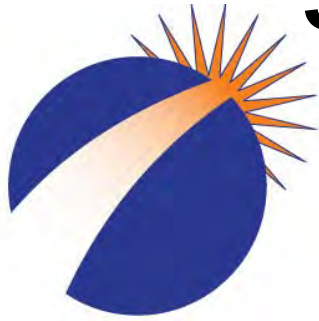


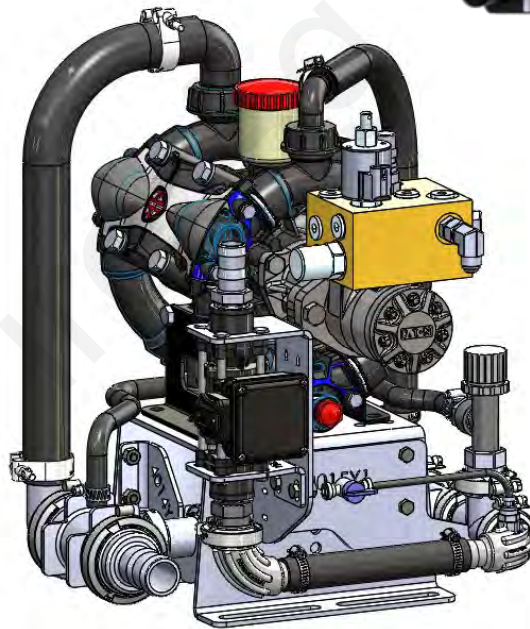
# 396-3815Y1



**SureFire**  
Ag Systems

## **PumpRight Fertilizer System for Raven Rate Control Module (RCM)**

**PUMPRIGHT**  
HYDRAULIC DRIVE DIAPHRAGM PUMPS



### **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



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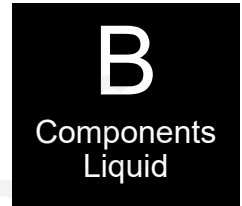
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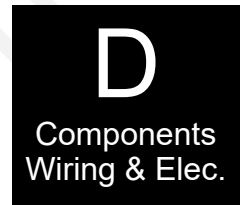
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**QuickStart Setup Sheet** See the sheet for your harness, profile, and product setup

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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.





## 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



# General Description

## A

### Introduction

You have purchased a SureFire fertilizer system for your equipment. This system will be controlled by your in-cab display and Raven Rate Control Module (RCM). The RCM will adjust the speed of the SureFire PumpRight hydraulic pump based on feedback from the flowmeter and vehicle speed. The system is capable of using optional section valves to minimize overlap.

The RCM is capable of controlling up to 5 products depending on the exact situation. So, the same RCM that controls this PumpRight system could control additional liquid, dry or anhydrous ammonia products on your equipment.

You will need a SureFire RCM adapter harness to connect the RCM to the product harness(es). Setup instructions will be furnished with the adapter harness so all the products controlled with a single RCM controller will work properly.

You will use the Virtual Terminal (VT) or Universal Terminal (UT) software on your display to view the RCM on your screen.

To do Section Control, presor mapping you will need a Task Controller unlock for your display.

## Basic Installation Steps

1. Mount the Raven RCM and connect it to the Implement ISOBUS.
2. Open the packages and familiarize yourself with the components. See the System Overview Example on the following page to see the big picture of how SureFire Fertilizer Systems are installed. Refer to manual sections B & D for component information.
3. Mount the PumpRight pump and make hydraulic connections. See section E for hydraulic plumbing information.
4. Plumb the tank to the PumpRight inlet. See section E for details.
5. 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.
6. Attach the flowmeter outlet to section valve, manifold inlet, or LiquiShift inlet. Attach section valve outlets to flow indicator inlets.
7. Attach harnesses as shown in Section D.
8. Set up RCM for SureFire fertilizer system as shown in Section F or in the setup instructions sent with the RCM adapter harness.
9. Fill system with water, conduct initial operation and tests per Section F or in the QuickStart instructions.
10. Winterize system with RV Antifreeze if freezing temperatures are expected.
11. Do pre-season service each year as described at end of manual.

