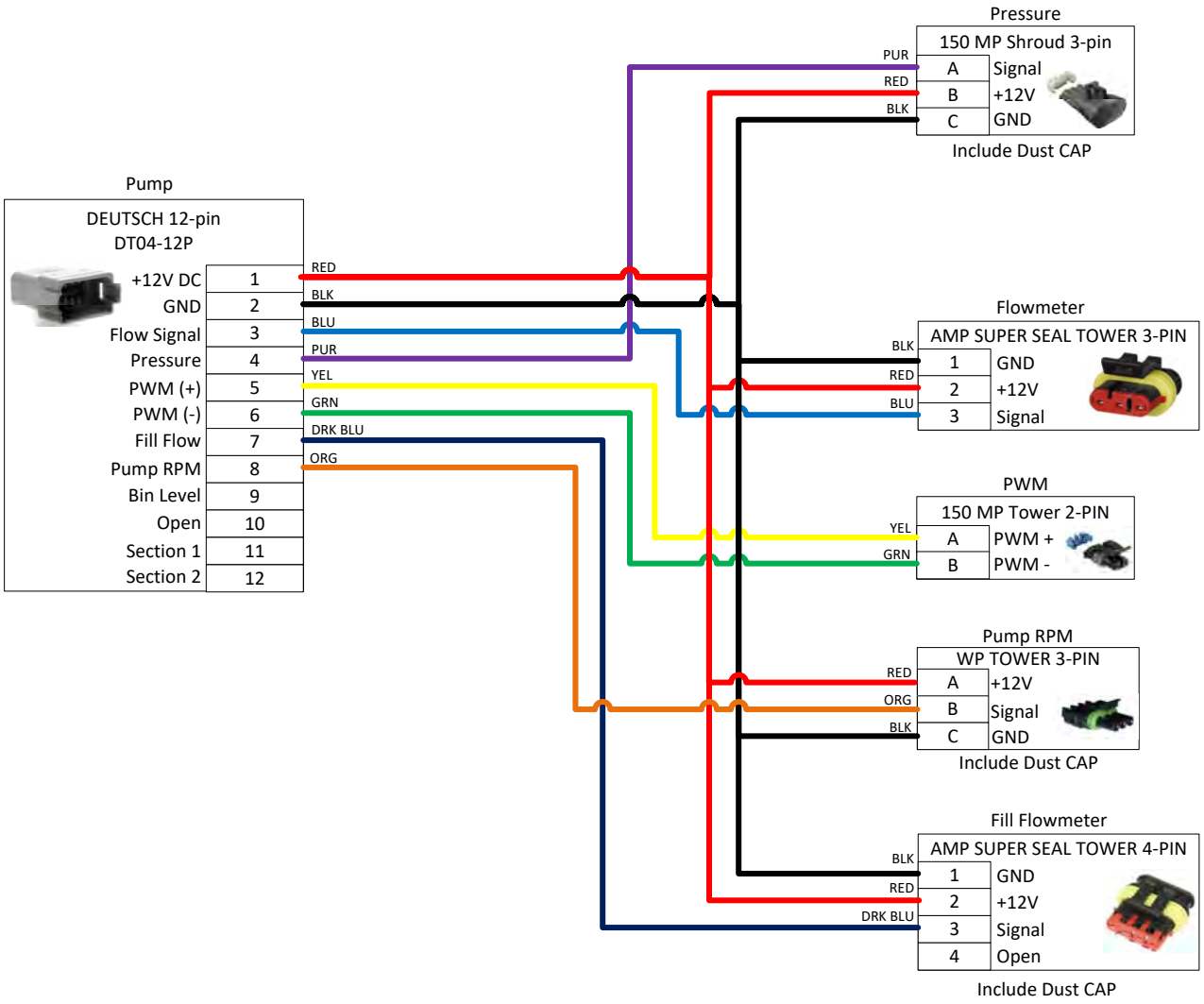


SureFire Ag Systems	Part No:	213-05-3843Y2	Drawn By:	Mark Wolters	
	Description:	Pro 700 and 2150 Planter ECU adapter harness w 12-pin Product and 14-pin Section	Last Edit Date:	4/11/2019	Revision A-03
	Copyright 2017 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden		26		

207-4190Y1

12-pin Deutsch Final Cable-same as 3462Y1

Wire 18AWG unless otherwise specified



SureFire Ag Systems	Part No:	207-4190Y1	Drawn By:	Brandon Cavenee	
	Description:	12-pin Deutsch Final Cable-same as 3462Y1(pwm, flow, pres., pump rpm, fill flow)	Last Edit Date:	10/31/2016	Revision A-02
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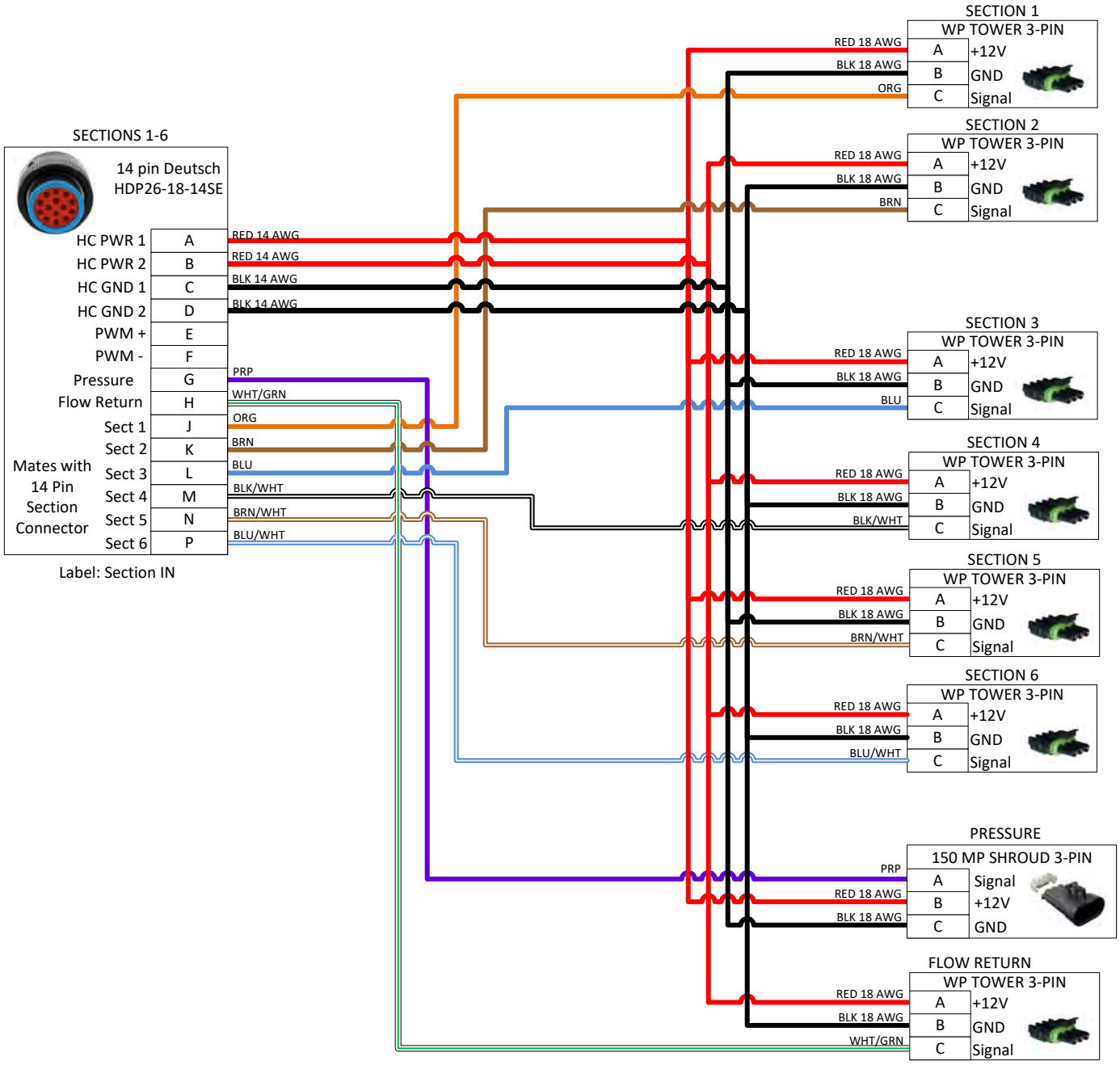
207-3463Y1

14-Pin 6-Section Final Cable (6 sections, flow return, pressure)

Wire 18AWG unless otherwise specified

Provide dust caps for WP and MP connectors



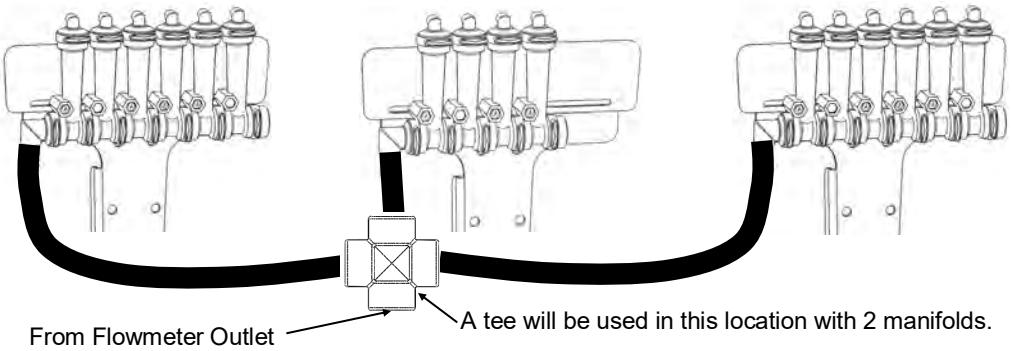
SureFire Ag Systems	Part No:	207-3463Y1	Drawn By:	Brandon Cavenee	
	Description:	14-Pin 6-Section Final Cable (6 sections, flow return, pressure)	Last Edit Date:	11/2/2016	Revision A-01
	Copyright 2016 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden		28		

Floating Ball Flow Indicators

E
Installation Overview

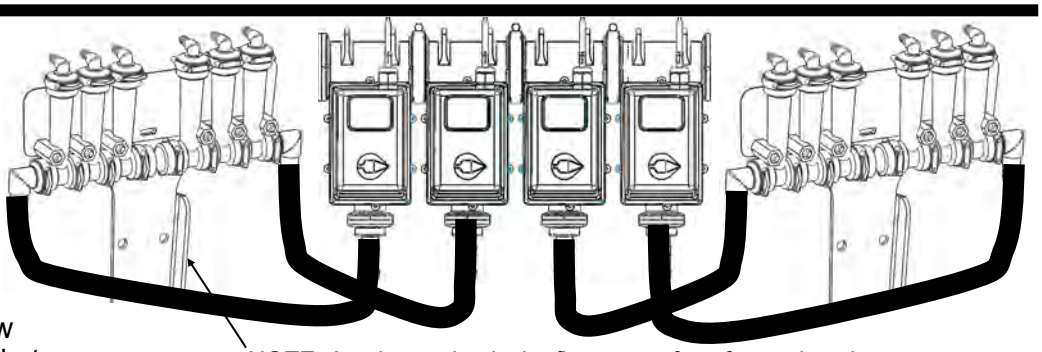
Flow Indicators are extremely flexible and can be mounted in hundreds of different configurations on various types of liquid application equipment. This page is to give you some ideas and let you customize the installation for what works best on your equipment.

16-row
Split 6 - 4 - 6
This configuration works well on a 16-row front fold planter. Each flow indicator manifold is shown fed by a cross in a single section installation. Each manifold could be fed by a section valve if desired.

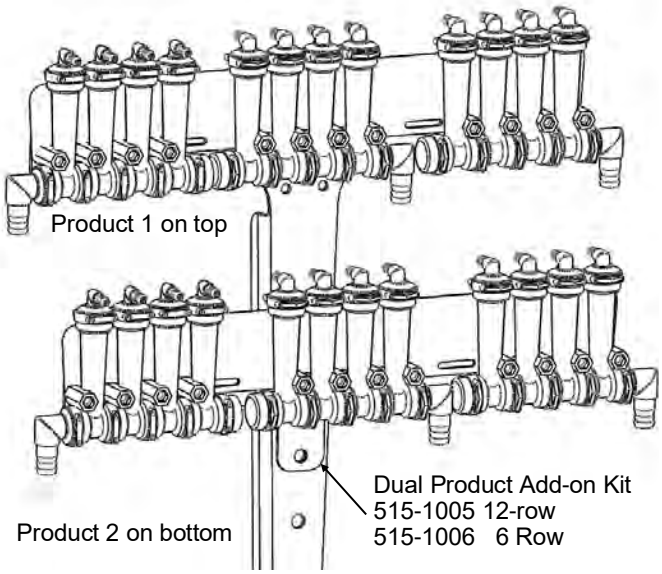


12-row
Split 3 - 3 - 3 - 3
Shown here is a 12-row with four 3 row sections controlled by four section valves. Note each 6 row T-Bracket can hold two separate 3 row manifolds.