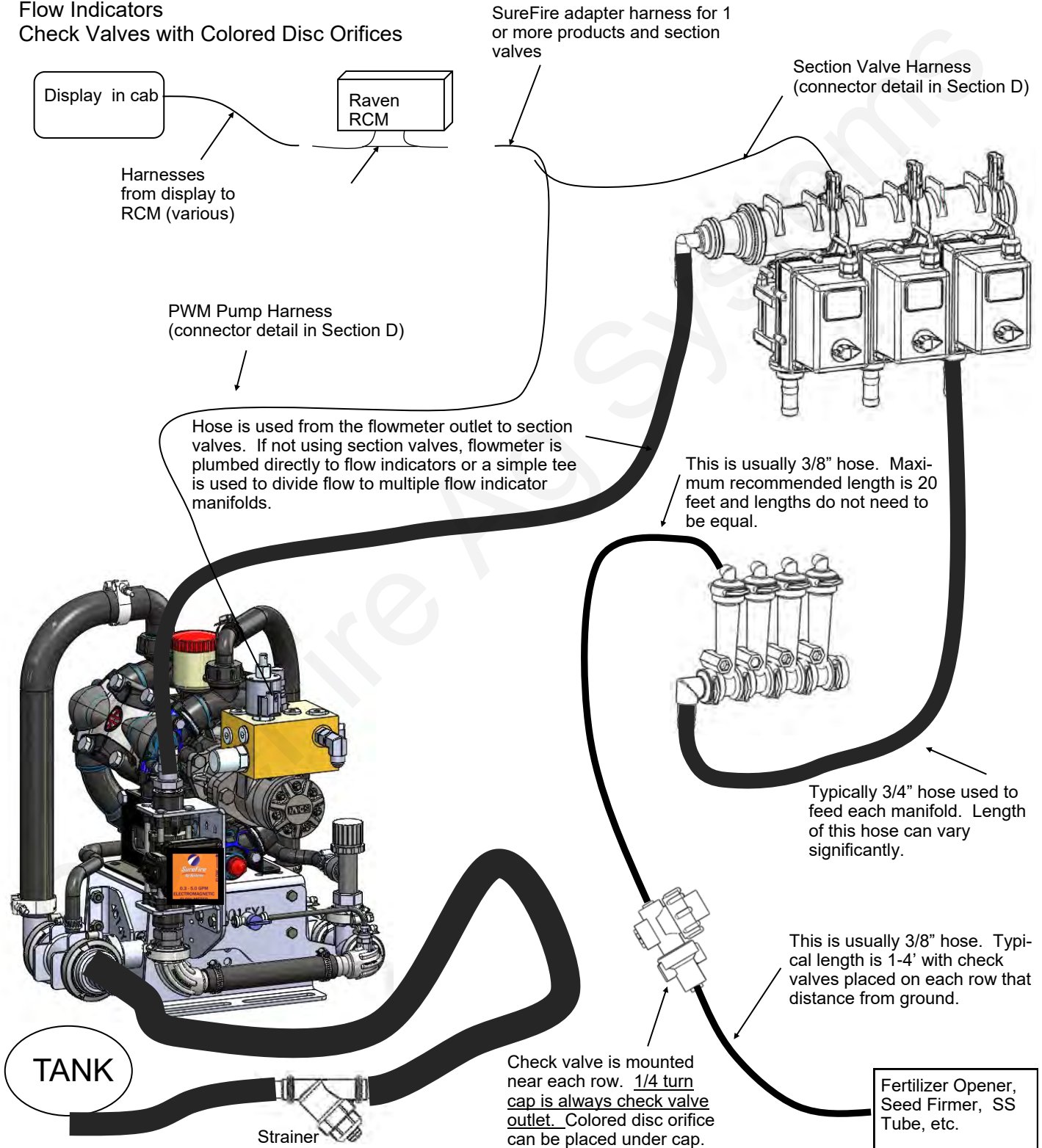
# System Overview Example

# A

Introduction

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

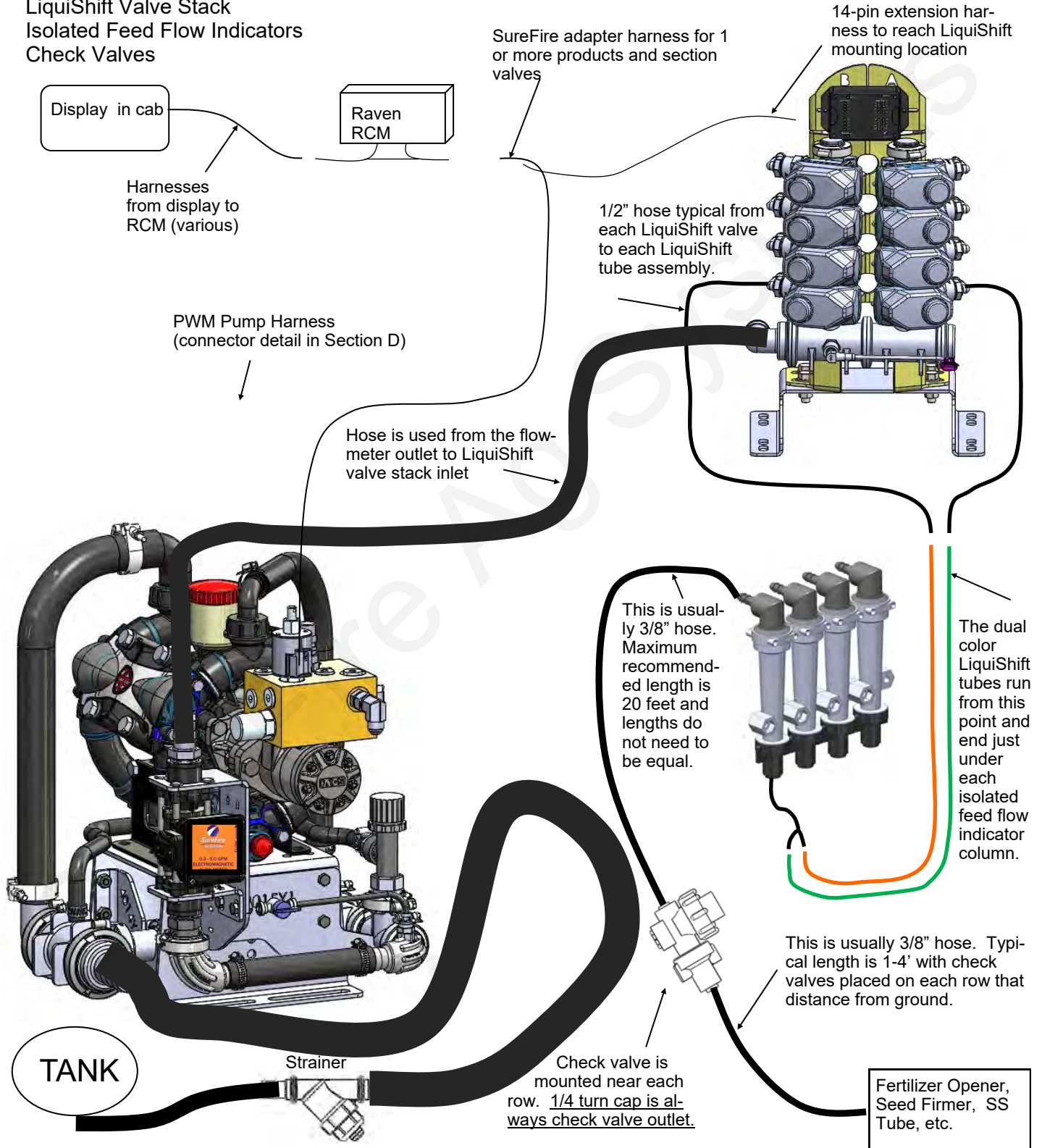
- In-cab Display
- Raven RCM
- PumpRight PR17
- Section Valves
- Flow Indicators
- Check Valves with Colored Disc Orifices





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

- In-cab Display
- Raven RCM
- PumpRight PR17
- LiquiShift Valve Stack
- Isolated Feed Flow Indicators
- Check Valves



# PR17 & PR30 Electromagnetic Flowmeter Kits

0.13 - 2.6 GPM Item Number 500-02-2082 (PR17)

0.3 - 5 GPM Item Number 500-02-2085 (PR17)

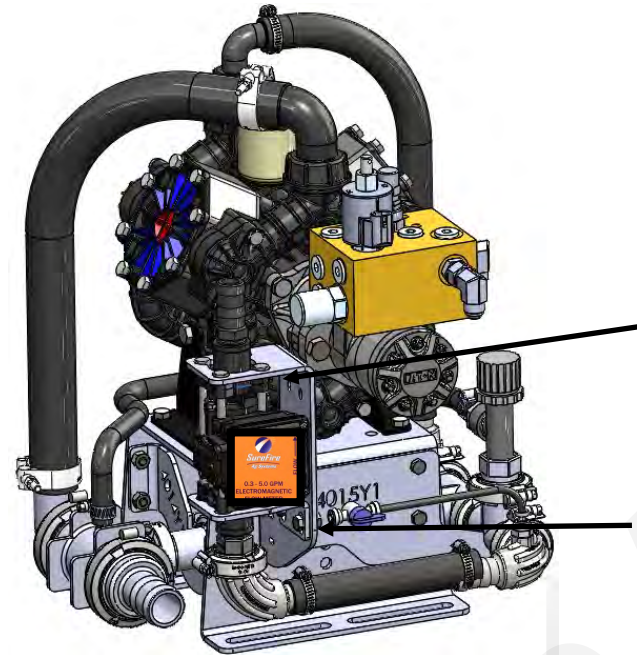
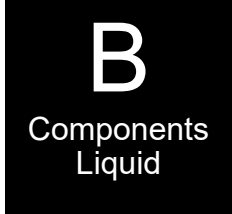
**0.6 - 13 GPM Item Number 500-02-2090 (PR17 & PR30)**

**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.

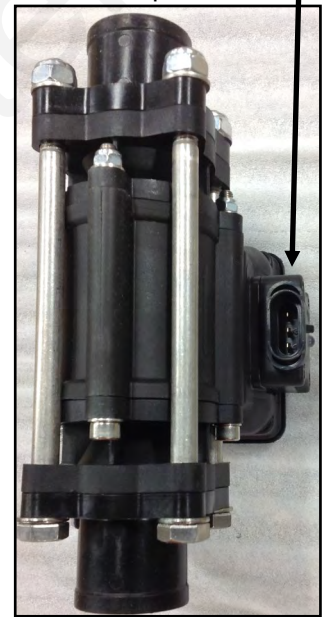
-Do not power wash the flowmeter. High pressure spray directed at the back edge of the face plate or at the wire connector may allow water into the flowmeter electronics.



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)	JD GRC 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"

Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. See the documentation for those meters to find the calibration numbers.

# PR40 & D250 Electromagnetic Flowmeter Kit

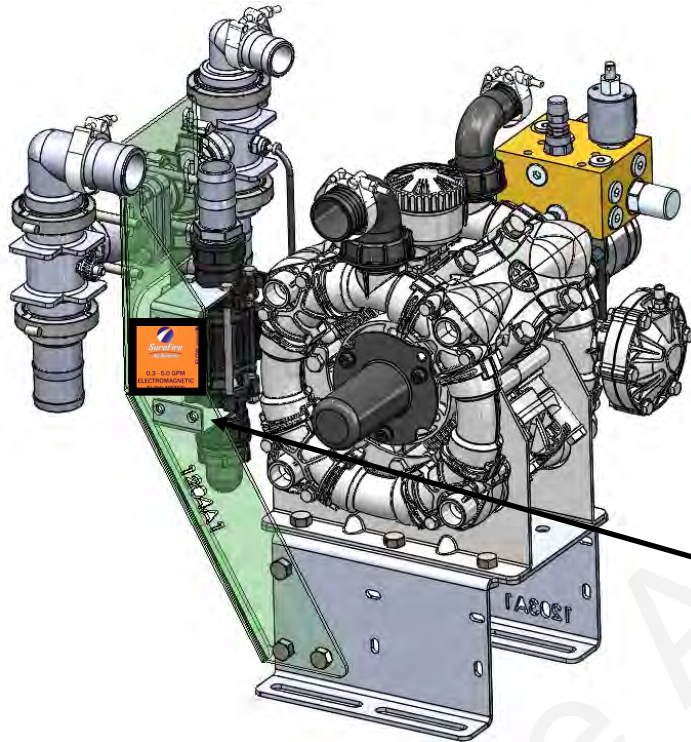
## 2.6 - 53 GPM Item Number 500-02-2080

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

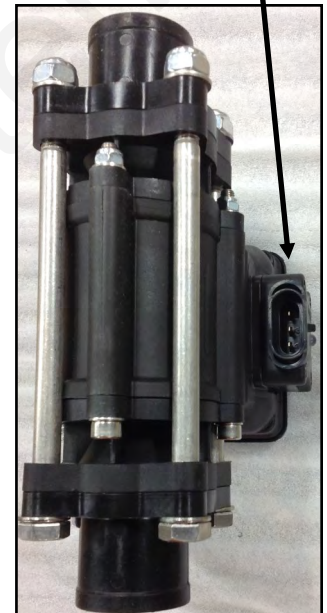
B  
 Components  
 Liquid

-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.



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



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



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"

Earlier model flowmeters (meters with white labels with black text) have different calibration numbers. See the documentation for those meters to find the calibration numbers.

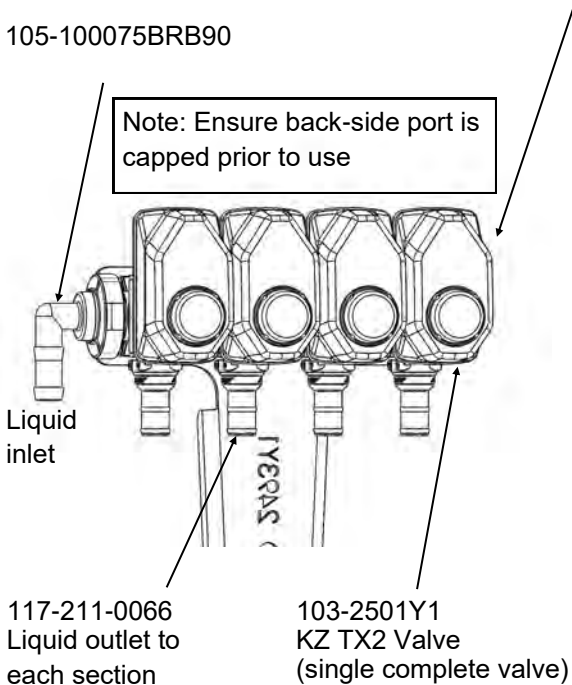
# Section Valves and LiquiShift Valves

# B

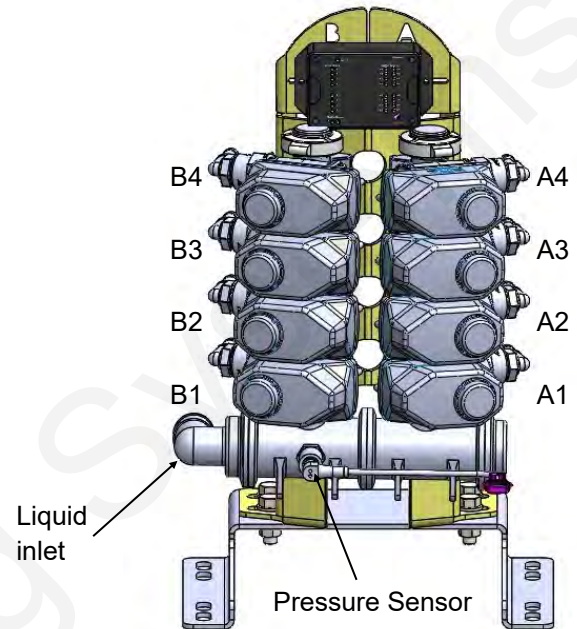
Components  
Liquid

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

105-100075BRB90



**LIQUISHIFT**  
Variable Rate Technology



### Additional Parts:

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

### 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.

<b>Wiring Connector:</b> Pin A—Red, 12 Volts + Pin B—Black, Ground - Pin C—White, Signal 12V=on ; 0V=off	<b>Mounting Hardware:</b> 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 (KX TX2) and have a 3-pin weather pack electrical connector.

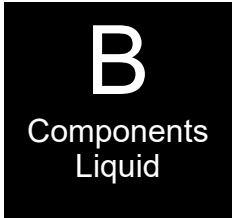
LiquiShift systems are available with systems from 1-8 sections.

On the RCM, LiquiShift systems connect to the RCM Adapter Harness with a 14-pin round connector. Typically this connector would be for Sections 1-6 (product 1) or Sections 7-12 (product 2). Your system may vary so check the specific instructions with our RCM adapter harness.

# Pressure Sensor

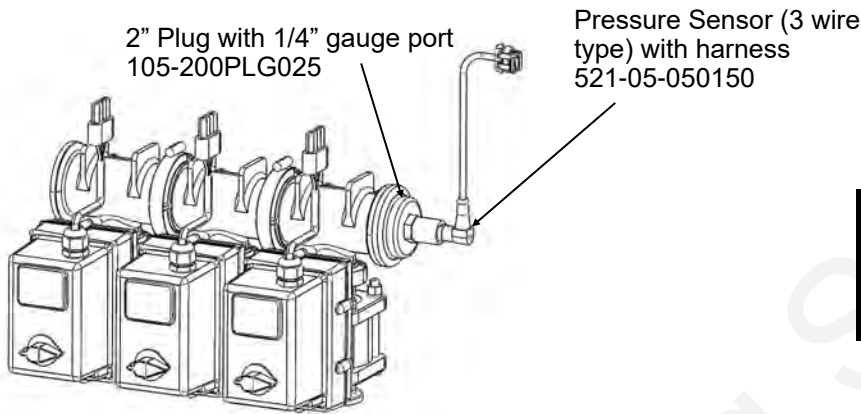
## 3 Wire Sensor with 2" Manifold x 1/4" MPT Fitting

### Item Number 520-00-055100

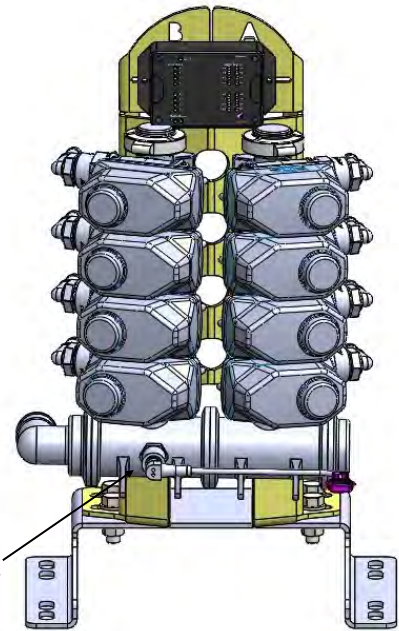
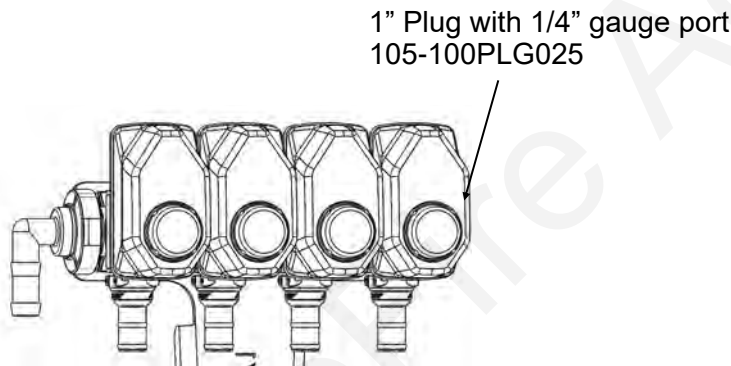


The RCM has the ability to show fertilizer system pressure on the display. The pressure sensor is most often mounted on electric section valves when used in PumpRight systems. The pressure sensor is a 100 psi, 0-5 v, 3-wire type sensor for compatibility with the RCM. The sensor has a 1/4" MPT fitting.

The user can select to display the pressure on the in-cab display. The pressure sensor is very helpful to optimize system performance and troubleshoot any issues. Pressure alarms or limits can be set on the display in the cab.



RCM Setup:  
 Pressure Sensor Type: Custom  
 Pressure Calibration: 50 mv/psi



Pressure Sensor for LiquiShift is mounted at the base of the valve stack. The same sensor is used for LiquiShift and displayed on the display.

## Pressure Sensor Hose Tap Kits

When electric section valves or LiquiShift is **not** used in the fertilizer system, the best location to install the pressure sensor is in the hose after it leaves the flowmeter. To use these kits, order the correct kit for your hose size. Then also order the kit above that includes the 2" Manifold x 1/4" MPT fitting.

- |                          |               |
|--------------------------|---------------|
| 3/4" Hose Pressure Tap   | 520-00-055800 |
| 1" Hose Pressure Tap     | 520-00-055850 |
| 1 1/2" Hose Pressure Tap | 520-00-055900 |

# 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.

# B

Components  
Liquid

## Why use an air bleed valve:

Most fertilizer systems are equipped with a 4 lb 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.**

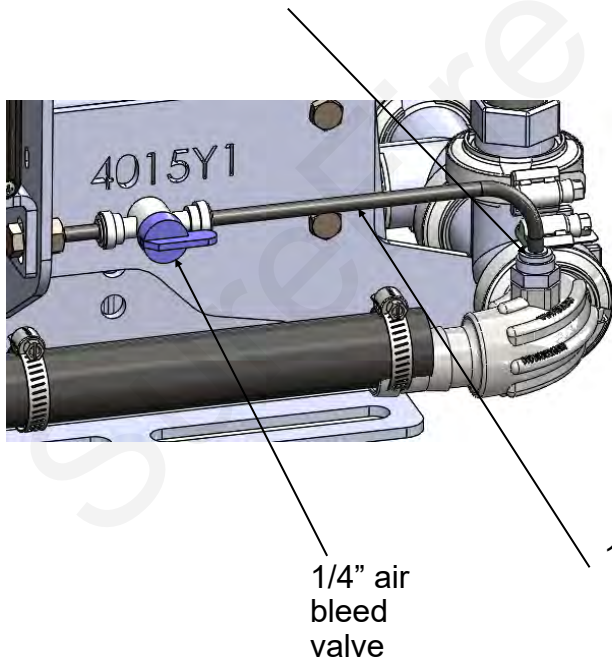
## How to install the air bleed valve:

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.**

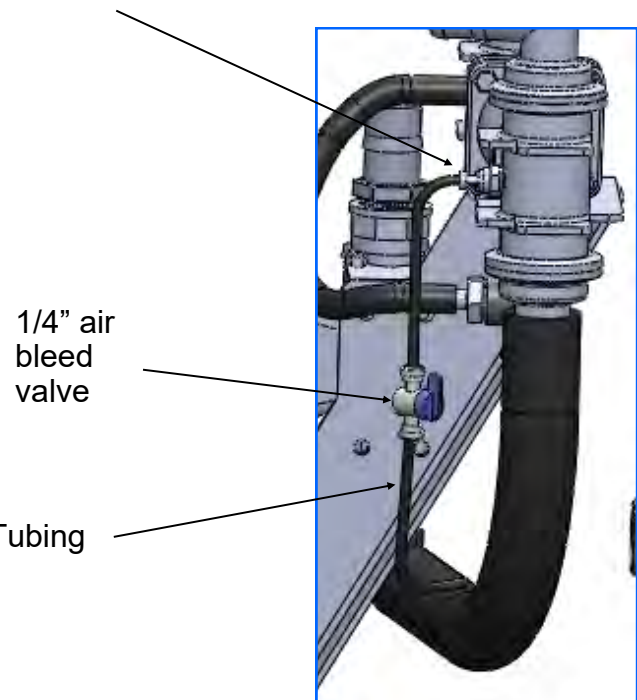
### PR17 & PR30

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



### PR40 & D250

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



# 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 its 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.

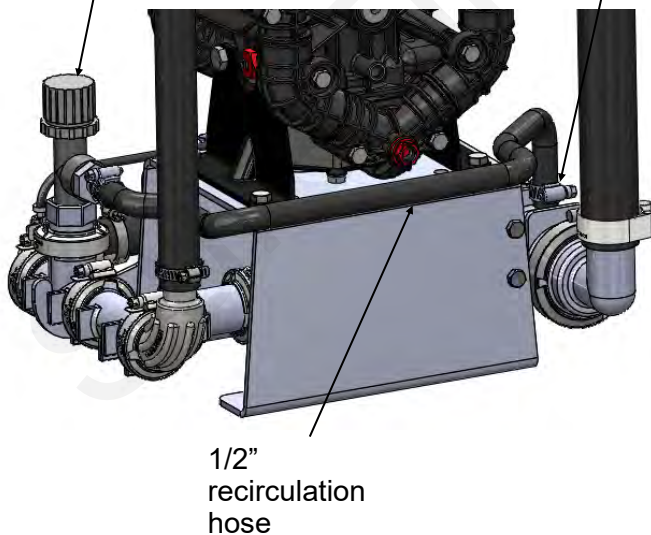
## How to modify for tank agitation:

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.

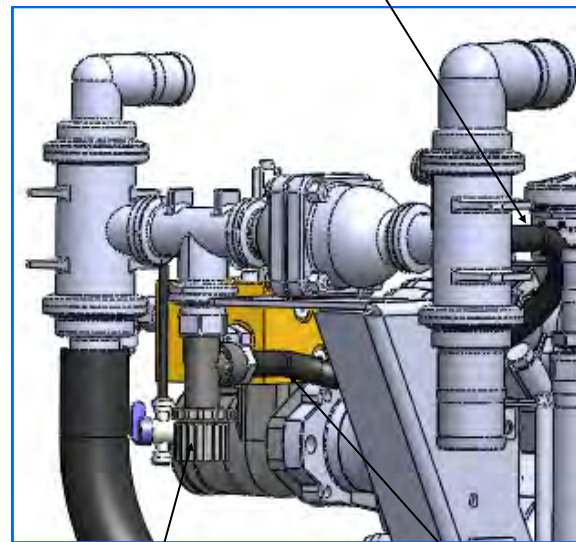
### PR17 & PR30

Recirculation Regulation Valve,  
102-23520-3/4  
*Start with a quarter to a half turn.*

Recirculation hose attaches to back of 2" x 1" tee  
on pump inlet



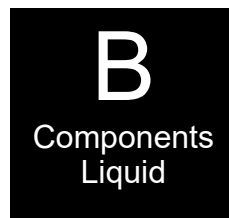
### PR40 & D250



## Product Distribution

**To assure proper and even distribution to each row, the product being applied must be metered to each individual row. 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.

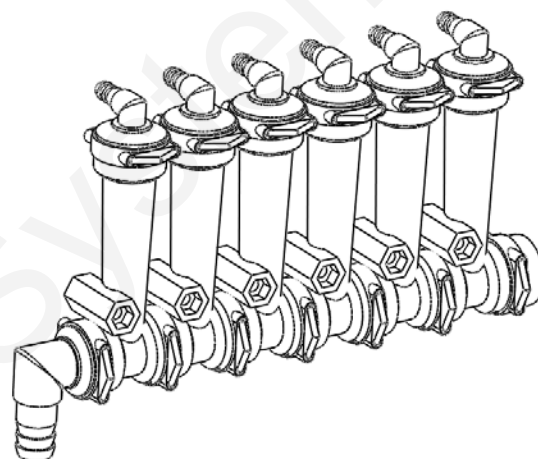


## Floating Ball Flow Indicator & Manifold System

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")

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

400-2010A1  
12-Row White Visi-  
bility Backer Plate

701-20460-950  
Full Flow Column  
w/ 3/8" HB Outlet

701-20521-00  
End Cap

701-20525-00  
Center Fed Tee  
with Gauge Port

101-100075BRB  
1" MPT x 3/4" HB

1/4" x 2"  
Bolt

400-3155Y1  
7-12 Row  
Bracket

380-1001  
Fits 7"x7" Tube



**B**

Components  
Liquid

# Low Flow Column (mostly 1/4" 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.

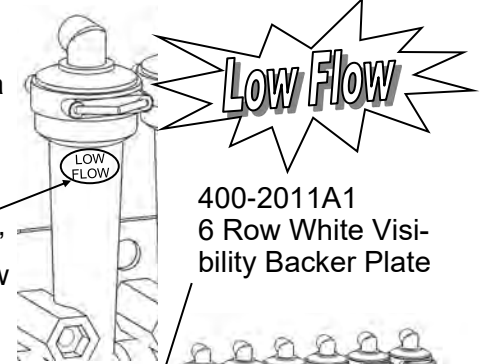
## Low Flow Indicators w/ 1/4" Push to Connect Outlet

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.



400-2011A1  
6 Row White Visi-  
bility Backer Plate

701-20513-  
00 3/4" HB  
90 degree  
inlet

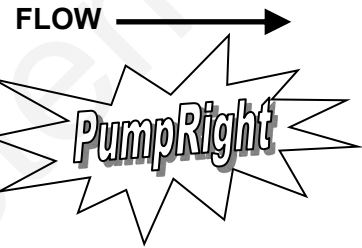
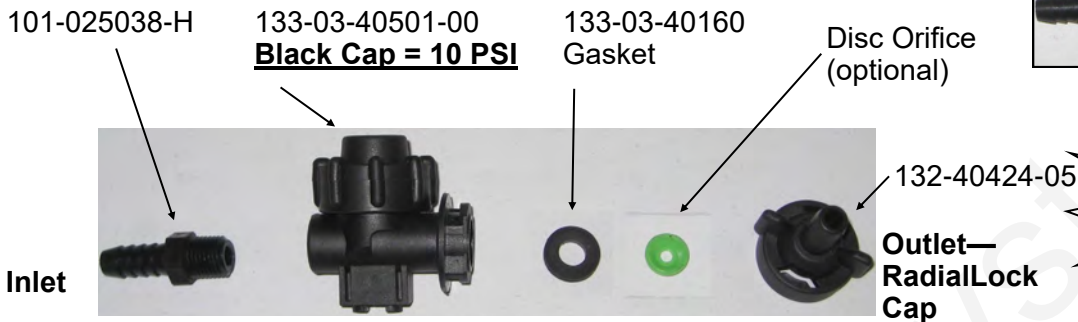
400-1037A1  
3-6 Row  
Bracket

# Check Valves

## 10 lb check valve with 3/8" hose barbs

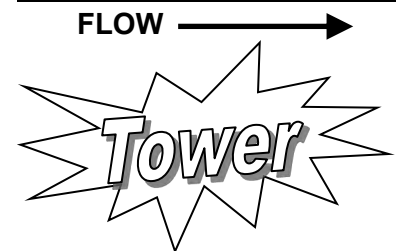
**B**  
Components  
Liquid

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

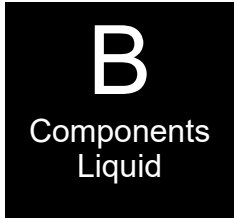
4 lb check valves are typically used with **electric pump systems**. SureFire recommends this valve for use with 1/4" tubing applying up to 10 GPA on 30" rows. The recommended minimum system operating pressure for this check is 10 psi, to ensure all checks open fully.