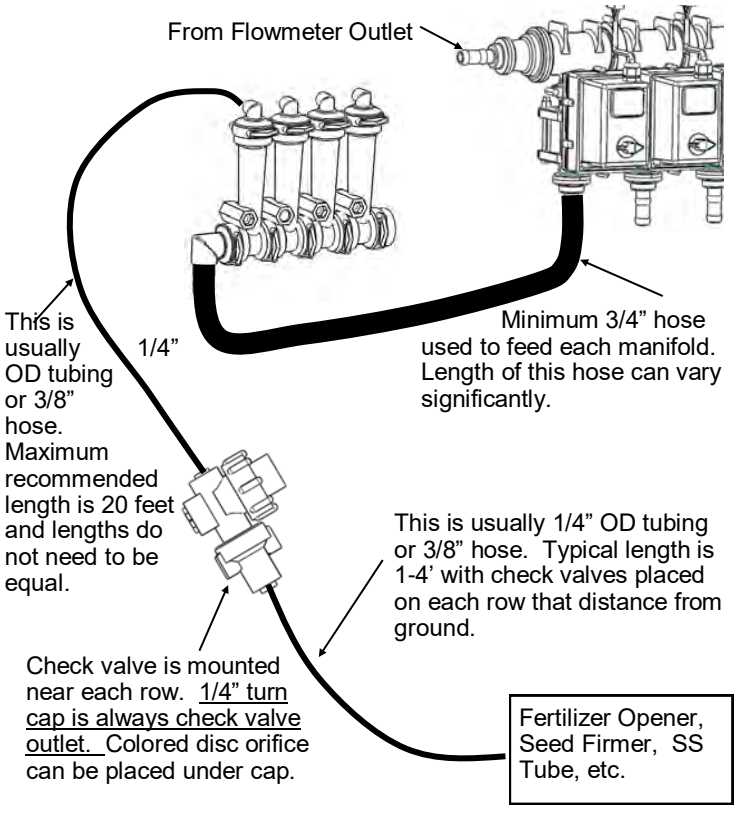
A 4 section 24 row could be similar with four 6 row manifolds on two large T-Brackets.



12-row Dual Product
Product 1 Split 4 - 4 - 4 / Product 2 Split 4 - 4 - 4
In this case each manifold would be fed by a section valve. There would be 6 total section valves (3 sections X 2 products). Most often one set (top) of flow indicators would be Full Flow for high rate fertilizer and 2nd set (bottom) would be Low Flow for starter.



General Plumbing Guidelines

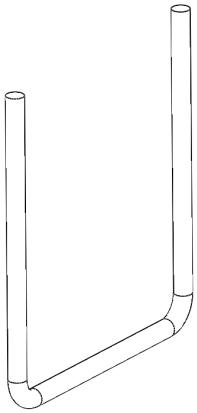


PumpRight Pump Installation

E
Installation Overview

Mounting

1. Mount pump in your preferred location. The PumpRight pump has excellent suction and priming ability, so it can be mounted away from or above fertilizer tanks.
2. SureFire has U-Bolts available to mount the pump directly to multiple bar sizes shown below. Each U-bolt kit includes 1 bolt and 2 flange nuts.
3. If the U-Bolts will not work, order the universal backer plate kit, number 515-203000 which will clamp to any size tube from 4” - 8” wide.



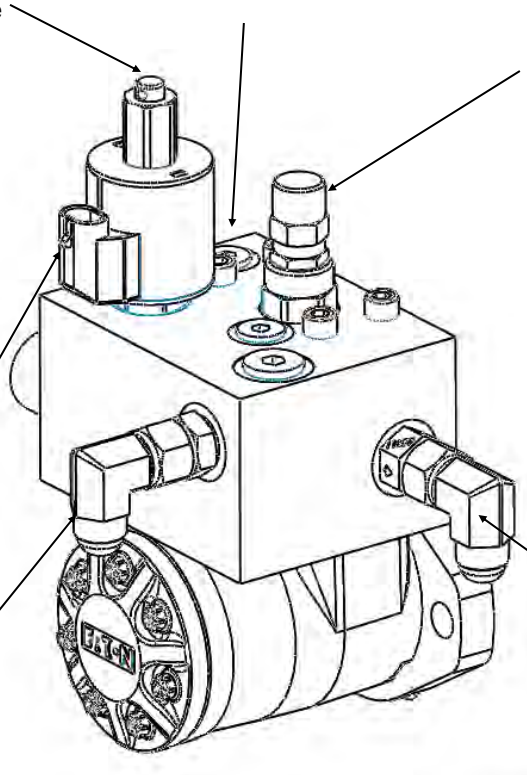
Item Number	Item Description
380-1001	1/2" U-bolt Kit - 1/2", fits 7" x 7" tube - (7" opening)
380-1014	1/2" U-bolt Kit - 1/2", fits 5" x 7" tube - (5" opening)
380-1015	1/2" U-bolt Kit - 1/2", fits 4" x 6" tube - (4" opening)
380-1016	1/2" U-bolt Kit - 1/2", fits 7" x 5" tube - (7" opening)
380-1017	1/2" U-bolt Kit - 1/2", fits 6" x 4" tube - (6" opening)
380-1018	1/2" U-bolt Kit - 1/2", fits 7" x 6" tube - (7" opening)
380-1019	1/2" U-bolt Kit - 1/2", fits 8" x 12" tube - (8" opening)
380-1020	1/2" U-bolt Kit - 1/2", fits 8" x 16" tube - (8" opening)
380-1021	1/2" U-bolt Kit - 1/2", fits 6" x 10" tube - (6" opening)

A Safety Tip from the Kansas Farm Bureau Safety Poster Program

PumpRight Hydraulic Connections
PWM Valve

Load Sense Port—For power beyond hydraulic use only.

Manual Override - Push down and turn 1/2 turn CCW to lift the valve for manual override to check for proper hydraulic operation. **Override will completely open valve, so limit tractor hydraulic flow to valve.**
(May need to clean packed dirt to allow movement of override knob.)
Push down and turn 1/2 turn CW to return to operating position.



Bypass Valve—Remove the cap to access a bypass needle valve. This valve is shipped from the factory closed. **The only case when valve should be open is when running in series with other hydraulic motors.**

Depending on your tractor and exact hydraulic plumbing scenario your pump may turn very slowly when it should stop. To stop the pump completely, open the bypass valve slightly.

To adjust the Bypass Needle Valve, first loosen the lock nut. Do not overtighten the needle valve.

PWM Valve Connector -2 Pin MP Shroud
Troubleshooting Tip:
To check coil, an ohmmeter placed on the two pins should show 7-9 ohms.

Return oil to Tank - Check valve included on return port

Pressure line from Tractor

DANGER

Hydraulic oil under extremely high pressure. Do not use hand or any other skin to check for or to stop hydraulic leaks. Be sure pressure is relieved before loosening hydraulic fittings. Replace worn hoses immediately. Seek medical care immediately if hydraulic oil is shot into the eye or the skin.

Pump Rotation Check Valve

A check valve is included on the outlet port of the hydraulic valve. This prevents the pump from running in the wrong direction. If ran in the wrong direction, liquid will be pumped, however the hydraulic valve will not be able to control the flow. The check valve can be identified by the Part Number 1108R stamped on it and a flow direction arrow.

How it Works with Power Beyond Hydraulics

This valve is designed to work with power beyond hydraulics. This configuration will not require a standard tractor remote hydraulic valve. The load sense port and hose described next will typically not be needed if other hydraulic ports are in use. If the load sense is needed, do this: First, remove the load sense plug and install a #6 male boss x #6 JIC adapter fitting, SureFire PN 161-01-6MB-6MJ. Then run a 3/8" or 1/4" hydraulic hose back to the tractor. This hose will connect to the load sense port on the tractor. The load sense line will signal the tractor hydraulic system to supply the flow needed by the pump to meet your application rate. The SureFire valve has an internal load sense check valve, which is required for power beyond hydraulics.. The bypass valve (see above) must be closed to use power beyond hydraulics or else an unlimited amount of oil will be continuously circulated.

PumpRight Hydraulic Connections

E
Installation Overview

Hydraulic Hose

SureFire recommends 1/2” hydraulic hose for both pump inlet and outlet. The hoses will need #8 JIC female swivel fittings.

Where do I get hydraulic flow for my PumpRight?

This question is often asked as many implements use up all the hydraulic connections on a tractor. SureFire has some recommendations as to what works best. Check with your Case dealer for detailed hydraulic schematics for your planter.

Preferred

Best Option - Dedicated PumpRight Circuit
If you have a tractor remote available, attach the tractor remote valve directly to the PumpRight pressure and return ports. DO NOT try to avoid this method simply to save another set of hydraulic hoses running to the tractor. Operating the PumpRight on it’s own circuit is the simplest for installation and operation. It guarantees the PumpRight won’t negatively affect any other hydraulic components on your equipment.

Option 2: 2150 16-row and 24-row
Connect the hydraulic hoses for the fertilizer pump to the Left-hand dual section motor control valve block (Left-hand vacuum fan, alternator) on the left wing of the planter.
Connect the P port on the pump to the P port on the liquid fert valve.
Connect the T port on the pump to the T port on the liquid fert valve.
Leave the bypass closed on the Liq Fert valve block.

Alternate Option - In Series with Bulk Fill Seed Fan
If you do not have a tractor remote valve available, this may be your best method. You can plumb the PumpRight after the seed distribution fan in series. If using this method, the SureFire PWM bypass valve must be open (see previous page for instruction & picture). If bypass is left closed, the SureFire valve will limit the speed of the seed distribution fan.

For example, the Bulk Fill fan uses around 7 GPM of oil. This will limit the PumpRight maximum flow (9 GPM oil necessary for maximum flow). See the charts on the next page for adjusted maximum pump flow. See section G for flow charts to determine your necessary flow rate.

DO NOT plumb the PumpRight in series with a vacuum fan. The vacuum fan uses just a few GPM of oil. Also, problems will be caused by excessive pressure at the vacuum fan motor

Hydraulic oil under extremely high pressure. Do not use hand or any other skin to check for or to stop hydraulic leaks. Be sure pressure is relieved before loosening hydraulic fittings. Replace worn hoses immediately. Seek medical care immediately if hydraulic oil is shot into the eye or the skin.

PumpRight Hydraulic Oil Flow Requirements

(Requirements for 4.0 CID Motor—standard SureFire motor beginning in 2016—Earlier motor was 4.9 CID which uses 20% more oil)

Setting Tractor Hydraulic Remote Speed

PumpRight pumps require a constant hydraulic oil flow from the tractor. The amount of oil needed varies with pump size and speed. The chart at right shows the necessary oil flow for each pump model at varying fertilizer flows.

Use this procedure to determine the correct setting on your tractor hydraulic flow (only if the liquid pump is connected to its own remote).

1. Run the fertilizer system in the field at the maximum rate and ground speed.
2. Turn down the hydraulic flow slowly while watching the pump flow (Volume / Minute).
3. Observe when the Volume / Minute begins to drop.
4. Turn the hydraulic flow back up slightly.

This setting will provide the Pump Right pump just enough oil for your application rate.

If running with the bypass open (only recommended when 2 motors are operated in series) this process will minimize the oil circulated in the bypass loop, leaving more oil flow for other hydraulic functions.

NOTICE

The pump is rated at a maximum of 550 RPM. Spinning the pump over 550 RPM may cause pump failure.