## 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

# Colored Disc Orifice Chart for 30" rows



## 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

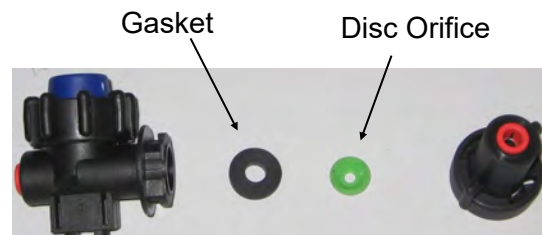
### Tower Electric Pump Pressure Recommendations (with 4 lb check valves):

- 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 assemblies 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

### 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

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





SureFire Ag Systems



# Dual Metering Tube Plumbing Kits with Dual Check Valve

For more information, read [Navigating the Metering Tube Maze](#) or [Metering Tube / LiquiShift Tube 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).

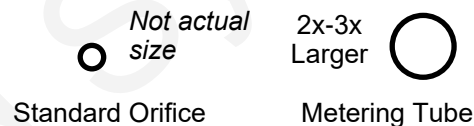
These instructions will show you where all the pieces go. It will provide guidance on how much metering tube to use. There are some optional fittings included in each plumbing kit. These instructions will show you where and why you'd want to use the optional pieces.

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.



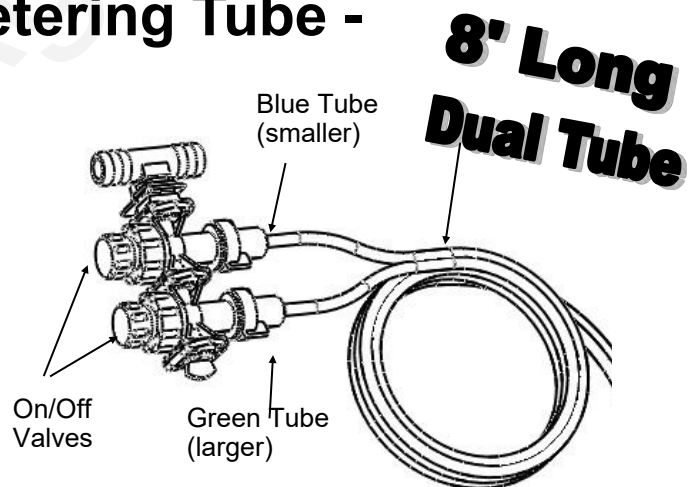
## Field Operation of Dual Metering Tube - Dual Check Valve System

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:  $Oz/min/row = (GPA \times MPH \times spacing \text{ (inches)}) \div 46.4$





## Dual Check Valve Plumbing Diagram

4 Row Planter Shown, add rows as necessary

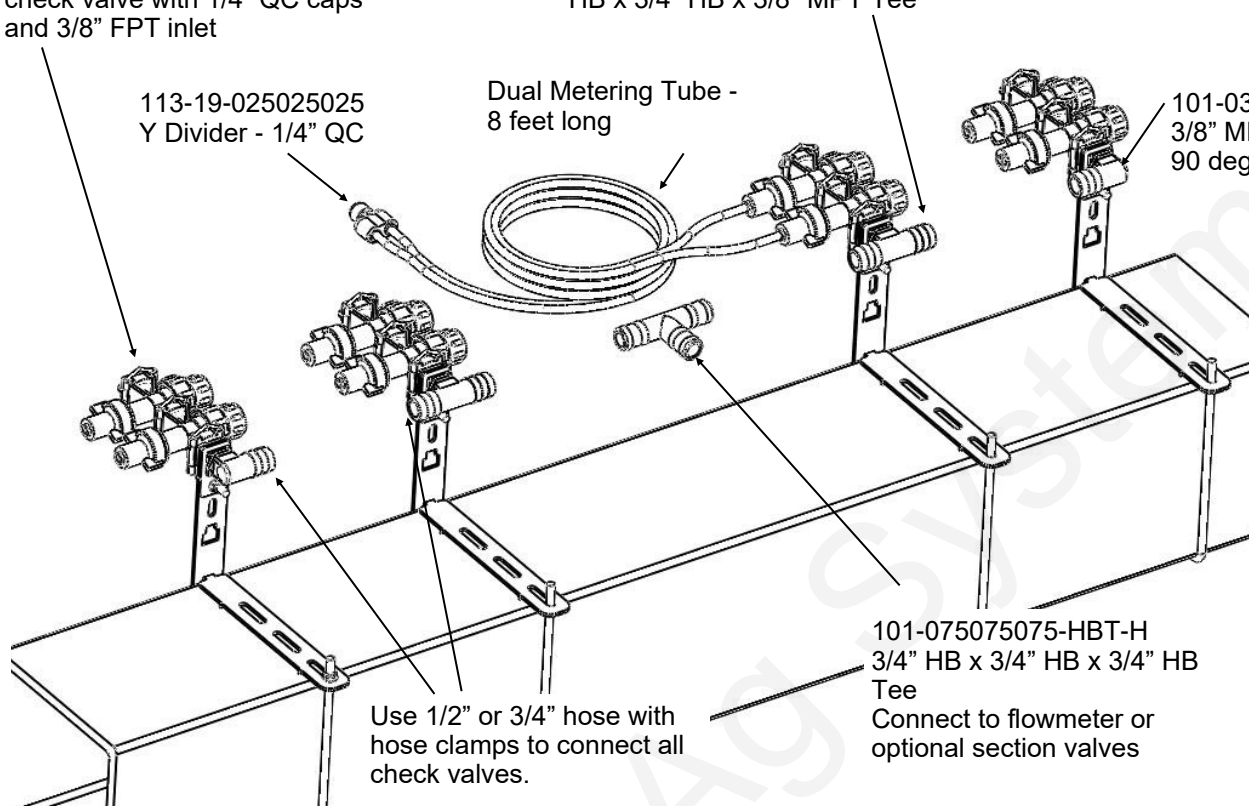
136-04-200400, Dual 4 PSI check valve with 1/4" QC caps and 3/8" FPT inlet

101-075075038-HBT-M-W 3/4" HB x 3/4" HB x 3/8" MPT Tee

113-19-025025025 Y Divider - 1/4" QC

Dual Metering Tube - 8 feet long

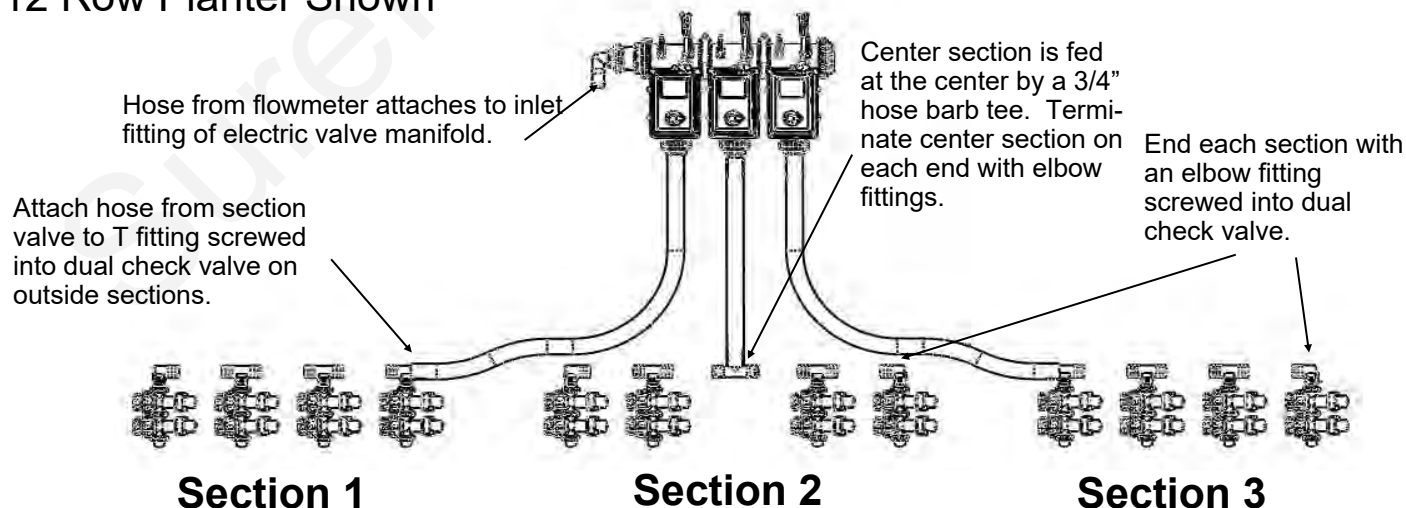
101-038075-90-W, 3/8" MPT x 3/4" HB - 90 degree



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



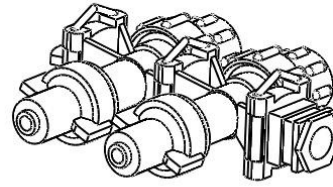
For a **2 section plumbing system**, omit the center section and plumb similar to the outside 2 sections.

# Dual Check Valve Assembly Steps

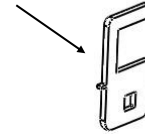
**B**  
Components  
Liquid

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

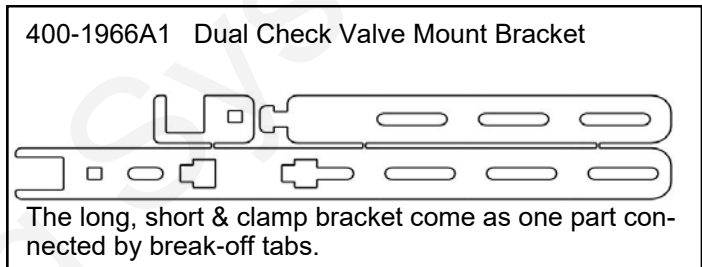
1. Screw the 3/8" MPT x 3/4" HB tee or elbow into the check valve using blue thread sealer. Orient the hose barb to run the 3/4" hose down the planter toolbar.
2. Insert the check valve into the "C" notch in the end of the bracket, according to how you want the check valve to be mounted on your planter. 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.



Clamp Bracket



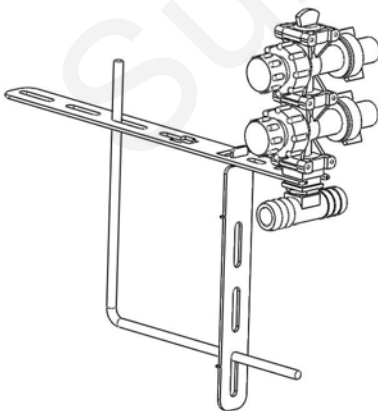
Elbow at end of section, Tee in mid-locations.



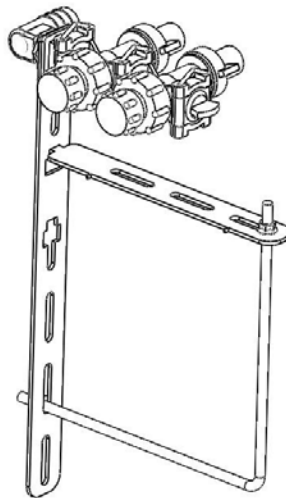
## Check Valve Mounting Options

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.

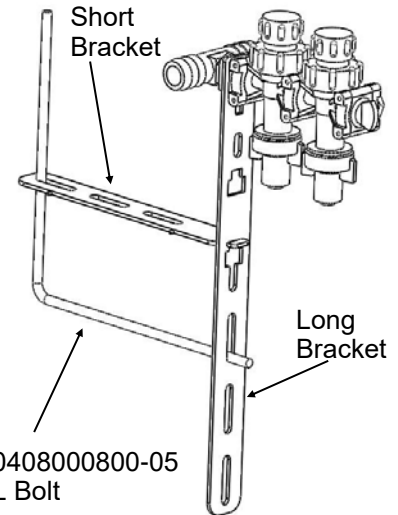
**Example 1.** Use the long bracket on the top of a bar. The check valve is mounted vertically. The liquid supply hose is ran directly on the front side of the bar. The U-bolt is placed in slots to clamp on a 4x6 inch tube.



**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.



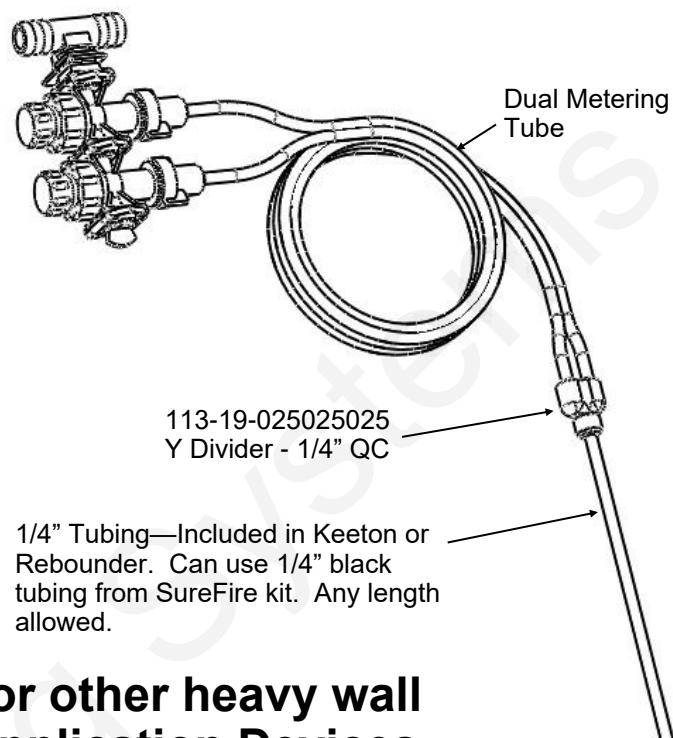
**Example 3.** Use the long bracket on the front of a 3x7 bar (vacuum tube on some planters). Mount the check valve hanging forward of the bar. The supply line will run directly over the bar. The excess bolt and bracket length can be cut off.



## 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.

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.

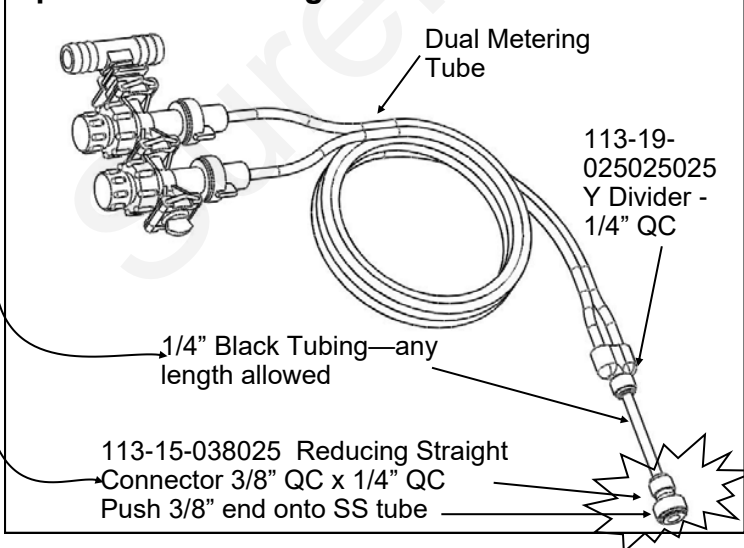


## Connection to Totally Tubular or other heavy wall Stainless Steel Tube Ground Application Devices

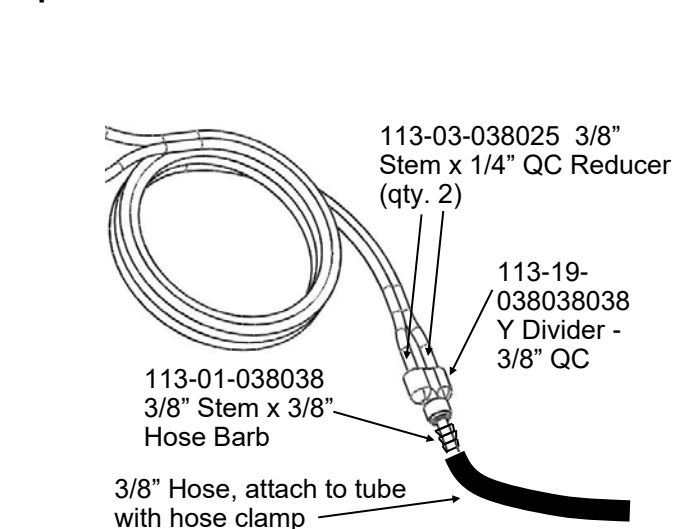
When using a 3/8" OD stainless steel tube to apply fertilizer to the ground, there are two options for the delivery tube plumbing. If the tube ID is less than 1/4" (tubing will not fit inside tube) this attachment method must be used. The description following is for Option 1. See bottom right picture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