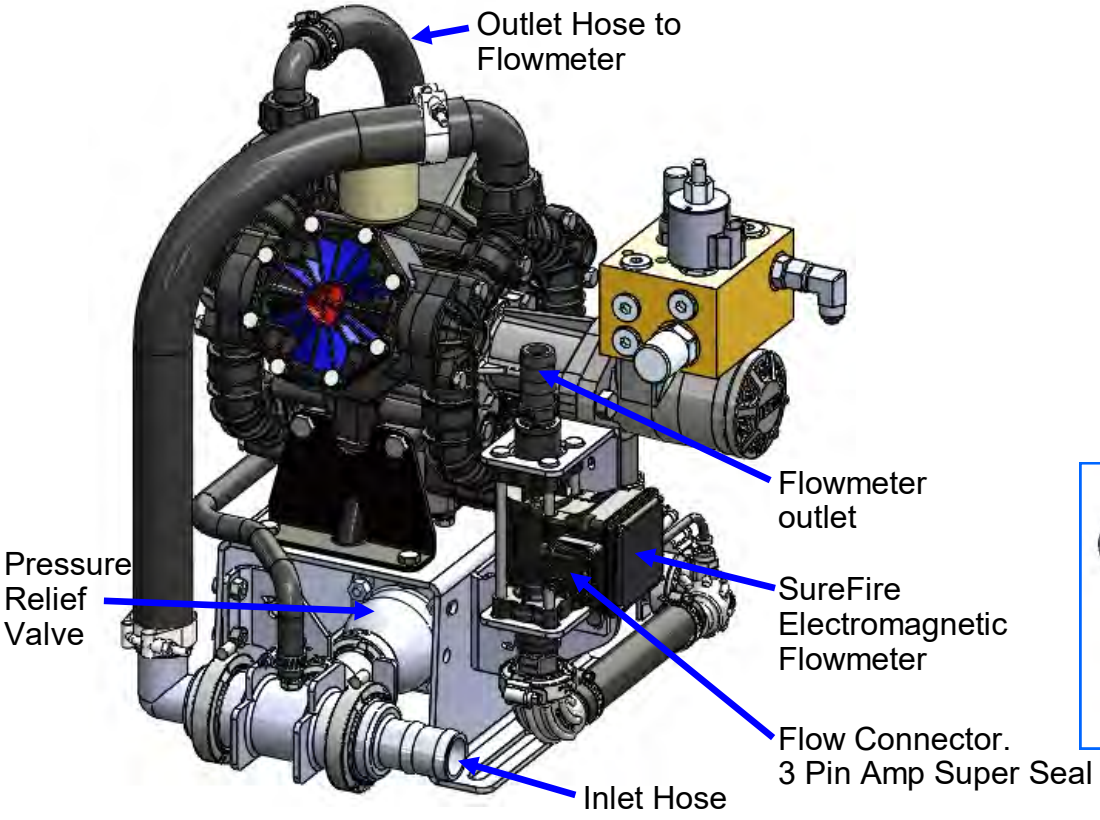
The system will spin the pump faster than that if precautions are not taken to limit the speed. This could happen if the strainer becomes plugged or blocked and the controller attempts to speed the pump up to achieve the desired Rate.
It could also happen if a high pressure situation occurs that opens the Pressure Relief Valve (PRV) and the pump speeds up to try to achieve the Rate.

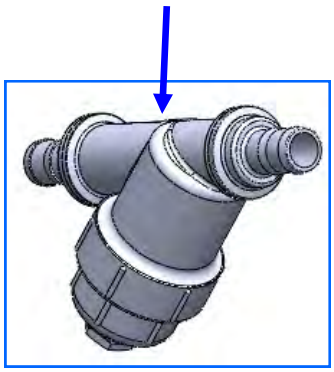
Monitor the pump RPM. If the pump begins to speed up, check for a blocked strainer or other issue.

Model PR17 - 3 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
5	137	2.4
10	275	4.8
15	412	7.1
17	467	8.1
Model PR30 - 3 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
5	85	1.5
10	170	2.9
15	255	4.4
20	340	5.9
25	425	7.4
30	510	8.8
Model PR40 - 4 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
10	115	2.0
20	229	4.0
30	344	6.0
40	458	7.9
Model D250 - 6 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
10	86	1.6
20	172	3.2
30	258	4.8
40	343	6.4
50	429	8.0
55	472	8.6

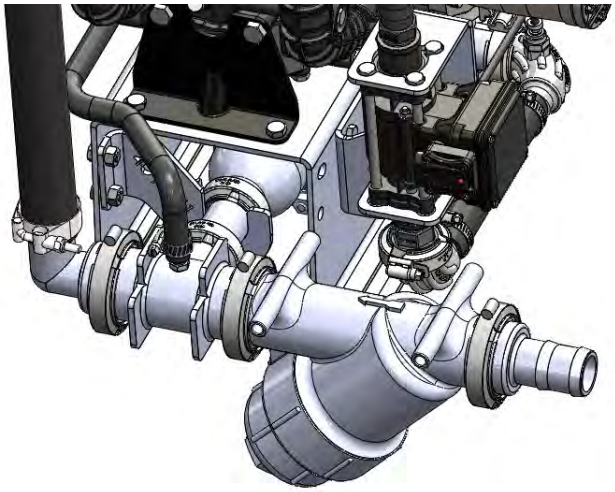
PUMPRIGHT HYDRAULIC DRIVE DIAPHRAGM PUMPS

PR17 & PR30 Liquid Plumbing Connections





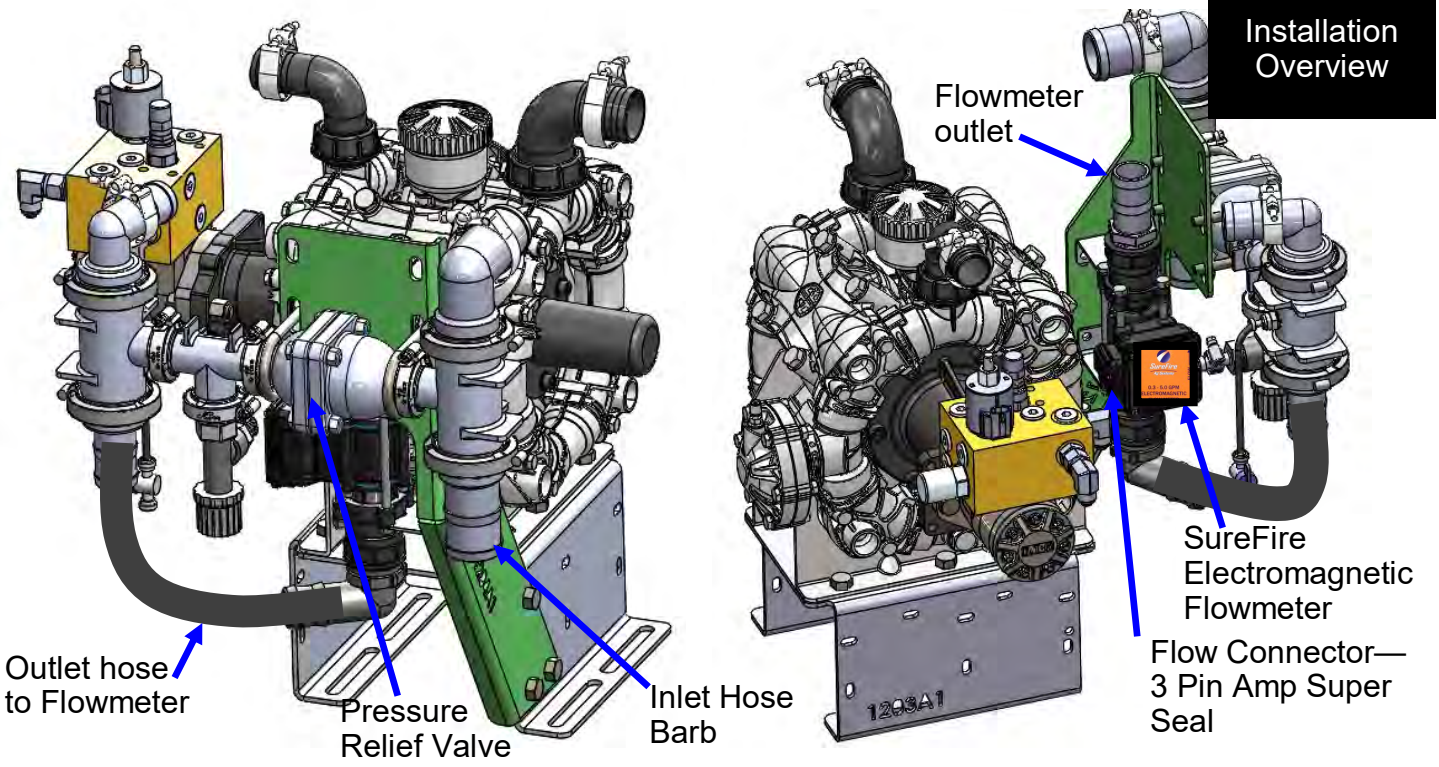
Inlet: The PR17 and PR30 PumpRight are shipped with a 1 1/2" inlet hose barb. Attach this to the hose from your supply tank and strainer . A 1 1/2" 90 degree hose barb is included and can be substituted.
Inlet Strainer: A 20 mesh strainer is included in the pump kit. The manifold strainer includes two hose barbs so it can be mounted anywhere in the inlet line. If space allows, the strainer can be mounted directly to the inlet plumbing assembly as shown below.
Outlet: The outlet is plumbed directly to the flowmeter with 1" hose. As shown above, the flowmeter may be mounted directly to the PumpRight pump. The flowmeter outlet is a 1" hose barb. The outlet hose should be a minimum of 24" long with a gentle curve prior to any fittings for optimum flowmeter performance. The flowmeter outlet will attach to your manifold(s) or section valves. A 3/4" hose barb is included in the bag of parts and can be substituted on the flowmeter outlet.
Pressure Relief Valve (PRV): The PRV is a 100 psi relief. If there is a restriction that creates over 100 psi in the system, the PRV will open allowing the excess flow to pass back to the inlet side of the pump. This protects the pump and fertilizer system from damage.

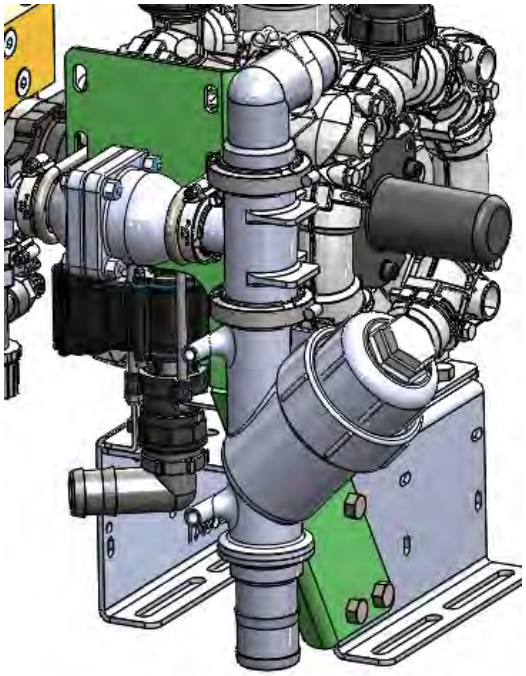


CAUTION

These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

PR40 & D250 Liquid Plumbing Connections





Inlet: The PR40 and D250 PumpRight are shipped with a 2" inlet hose barb. Attach this to the hose from your supply tank and strainer . A 2" 90 degree hose barb is included and can be substituted.

Inlet Strainer: A 20 mesh strainer is included in the pump kit. The manifold strainer includes two hose barbs so it can be mounted anywhere in the inlet line. If space allows, the strainer can be mounted directly to the inlet plumbing assembly as shown in image to the left.

Outlet: The outlet is plumbed directly to the flowmeter with 1 1/2" hose. As shown above, the flowmeter may be mounted directly to the PumpRight pump. The flowmeter outlet is a 1 1/2" hose barb. The outlet hose should be a minimum of 24" long with a gentle curve prior to any fittings for optimum flowmeter performance. The flowmeter outlet will attach to your manifold(s) or section valves.

Pressure Relief Valve (PRV): The PRV is a 100 psi relief. If there is a restriction that creates over 100 psi in the system, the PRV will open allowing the excess flow to pass back to the inlet side of the pump. This protects the pump and fertilizer system from damage.

⚠ CAUTION

These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

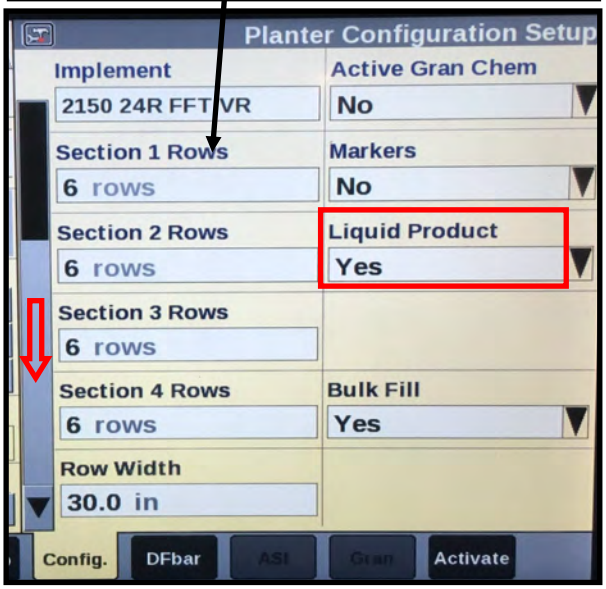
Setting up the Pro 700 Display

Refer to the AFS Pro 700 2000 Series Early Riser Planter Software Operating Guide for complete instructions for setting up and operating the liquid system. The Full Setup Wizard will take you through most of the setup. Some of the settings used by the liquid system are also used by the planting system, so not all setup screens are shown here. Some of the screens below may be covered by the Setup Wizard, but the screens related to liquid setup and operation are shown, along with typical starting values to enter.

Begin by letting it know you are using a liquid product that will be controlled by the Pro 700 with the Planter UCM software. This is part of the **Planter Configuration Setup.**

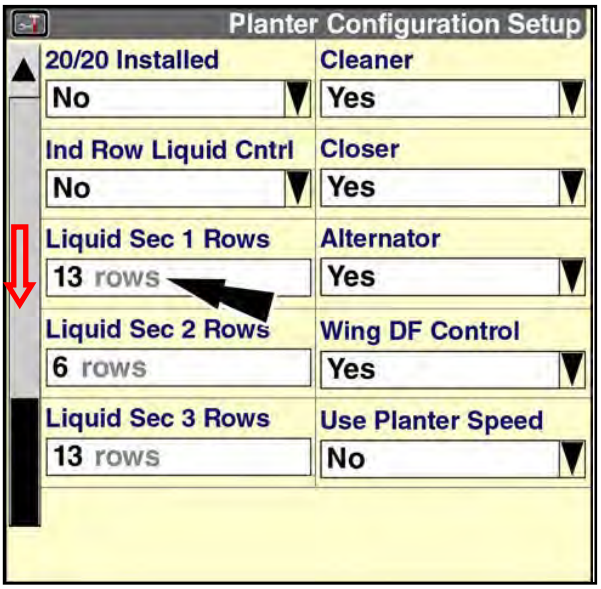
Home > Toolbox > Config

These 4 Section Rows setups are for the SEED, not the Liquid.



Advanced Setups > Set to YES to allow changes to LIQUID GAIN Settings (later).

Enter number of rows in each section for Liquid. This can vary.



Ind Row Liquid Cntrl: Do you have individual row shutoff for your liquid product?

Most of the time, the answer will be NO.

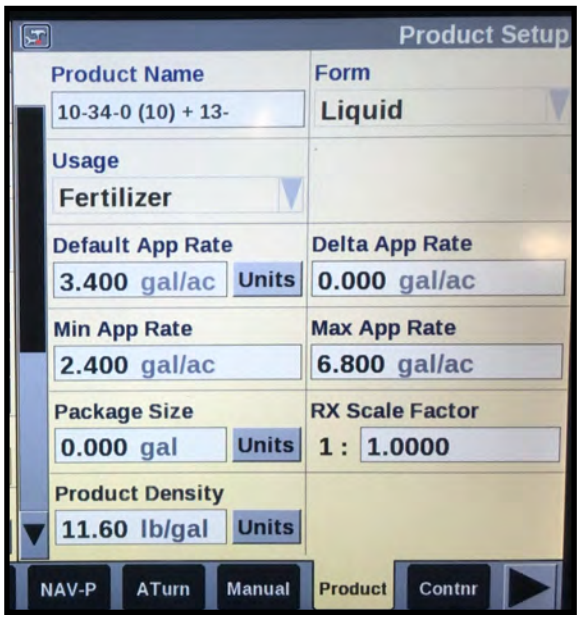
Answer YES if you do have individual row shutoff for the liquid.

TIP: Be sure your planter UCM and Pro 700 Display are running the latest software versions. Case dealers should be able to update those for you.

Product Setup

A product must be named before it can be selected, edited, or created. A product must be set up and assigned to a layer in order to be mapped.

Home > Toolbox > Product



Make the entries to fit your application. Typical setup entries are shown below. Yours may vary.

Product Name: Some other screens will only show the first 6 or 9 letters, so be concise.

Form: Liquid

Usage: Fertilizer

Units: gal/ac (typical)

Default App Rate: Target Rate

Delta App Rate: How much the rate will change when you press the up or down arrow on a "Liquid Control" window

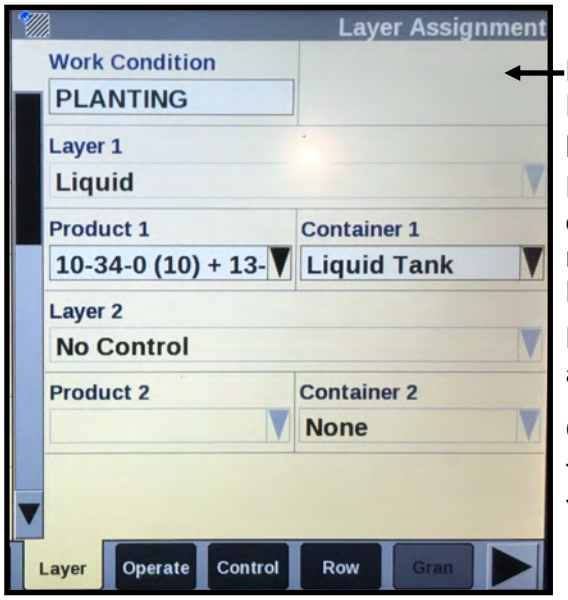
Min App Rate: The operator will not be able to drop the rate below this from a "Liquid Control" window.

Max App Rate: The operator will not to be able take the rate above this from a "Liquid Control" window.

The rest are optional entries that are not required for liquid fertilizer application.

Container Setup (Optional)

Containers are associated with products (seed, liquid, etc) using the "Layer Assignment" screen (*Home > Work Condition > Layer*). Container Control windows are not active until this assignment has been made.



Layer Assignment: Depends on the planter setup:

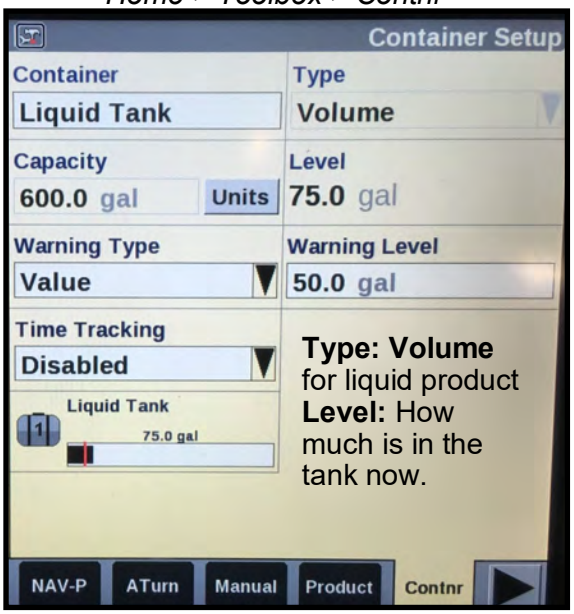
Layer 1 may be Seed or Liquid. **Layer 2** may also be Seed or Liquid. This will vary.

More layers are available.

Container Setup:

Typical setup shown. Your setup may vary.

Home > Toolbox > Contnr

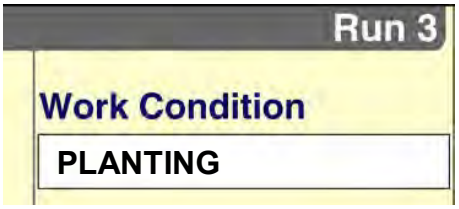


Type: Volume for liquid product

Level: How much is in the tank now.

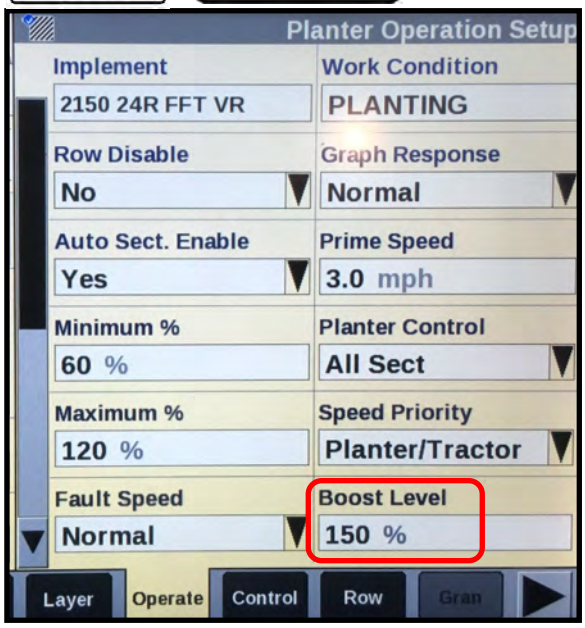
Work Condition

At least one Work Condition must be created in order to operate the planter. For planters, all selections contained in the “Layer Assignment”, “Planter Operation Setup”, “Planter Controller Setup”, “Row Setup”, and “Liquid Calibration” screens are connected to the selected Work Condition.



Operate

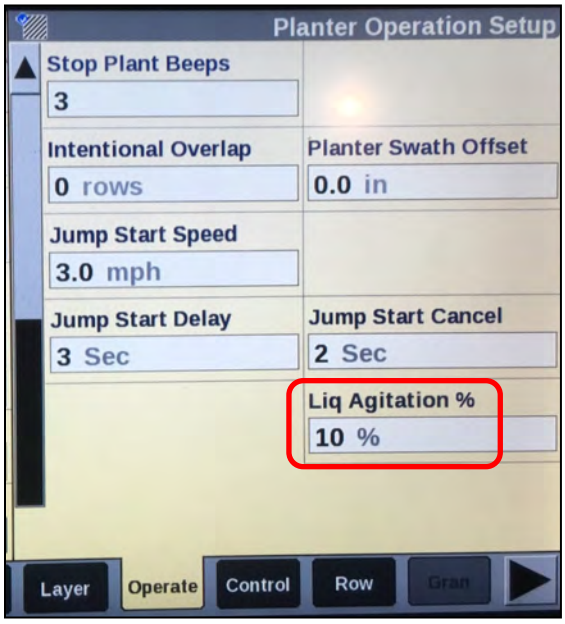
Home > Work Condition > Operate



Most items on these screens will be dictated by planter functions.

Boost Level > Gives the liquid pump a boost for 4 seconds on startup to get to rate quicker. Default is 150%. If that kicks the pump on too fast, reduce this number.

Liquid Agitation %- Not used with SureFire system.



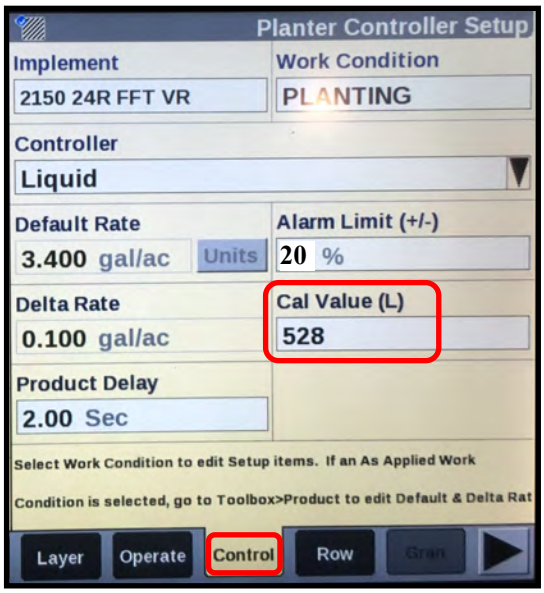
Controller Setup

Home > Work Condition > Control

Control

If a product/controller combination *was not* assigned to a map layer for the selected Work Condition, all windows will be active on this Planter Controller Setup screen for the liquid controller.