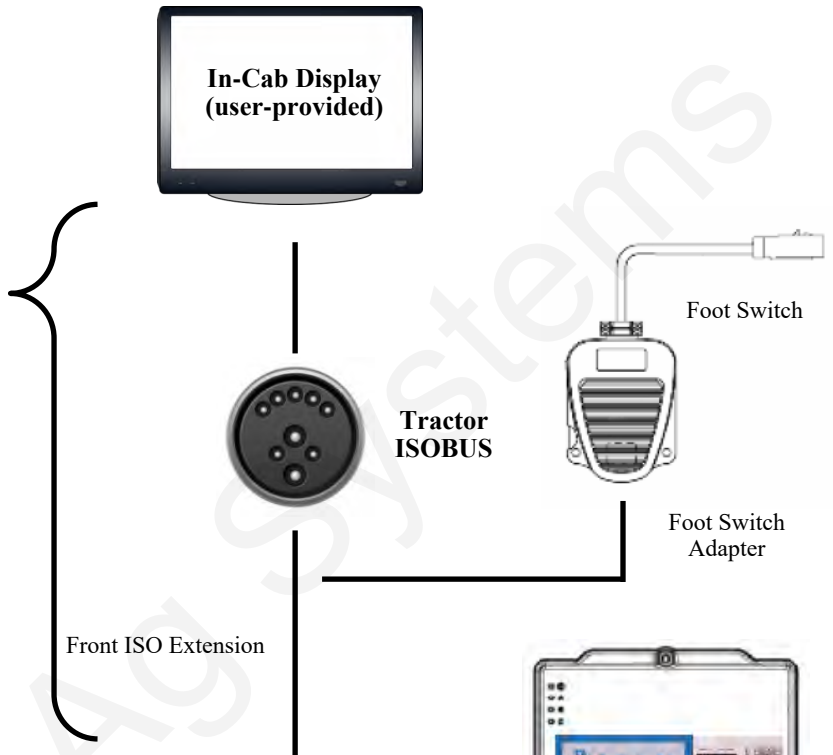
# SureFire Harness Layout for RAVEN RCM



SureFire recommends buying a Raven RCM Adapter Harness from SureFire that will connect directly to the three connectors on the Raven RCM Controller.

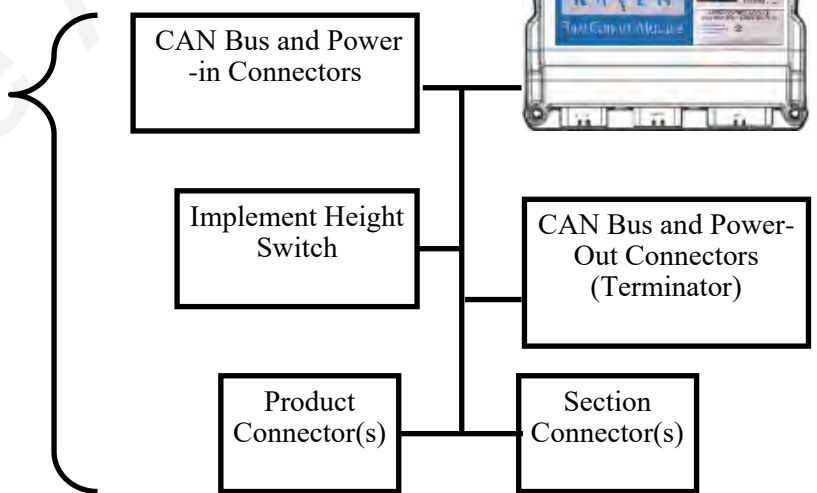
## Footswitch & ISO Extensions (Purchase from SureFire)

Designed to integrate with many ISOBUS virtual terminals, The Raven RCM's connection starts at the tractor's ISOBUS connection. Power and information is relayed to the Raven RCM using a SureFire Front ISO Extension which includes a foot switch and CAN bus connections. Already using the tractor ISOBUS? No Problem. SureFire has an ISOBUS Y harness that can be used in that instance.



## Raven RCM & Adapter Harness (purchase from SureFire)

These harnesses connect the CAN bus to the Raven RCM. Each harness will go directly to 12-pin product connectors and 14-pin section connectors. SureFire offers many different Raven RCM Adapter Harnesses built for a specific single-product or multi-product systems.



## Final Harnesses (purchase from SureFire)

Final Harnesses connect the Raven RCM Adapter Harness to pump drivers, flowmeters, hydraulic motors, speed sensors, pressure sensors, valves and any other components in a liquid, dry or NH3 application system.

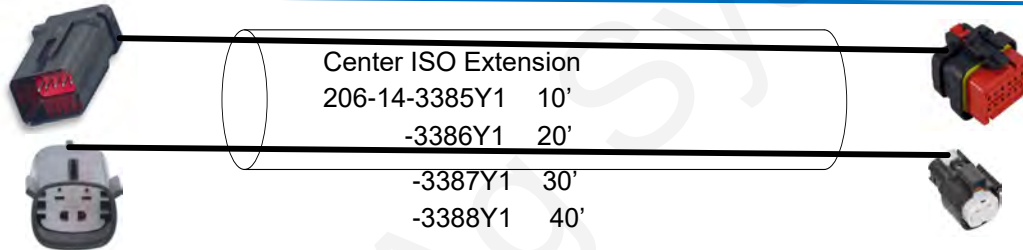
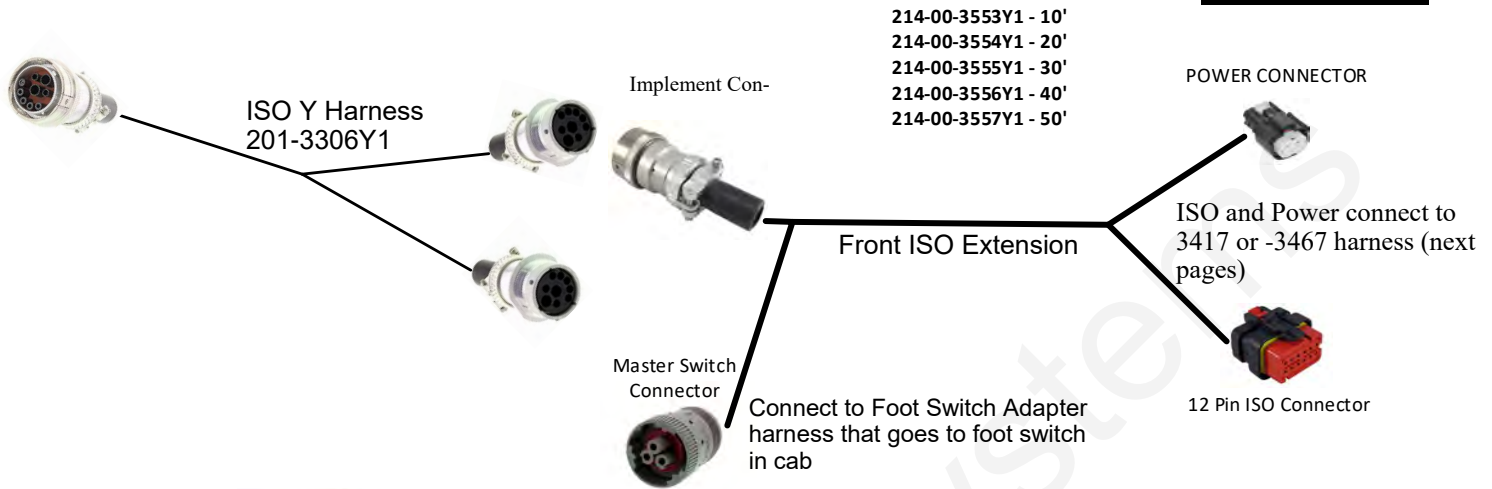
### Product Harnesses

One is required for each product being applied. They start with a 12-pin connector and are unique to Liquid, Dry or NH3 application.

### Section Harnesses

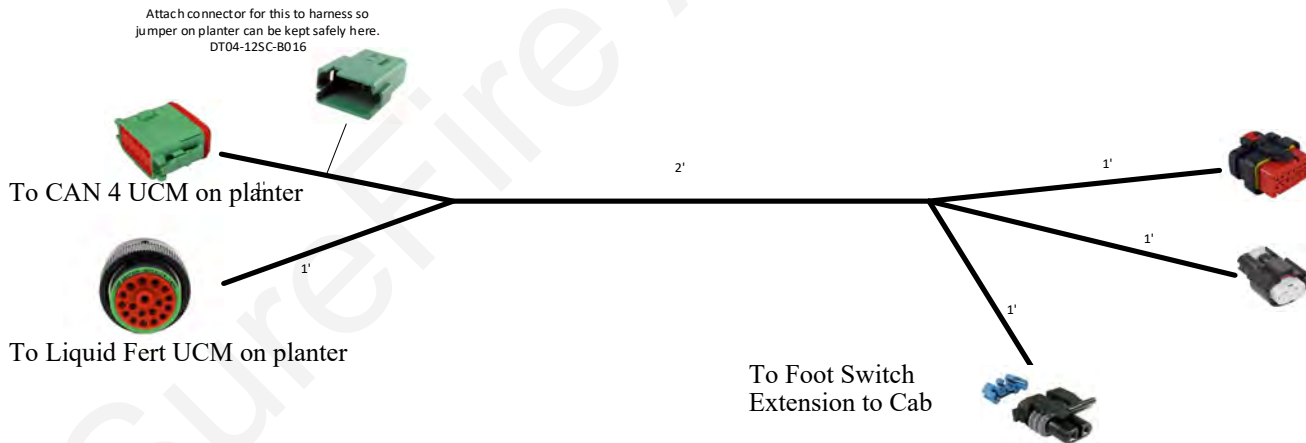
Each section harness starts with a 14-pin connector that allows up to 6 sections to be controlled.