If a product/controller combination *was* assigned to a map layer for the selected Work Condition, some of the windows will *not* be accessible.



Controller: Use the pull-down menu to select *Liquid*.

Units:
Default Rate:
Delta Rate:

Select/enter as needed.

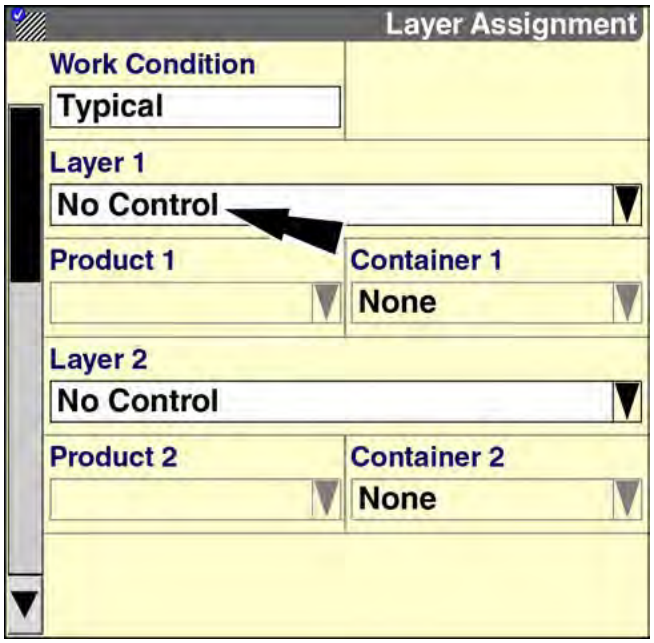
Cal Value: 528 pls/L

(528 is the Standard Cal Value for SureFire electromagnetic flowmeter on PumpRight with 2000 pls/gal flow cal)

3000 pls/gal = 792 pls/L

Layer Assignment

Home > Work Condition > Layer



May layer assignment must be done in order to operate with overlap control.

To assign map layers:

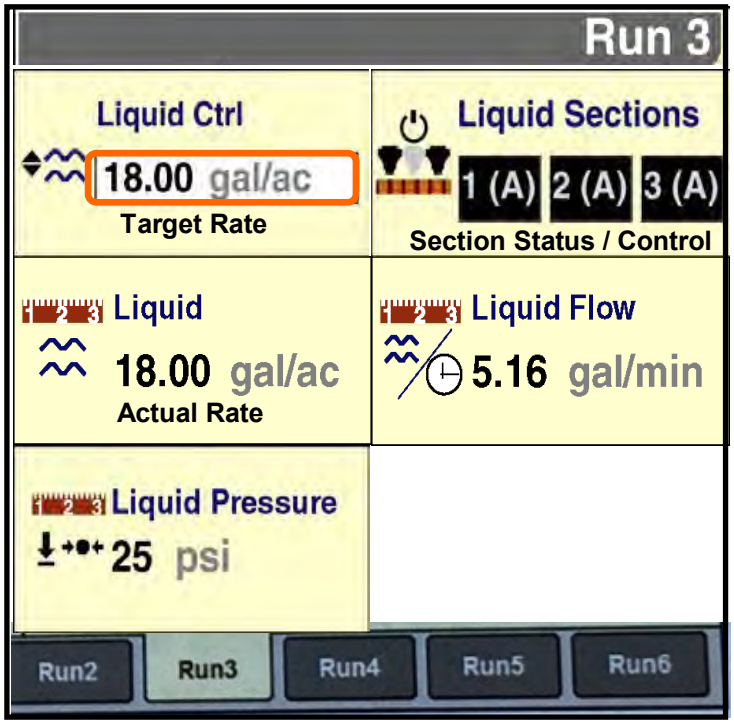
1. A layer must be selected for mapping: for example, Seed for Layer 1 and Liquid for Layer 2.
2. A Product must be selected for each layer. This might be Corn for the Seed Layer and 10-34-0 for the Liquid layer.

(The products must be set up with the Product Setup screen (*Home > Toolbox > Product)* before they can be selected for a Map Layer.

Run Screen Layout for Liquid

Home > Toolbox > Layout

Shown below is a possible layout for a Liquid Run Screen.



Liquid Ctrl (Liquid Control) - Use this to set the liquid fertilizer applied rate (Target Rate). Press on the box in the middle to bring up the following window:

Press on the left arrow to decrease the applied rate by the Delta App Rate set during setup.
Press on the right arrow to increase the applied rate by the Delta App Rate set during setup.
Press ON to toggle liquid application On or Off.
Press ENTER to save the change and close the window.

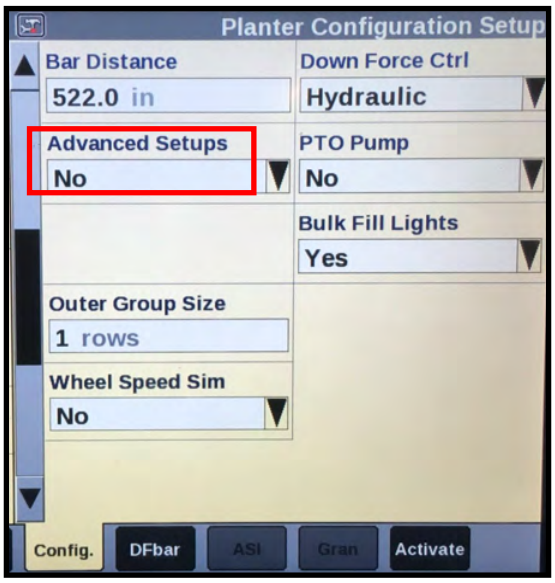
LIQUID shows the Applied Rate. **LIQUID FLOW** shows the current output flow in gal/min (typical units).

LIQUID PRESSURE indicates how hard the pump has to push to get the product from the sensor to the row outlet. The metering tube or orifice should be the main restriction. Rate, speed, product, and temperature will all affect the pressure.

Configuration Setup and Advanced Setups

Use the Advanced Setups screen to set and adjust the Liquid Gain. The Gain controls how quickly the pump responds to changes in output. If the Gain is too high, the pump will not lock on to the rate going across the field. It will be constantly adjusting above and below the rate.
If the Gain is too low, the pump will adjust too slowly when adjustment is needed, and it will take too long to get back to the desired rate.

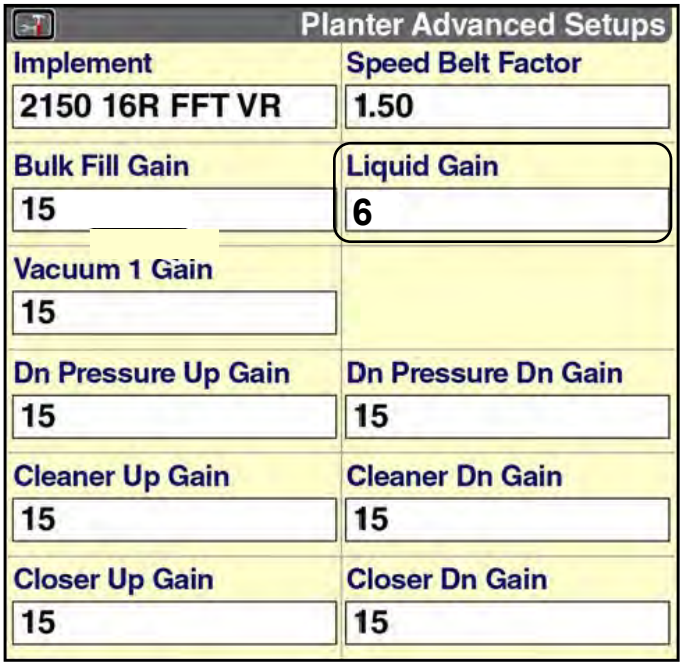
Home > Toolbox > Config



Advanced Setups:

Yes

This makes the Advanced Setup screen (below) available for access.



Home > Toolbox > Adv. Set.

Liquid Gain: Start at 6 for hydraulic pump.

Adjust as needed in the field.

If the system oscillates and won't lock on to the rate, decrease this number.

If the system is slow to respond to speed or rate adjustments, increase this number.

On a SureFire Tower electric pump, start with the Liquid Gain at 20.

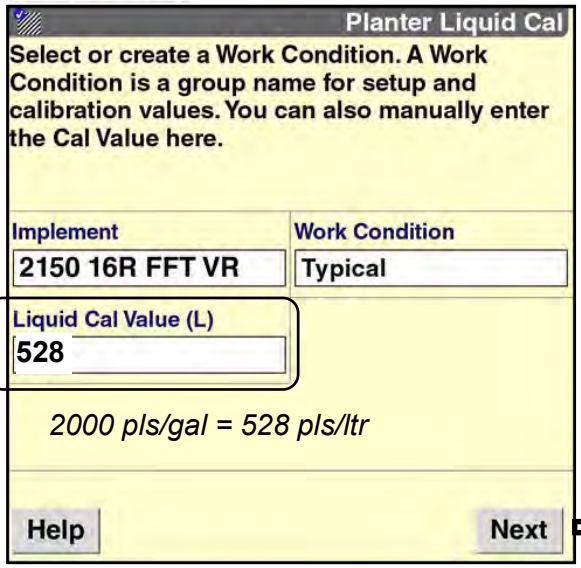
Prime Control

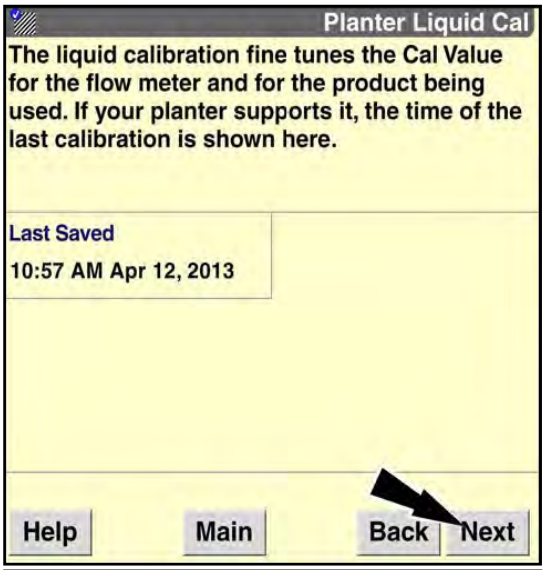
The Prime Control window is used to prime the seed meters and liquid fertilizer system.
When priming, the vacuum fan must be ON. Seed Control and/or Liquid Control windows can be set to turn Seed or Liquid ON or OFF for priming. If you just want to prime the seed, the Liquid Control screen can be used to turn the Liquid OFF. If you just want to prime the liquid system, use the Seed Control screen to turn the Seed OFF.
Use the Section Control window to enable or disable sections for priming.

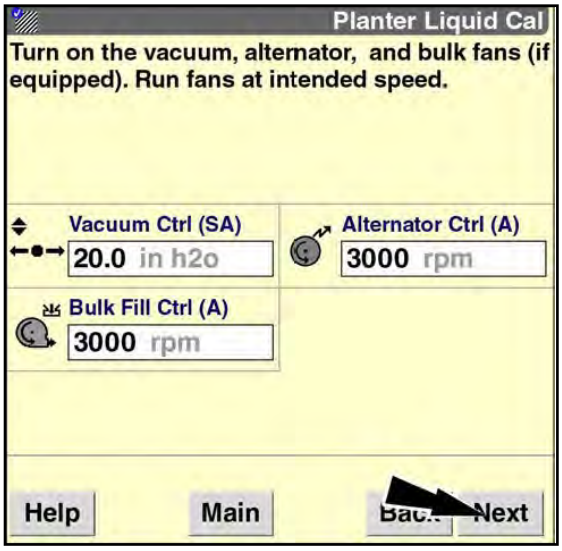
Liquid Fertilizer Calibration

The fertilizer system can be tested and calibrated from these screens. The flowmeter should need very little calibration, but it is a good idea to do some catch tests to verify that everything is set correctly. Don't change the recommended Cal Value unless a series of good catch tests or load weight comparison confirms that an adjustment is needed.

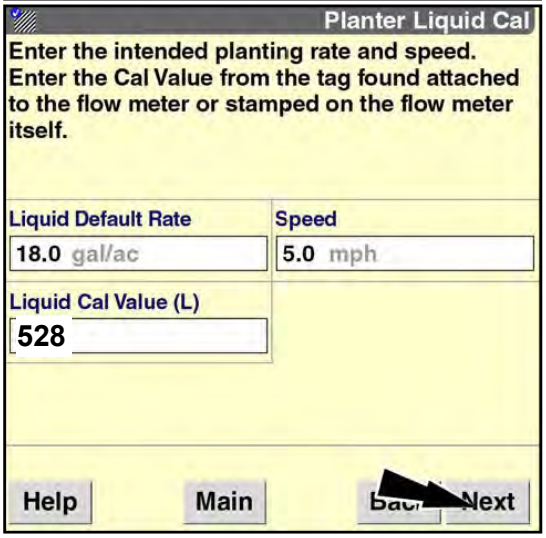
Home > Work Condition > Liquid







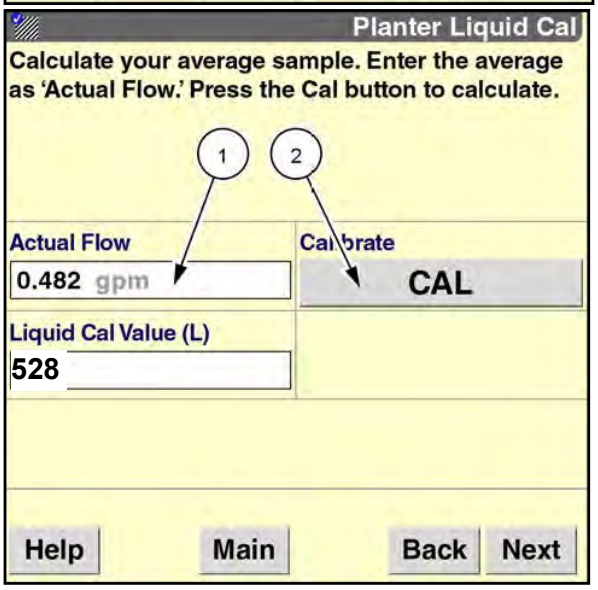
1. Enter or verify the Rate, Speed, and Cal Value.
2. NEXT



CAUTION

This procedure will run the pump and dispense liquid. Be sure it is safe to dispense the liquid where the test is being run. These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

Liquid Fertilizer Calibration (cont)

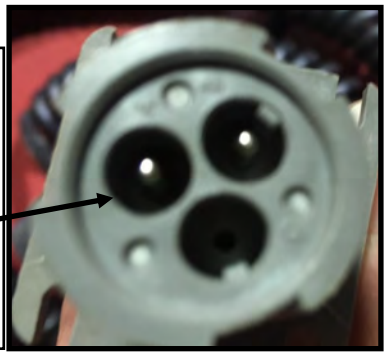


After hydraulics are on and running, follow the instructions to the right:

1. Press RUN
2. Press tether switch (or jump pins—see below)
3. On first startup, the pump may need time to prime. Open the air bleed valve. Be sure the recirculation knob is closed. When pump is primed, close the air bleed valve.
4. When flow is stable, perform a one-minute catch test on each row.
5. After catch test, do the calculations to figure the actual flow in gal/min per row.
6. Compare the Target per Nozzle with the Actual Flow you caught.
7. Do the test again to see if the results are consistent.
8. *Don't change the Cal Value for a SureFire electromagnetic flowmeter unless repeated well-run catch tests indicate a change is needed.*
9. Always verify amount applied in the field with what the display says was applied. Use weigh tickets on loads if possible.

If this test is being run with water, the system pressure will be much less than it will be with fertilizer. If the pressure is too low, some of the check valves may not open and there will not be flow from those rows. Increase the flow until flow is uniform from all rows.

Tether switch from Case. Connects to connector on back of planter
(*Jump across these two pins on planter connector to activate pump without tether switch)*



Troubleshooting

Pump Will Not Turn

Turn hydraulics off, go to the SureFire PWM valve and use the manual override on top of the electric coil to manually open the valve (Manual Override UP = valve fully open). (You may have to clean dirt out to move the manual override knob.) Turn hydraulics on **at a low flow only** as the valve is 100% open. Slowly increase hydraulic flow. If the pump does not turn, try hydraulic lever in opposite direction. Does the pump turn? If it turns, your problem is electric / electronic. If the pump still does not turn, you have a hydraulic problem.

Electric / Electronic Problem

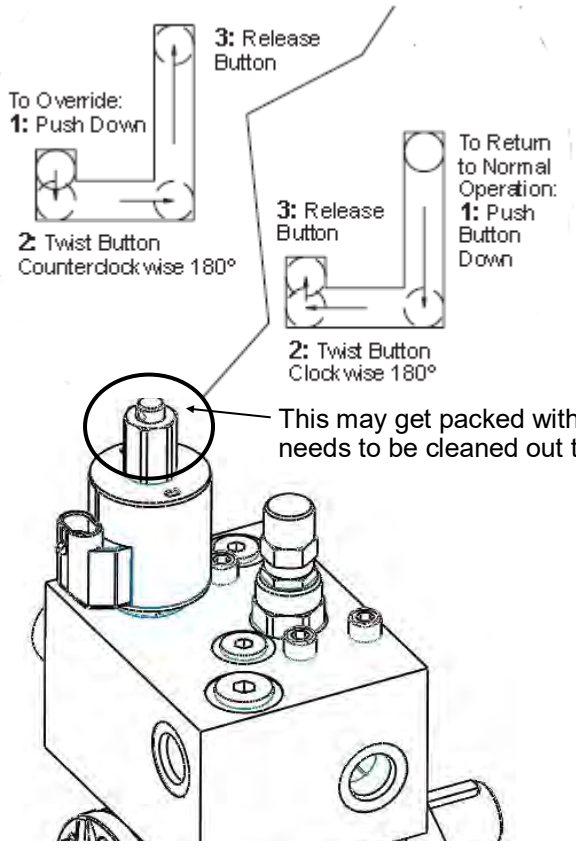
The Pro 700 does not offer a good way to run the system in Manual mode for testing and diagnostics. The procedure below runs the system in the Liquid Cal mode. If the system does not run, it may be difficult to test the voltage on the PWM signal before the system times out. Be ready to test the voltage at the PWM connector on the pump harness as soon as the test is started.

1. Close manual override (lock down).
2. Go to Work Condition > Liquid to run the Liquid Cal procedure to investigate this issue.
3. Verify hydraulics are on.
4. Enter a rate and speed.
5. Start the test (RUN). Hold the tether switch or jump the connectors or jump the connectors for tether switch on the planter.
6. Take a metal object and hold it next to the coil. If the coil is working, you will feel the magnetic pull. The coil should also show 7 to 9 ohms between the two pins on the electrical connector to the coil.
7. If no magnetic force is felt, disconnect the PWM valve connector and check voltage. You will need 6-12 volts to get hydraulic valve to open.
8. If 6-12 volts is not present, check harnesses and review control valve type setup.

Hydraulics Problem

1. Leave the manual override open on the SureFire valve.
2. Check the hose routings. The “P” port on the SureFire valve should hook to pressure. The “T” port is the return that should flow back to the tractor.
3. Try hoses in a different hydraulic remote. Inspect hydraulic connectors for damage or restrictions.

Hydraulic Manual Override
Down - Normal Operation
Up - Override, valve 100% open



Troubleshooting

Section Valve(s) will not move

The Pro 700 does not offer a good way to run the system in Manual mode for testing. Using the Liquid Cal procedure is about the best way to try it.

1. Go to Work Condition > Liquid Cal > enter speed and rate, to investigate this issue.
2. Start the test. Section valves should open when test is started.
3. Even when the valves are off, there should be 12 v between pins A & B.
4. Verify that the Section Control and Overlap Control on the Run Screen are set correctly.

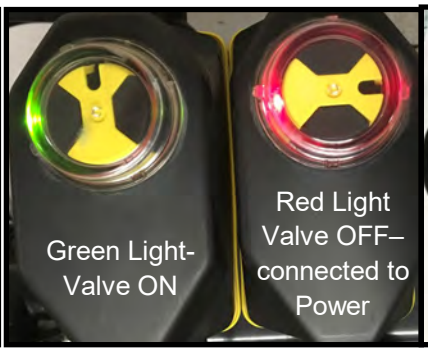
If Valve doesn't work:

1. Check the harness connection to that valve. It is a 3-pin Weather Pack connector.
2. Switch a valve or connector with one that is working to help diagnose where the problem is.
3. Check voltage pin A to Pin B. Must be 12 volts, if not, go back to 14-pin connector and check voltage. See Section D for wiring diagrams.

Pin	Function
A	+ 12 V Constant
B	GND
C	+ 12 V Signal

4. If voltage is present on pins A&B of 3-pin connection to valve, then check pin C to Pin B. This should be 12 volts when the valve is commanded on or open, this should be zero volts (may be 5-6 v on Case) when valve is off or closed.
5. If signal voltage is not present to open valve, use diagrams to check at the 14-pin for voltage.
6. If constant voltage (Pins A&B) and switched voltage (Pins C&B) are present, inspect, repair or replace the valve.

If valve indicator stays GREEN all the time or if valve indicator is not in full ON or full OFF position, replace actuator. Pull gray pin to remove actuator from valve.



Replacement Valve Actuator—**104-KZ1169**—KZ Electric TX2 Series Actuator

This is a 3-way valve. If product will not flow when valve is ON, either move the outlet hose to the other outlet port, or remove actuator and rotate valve ball 180º, and replace actuator. Product should flow through the port closest to the Indicator light when the valve is open (green).

If the Pro 700 gives a message similar to this every time the valves are closed, "Planter UCM digital output connected to the liquid fertilizer section 1 valve is detecting above normal voltage when OFF", *the system will need a* 201-3933Y1 adapter harness. This adapter has a small resistor for each valve so the Pro 700 will be happy.

No Flow shown on display, but liquid is being pumped
Flowmeter Tap Test

See which flowmeter connector you have

Remove red guard to reach pins. Don't break red side clips.

Flowmeter pinout:

3-pin MP Tower A- Signal B- 12V Power C- Ground

3-pin AMP SuperSeal 1– Ground 2– 12V Power 3– Signal

1. Unplug the flowmeter. With voltmeter, check for **12 volts between Power & Ground** of flowmeter connector. Should have **4-5 volts between signal and ground**. If voltage is not present, inspect wiring harness and check for voltage at harness connection(s) nearer the Rate Controller (at 12-pin Deutsch connector, Power is 1, Ground is 2, Flow Signal is 3).
2. If 12 volts is present, then conduct a **tap test**. Go to setup and change the flow cal to 1. Have a second person watch GPM on the screen while other person taps repeatedly (use a short piece of wire or a paper clip) between signal and ground pins of flowmeter connector. A flow value (gpm) should show up on the display indicating the wiring is not damaged. (If alone, note or reset a volume counter to 0. Check for increased volume after tapping.)
3. If the flow showed on the display during the tap test, your wiring to that point is good. If tap test did not work, go back to the next harness connection and do a tap test there between signal and ground.
4. If the tap test registers flow on the display, replace flowmeter. (*Sometimes, cleaning the inside tube of the flowmeter with soapy water and a soft brush will remove a film covering the electrodes.)*
5. Change Flow Cal back to appropriate Flow Cal when finished with Tap Test.
6. SureFire has a Speed/Flow Simulator (PN 219-01462) or a Tap Tester (212-03-3912Y1) that can be used to confirm if the wiring is good between the flowmeter and controller.

Field Verification of Flowmeter Calibration

Always verify the flow cal setting by comparing the amount actually applied in the field (from weigh tickets) with the amount shown on the display. Adjust the flow cal as needed to get less than 1% difference between the actual amount applied and the amount shown on the display.

In general:

Increase the Flow Cal number if not enough product is actually being applied. *(If you want more, increase the number)*

Decrease the Flow Cal number if too much product is being applied. (*If you want less, decrease the number)*

Formula to Adjust Flow Cal Number

(Volume shown on display) / (Volume actually applied) X flow cal number in display = new flow cal

Example: Display shows 727 gallons was applied. Weigh ticket shows 750 gallons was actually applied. Flow cal number in display was 2000. *(We applied too much, so we will decrease the flow cal.)*

727 / 750 X 2000 = 1939 (new flow cal number to set in display)

(*Any adjustments to the flow cal number will only be as accurate as the measurements used in figuring it.)*

Do not power wash the flowmeter.

Unplug the flowmeter before welding on the implement.

Troubleshooting

Application Rate Fluctuates

Inspect & clean pump inlet strainer. Strange flow rate fluctuations are very often due to an obstruction to the pump inlet. Inspect plumbing from tank to pump. Be sure the strainer is clean and is not gelling up while running.

Be sure the recirculation is not open too far. In most cases, the recirculation can be closed all the way. If some recirculation is necessary, start with a quarter turn of the knob. Open the knob as little as possible.

The Pro 700 does not allow the user to run a good manual test. Work Condition > Liquid lets the user run the Liquid Cal procedure.

In general, if the system does not lock onto the Target Rate when going across the field, the Liquid Gain needs to be set lower.

Home > Toolbox > Config < Advanced Setups > YES.

Home > Toolbox > Adv.Set. > Liquid Gain (start at 6 for SureFire hydraulic pump). Reduce if system oscillates going across the field.

Application Rate is slow to get to the Target Rate

1. Increase the Boost Level if the pump is slow starting up. *Home > Work Condition > Operate > Boost Level (default is 150%)*
2. If the pump is just generally slow to adjust to speed or rate changes, increase the Liquid Gain (see above).

No Flow shown on display but liquid is being pumped

See previous page.

Other issues

1. **"My rate won't go low enough. I want 8 gpa, but it won't go less than 11."**

   On a hydraulic pump, be sure the red manual override knob is down and locked on the hydraulic valve. If the manual override knob is up, the pump is just running based on how much hydraulic oil it is getting. No other control is happening.

2. **"I can't get up to my rate. I want 16 gpa, and I can't get more than 14 gpa."**

   A. How many GPM are required to hit your rate? Is this within the pump's specifications? On an electric pump, the output of the pump decreases as the pressure increases. Keep the pressure under 40 PSI on an electric system.

   B. **Is a recirculation valve open**, allowing too much liquid to recirculate? Normally, the recirculation valve should be closed. If it needs to be open, start with a quarter turn.

   C. **Is the strainer plugged?** If too small of a mesh strainer is being used, the fluid can gel up around the screen as the fluid is pulled through. Most SureFire systems with metering tube and electromagnetic flowmeter can use a 20– or 30-mesh strainer.

   D. Does the pump have enough hydraulic oil to hit the desired rate? If the pump is in series behind another pump or motor, the hydraulic oil to this pump may be limited. Run pump in Manual Override to see output.

   E. Is the flow cal correct? Is the width of the implement set correctly? Is speed reading correctly?

3. **"It's pretty close to the rate, but it won't ever lock in to the rate."**

   A small bouncing around is normal. When moving across the field, slight changes in speed can cause the rate to appear to jump around. Some displays have a feature called Rate Smoothing or Display Smoothing so these small changes do not show on the screen. Pro 700 does not have that feature.

   A larger bouncing around on a regular basis may mean the Liquid Gain setting needs to be lowered. See that screen in Section F of this manual.

4. **How do I set the Recirculation knob?**

   Generally, the recirculation knob is closed. If tank agitation is necessary while applying, the recirculation hose can be plumbed back to the tank. Electric pumps do not have the capacity to do much agitation. A small amount of recirculation may be desired if the pump needs to run slowly and the output is not smooth. Start with a quarter turn of the knob (less on an electric pump). A half turn of the knob will recirculate a lot. If too much is recirculated, the pump may not be able to hit the rate to the rows. Opening recirculation will not lower the pressure required to push the desired product to the rows.

5. **"My pressure is too high / too low."**

   The pressure will be what it is depending on how hard it has to push to get the amount of liquid you are moving from the pressure sensor to where it leaves the system. This pressure will depend on the product itself, the volume (gal/min) you are moving and how much restriction there is to that flow. The orifice or metering tube will be the primary restriction, but it is possible that other parts of the system may add to the total pressure. 1/4" tubing can build a lot of pressure with 10-34-0. The pressure a system develops will be less (possibly much less) with water than it will be with a fertilizer product.

   What pressure is "too low"?

   You need enough pressure to open the check valves. If the pressure is too low, some check valves will open before others, so that some rows may be flowing while others are not. **With 4 lb check valves, we like at least 8 PSI. With 10 lb check valves, we like 15-20 PSI.**

What pressure is "too high"?

A pressure is too high if it keeps the system from being able to hit the rate you want or if it opens the PRV (Pressure Relief Valve) on a hydraulic pump.

The plumbing components of a SureFire system are rated at 100 PSI or above. On an electric pump system, the pump capacity decreases as the pressure increases. Our standard Tower electric pump has an internal 70 PSI bypass. **With an electric pump, we like to see pressures from 10 to 30 PSI.** If the pump has the capacity to hit the rate at higher pressures, there is not a problem with doing that, but for long-term operation it would be best to switch to a larger orifice or metering tube. High pressure requires more current, which causes more voltage drop, which causes EPD problems.

The SureFire PumpRight hydraulic pump has the ability to pump up to 290 PSI. SureFire plumbs these with a 100 PSI pressure relief valve (PRV) so that plumbing components will not be damaged if high pressure develops. **Typical operating pressures with hydraulic pumps will be 20-60 PSI**, but the pump will work fine at 80-90 PSI if that is needed. If continually running in that high range, consider a larger orifice or metering tube.

The SureFire LiquiShift system will generally run in a pressure range from 20 PSI to 70 PSI. This allows the system to achieve a wide flow range, accommodating wide speed ranges or wide rate ranges.

Lower pressure will not necessarily reduce the ***velocity of the output stream*** at the row. Conversely, higher pressure will not necessarily increase the velocity of the output stream at the row. The velocity of the output stream is determined by the volume of the flow and the size of the opening at the output. Changing the pressure by changing an orifice or metering tube upstream from the outlet will not affect the velocity of the output stream if the flow volume remains the same.

Options if pressure is too high with orifices: Use a bigger orifice. Slow down. If pressure is too low, use a smaller orifice.

With metering tube: Options if pressure is too high: Use a larger diameter tube. Shorten the tubes that are on now. Slow down. (*The pressure in a metering tube is related to the viscosity of the product. Many products change viscosity as the temperature changes. A product will have a higher viscosity (and therefore higher pressure) on a cold morning than it will on a hot afternoon.)*

With metering tube: Options if pressure is too low: Switch to a smaller diameter tube. Use a longer tube.

See SureFire publication "396-3269Y1 Navigating the Metering Tube Maze" or "396-4116Y1 Metering Tube Charts" for more information on how metering tube works.

6. My system shuts off every time I turn around at the end of the field. It's annoying.

This may happen because of the safeguards built into the software for the 2000 Series Planter factory liquid fertilizer system. The system may shut down either due to low pressure or high pressure. If the system builds high pressure when turning around, open the recirculation valve slightly.

Case programs the planter UCM to protect the centrifugal pumps that are used on the Case factory liquid fertilizer system. The seals in the centrifugal pump will burn up if they run dry for even a short time. That is not a problem with either the Sure Fire electric pumps or the SureFire PumpRight hydraulic pumps. Nevertheless, the software for the 2000 series planter liquid systems is programmed so that the system will shut down if it doesn't see pressure for 2 or 3 seconds. Low pressure is normal when the pump stops while turning around on a PWM-controlled system. If this continues, it may be necessary to plug a AA or AAA battery into the pressure sensor connector, so the system thinks there is pressure there all the time. This will mean that the pressure will not display correctly when applying liquid.

See SureFire publication "396-3229Y1 Liquid System Components Overview" for a description of all the system components and additional troubleshooting/service information.

See the system manual for your system for more complete information. Manuals and publications are available for download at www.surefireag.com.

Recommended Care and Maintenance

Winterization

SureFire recommends flushing your fertilizer pump and complete system with adequate amounts of water first. Next, use RV antifreeze to winterize your system by pumping an adequate amount through all components. At the beginning of the next season, begin with water to verify the system is in working order with no leaks.

Change Pump Oil Annually

PumpRight pumps use an internal oil lubricated crankshaft and connecting rod design. The oil is held in an external reservoir with level indicators. Hypro oil is recommended for the pump. This is a non-detergent SAE30 weight oil. If not available, hydraulic jack oils are a similar non-detergent formulation. Annual oil changes are recommended.

To fill or drain the pump completely, the pump shaft must be turned slowly by hand. The hydraulic motor will have to be removed to do this.

On some pump models, the pump will have to be removed from the mounting bracket and lifted slightly to allow access to the oil plug.

When refilling the pump with oil, the shaft will again have to be rotated to fill the pump to its required oil volume.

CRANKCASE OIL CAPACITIES				
Model	Capacity		Model	Capacity
PR17	13 oz		PR40	56 oz
PR30	28 0z		D250	98 oz

Diaphragm & Valve Replacement

PumpRight pumps are designed to allow very simple replacement of the two main pumping components; the diaphragms and the inlet & outlet valves. It is a good practice to replace these every 2 or 3 years (or every 1000 hours). It is a small job that helps ensure reliable operation during the busy season.

Pre-season Service

(A little time spent here may prevent some downtime when you want to be rolling.)

1. Visually check entire system (hoses, fittings, harnesses, etc.) for any signs of wear or trouble.
2. On the display, recheck all setup screens (see Section F) to verify correct setup.
3. Fill system with water and run in Liquid Cal mode to verify components and system are in working order. (May need to open air bleed valve to prime pump the first time. Be sure air bleed tube is not plugged.)
4. Clean out the dirt that may be packed in to the manual override knob on the hydraulic valve block. Be sure manual override knob can be operated in case it is needed for troubleshooting. The knob should be pushed down and locked for normal operation.
5. If necessary run pump in manual override mode to check hydraulic setup (see page 43).
6. Tighten all clamps. Loose clamps may be evident by leaks on the output side of the system. Loose clamps from the tank to the pump are not always apparent, but can be sources of air getting into the system which can create issues.
7. Push in tubes at all Quick-Connect fittings so they are seated tightly. Tubes that are not fully seated are not always obvious, but may allow air in, which can cause check valves to leak.
8. Remove the black cap from the top of each check valve. Check the diaphragm to be sure it is intact and not gummed up with residue. Look under the diaphragm for debris. Compress the spring in the cap to be sure it moves freely. Carefully replace diaphragm and tighten cap.
9. Remove and clean the strainer. Be sure strainer is tightened securely so it will not suck air.
10. Be sure all rows are flowing and that all metering tubes/orifices are open. (Note: It will take a higher flow rate with water to create enough pressure to open all the check valves.)
11. Run the Liquid Cal procedure to verify that system will lock on to a Target Rate.

Hydraulic oil under extremely high pressure. Do not use hand or any other skin to check for or to stop hydraulic leaks. Be sure pressure is relieved before loosening hydraulic fittings. Replace worn hoses immediately. Seek medical care immediately if hydraulic oil is shot into the eye or the skin.

These pumps can deliver liquid at high pressure (290 PSI). Be sure the 100 PSI Pressure Relief Valve (PRV) is installed and functioning so system pressure will be kept under 100 PSI. Check hoses, hose clamps, and liquid fittings regularly and repair or replace loose connections.

PumpRight Valves & Diaphragms for D– pumps

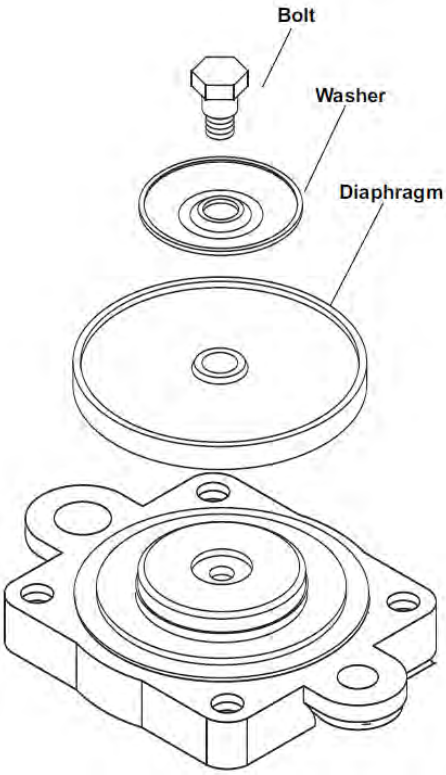
All PumpRight D-models use the same diaphragm and valve parts.

Diaphragm Pump Service Kit Item Number 291-02-100500

1 Kit contains 1 diaphragm and 2 valves to service a single pumping diaphragm. Order multiple kits to service all the diaphragms in your pump per chart at right.

Qty in Kit	Part Number (all begin 291-02-9910-xxxxxx)	Description
1	550085	Diaphragm (Desmopan)
2	320030	O-Ring
2	759051	Valve Assembly

	Number of Diaphragms
D70	2
D115	3
D160	4
D250	6

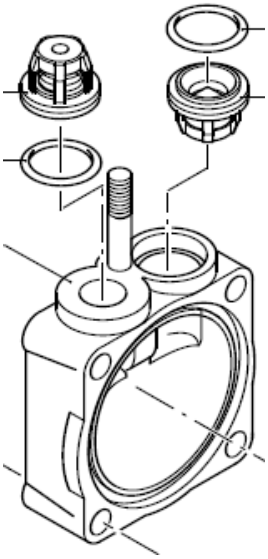


Diaphragm & Valve Service Steps:

1. Remove inlet and outlet plumbing connections by unscrewing ring nut on inlet and outlet fitting.
2. Use extreme caution when removing and replacing drain plug, so that threads are not stripped and o-ring is not damaged. Remove drain plug from bottom of pump to drain oil from pump. Rotate pump shaft to remove all oil. Replace drain plug making sure o-ring is in place. Tighten plug to 171.4 In.Lbs.
3. Remove pump manifold(s) using a 17mm or 13 mm wrench.

D70	1 manifold	2 x 17 mm nuts (on top)
D115	1 manifold	3 x 17 mm nuts (on side)
D160	2 manifolds	Each manifold has 4 sets of 2 x 13 mm nuts
D 250	2 manifolds	Each manifold has 6 sets of 2 x 13 mm nuts

4. Remove and replace complete valve assembly.
5. Remove the pump head.
6. Remove the diaphragm bolt, support washer and diaphragm. Turn the pump shaft to up stroke to replace diaphragm.
7. Install new diaphragm (LIQUID side up), then replace washer and bolt.
8. Turn pump to downstroke to seat new diaphragm into the sleeve groove.
9. Replace pump head and manifold(s).
10. Refill crankcase with SAE30 non detergent oil (PumpRight Oil or hydraulic jack oil). Turn pump shaft and top off sight glass with oil.



D70 - D115 Valves are on same side of head. Valves should pop out with slight screwdriver pressure.

D160 - D250 Valves (not shown) are arranged on opposite sides of head.

Other Service Parts D70, D115, D160, D250

Part Number (all begin 291-02-9910-xxxxxx)	Description
550080	Diaphragm (Buna, Optional)
550190	Accumulator Diaphragm

PumpRight Valves & Diaphragms for PR pumps

Diaphragm Pump Service Kits

1 Kit contains 1 diaphragm and 2 valves to service a single pumping diaphragm. Order multiple kits to service all the diaphragms in your specific pump per chart below...

QTY in Kit	Part Number (All parts begin with 291-13-9910-XXXXXX)	Description
PR17 Pump Service Kit - 3 Diaphragm		
KIT #: 291-13-100100		
1	1040083	BlueFlex Diaphragm
2	2429051	Valve
2	3460380	Gasket/O-ring

PR30 Pump Service Kit - 3 Diaphragm		
KIT #: 291-13-100150		
1	550081	BlueFlex Diaphragm
2	2429051	Valve
2	3460380	Gasket/O-ring

PR40 Pump Service Kit - 4 Diaphragm		
KIT #: 291-13-100150		
1	550081	BlueFlex Diaphragm
2	2429051	Valve
2	3460380	Gasket/O-ring

D250 Pump Service Kit - 6 Diaphragm		
KIT #: 291-13-100200		
1	550081	BlueFlex Diaphragm
2	759051	Valve
2	680070	Gasket/O-ring

For other service parts, see individual Pump Part Breakout Diagrams in the Pump Manual —396-4034Y1 or at support.surefireag.com/

Categories > Application Systems > Liquid Application Systems > Pumps > Gen2 PumpRight PR Series Hydraulic Diaphragm Pumps (10/2018 - present)

PumpRight Valves & Diaphragms

Diaphragm Pump Service Kit Replacement Instructions for PR Pumps

Visit www.surefireag.com for PumpRight Diaphragm Pump Repair and Maintenance Video or support.surefireag.com

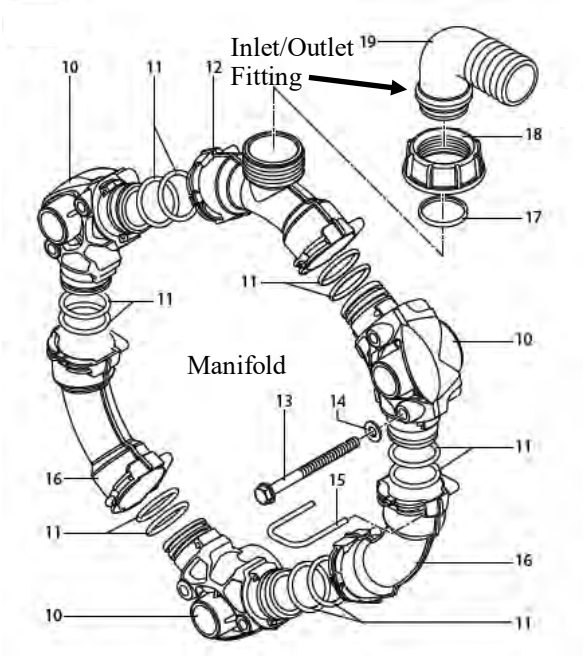
	Number of Diaphragms
PR17	3
PR30	3
PR40	4
D250	6

Diaphragm & Valve Service Steps:

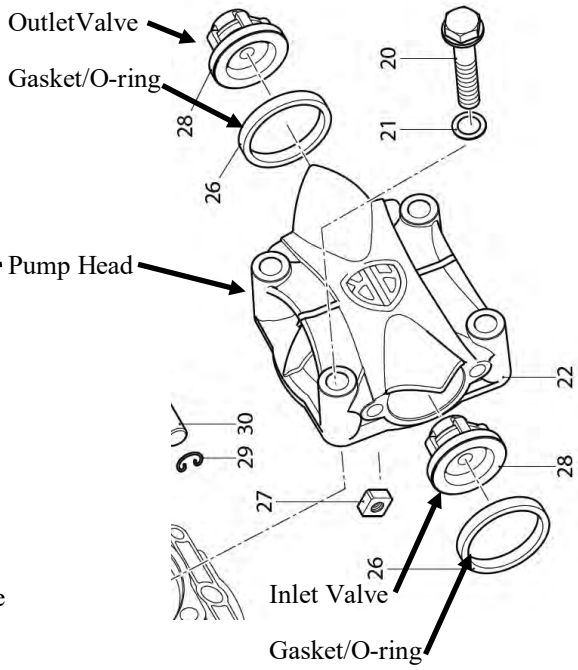
1. Remove inlet and outlet plumbing connections by unscrewing ring nut on inlet and outlet fitting.
2. Use extreme caution when removing and replacing drain plug, so that threads are not stripped and o-ring is not damaged. Remove drain plug from bottom of pump to drain oil from pump. Rotate pump shaft to remove all oil. Replace drain plug making sure o-ring is in place. Tighten plug to 180 In.Lbs.
3. Remove pump manifold(s) using a 13 mm wrench.
4. Remove and replace complete valve assembly.
5. Remove the pump head.
6. Remove the diaphragm bolt, support washer and diaphragm. Turn the pump shaft to up stroke to replace diaphragm.
7. Install new diaphragm (LIQUID side up), then replace washer and bolt.
8. Turn pump to downstroke to seat new diaphragm into the sleeve groove.
9. Replace pump head and manifold(s).
10. Refill crankcase with SAE30 non detergent oil (PumpRight Oil or hydraulic jack oil). Turn the pump shaft and top off sight glass.

NOTE: See individual Part Breakout Charts for Bolt/Nut Torque Specs.

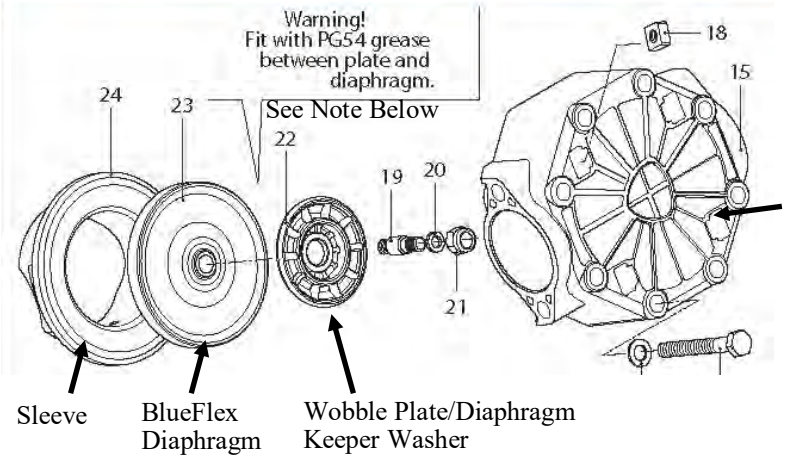
Typical Manifold—2 per pump—inlet and outlet



Typical Valve Assembly



Typical Diaphragm Assembly



NOTE: A multipurpose grease is fine to use for applying in between the Diaphragm and Wobble Plate/Washer

Pump Assembly and Part Breakdowns

See 396-4034Y1 Gen2 PumpRight Hydraulic Pump & PWM Valve General Instructions Manual for complete breakdown of pumps and pump assemblies.
(Or go to support.surefireag.com
Categories > Application Systems > Liquid Application Systems > Pumps > Gen2 PumpRight PR Series Hydraulic Diaphragm Pumps (10/2018 - present)
or search for 396-4034.

PWM Valve and Motor Parts

164-FTA0994 4.0 CID motor ***This is the standard motor beginning in 2016.***

164-FTA1609 Same as 164-FTA0994, but with RPM Speed Sensor (Pump RPM not available on Pro 700 Planter UCM software)

166-SP10-20M-0-N-00
H/F Prop 2-W Solenoid Valve with Manual Override (cartridge valve only, does NOT include electrical coil)

166-NV10-22C-O-N
Needle valve for hydraulic PWM motor

164-60564
Hydraulic Motor Seal Kit for Eaton T Series hydraulic motor with 1" shaft

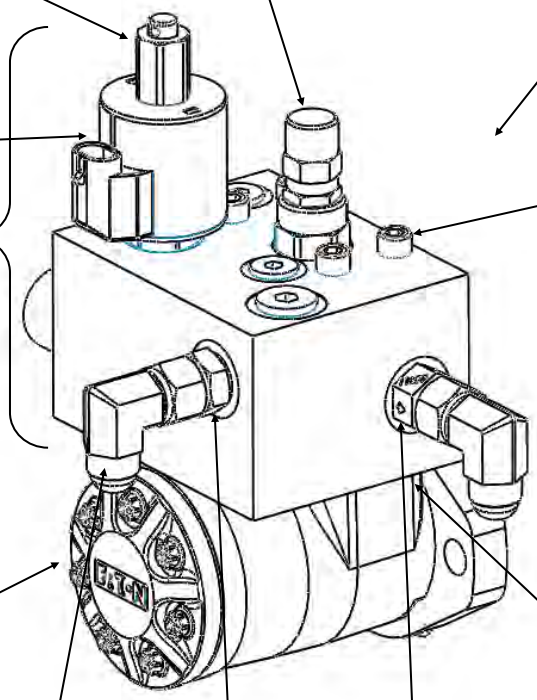
166-4303512
Coil, 12 Volt DC EY Coil
Oring-910 Duro 90 or 10 Male Boss 161-08-910-V)

166-050308-SS
.312 (5/16) x 3 - 1/2" SS bolts for hydraulic motor

166-05LW-SS
5/16" SS lock washer for hydraulic motor

Qty 4 each

165-P15648-2
PWM Hydraulic Valve with Bypass, Complete Manifold Only for mounting to Eaton T Series Motor



166-158-1543-001
Eaton T Series Motor, 1" Shaft, 4.0 CID, Manifold Ports —-

161-02-8MJ-8FJX-90
Elbow - #8 Female JIC x #8 Male JIC - 90 (optional)

161-01-8MB-8MJ
Adapter - #8 Male O-Ring Boss x #8 Male JIC

161-07-1108R
Hydraulic Check Valve - #8 Male O-Ring Boss Inlet x #8 Male JIC Outlet

166-ORING-012
O-ring for manifold ports between valve and motor
Qty 2
(12 Buna 70 Duro O-ring)

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