**Harness Layout** Below and on the next page are the harnesses in a typical setup. Your layout may vary. A layout could begin with a Center ISO Extension if there is a connection for that on the implement.



### Harness Option for Case 2000 Series Planter to Raven RCM

213-05-3873Y\_



Plugging in the Raven RCM:

1. Plug the 35-pin and 23-pin connectors from the SureFire adapter harness (213-00-3467Y\_) into the RCM.
2. Plug the 12-pin ISO and 2-pin Power connector on the long leads of the 213-00-3467Y\_ harness into the ISO and Power connectors shown above. Plug in an ISO terminator to the short ISO lead, or connect next ISO module.
3. The RCM must have a foot switch in the cab. Make the necessary connections to connect the foot switch.
4. Plug in the Implement Height Switch if it is being used.
5. Plug in the final Product and Section harnesses.

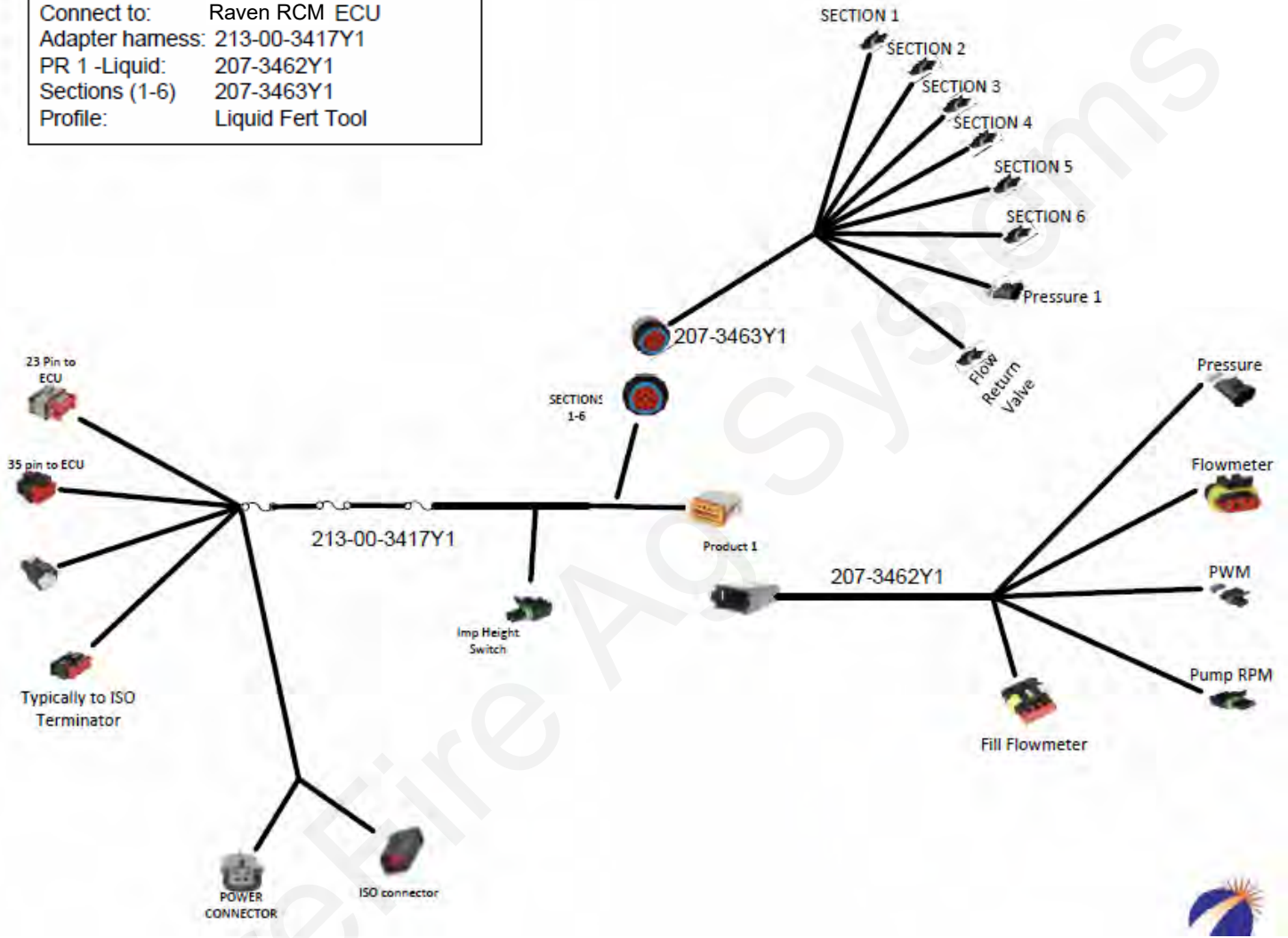
# Example PumpRight & RCM Layout

The harnessing shown below would be used to connect a SureFire PumpRight system with up to 6 section valves to the Raven RCM.



## Using SureFire Direct to RCM ECU

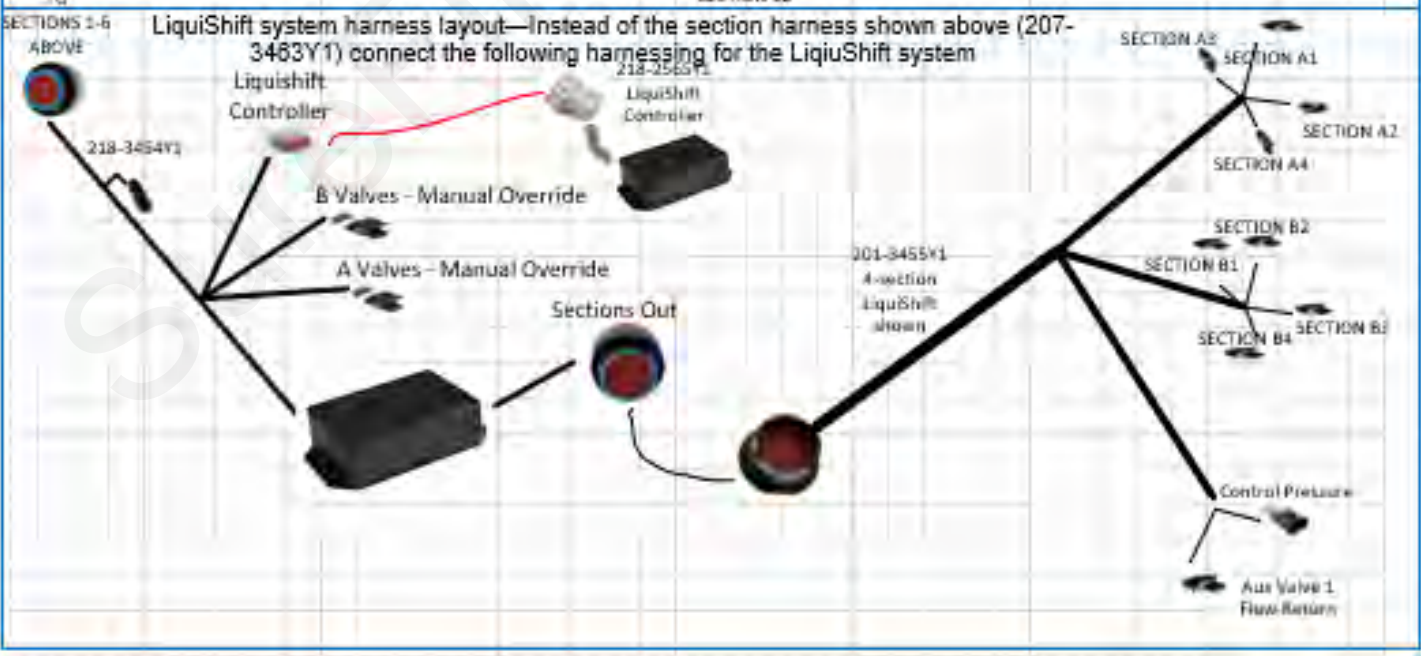
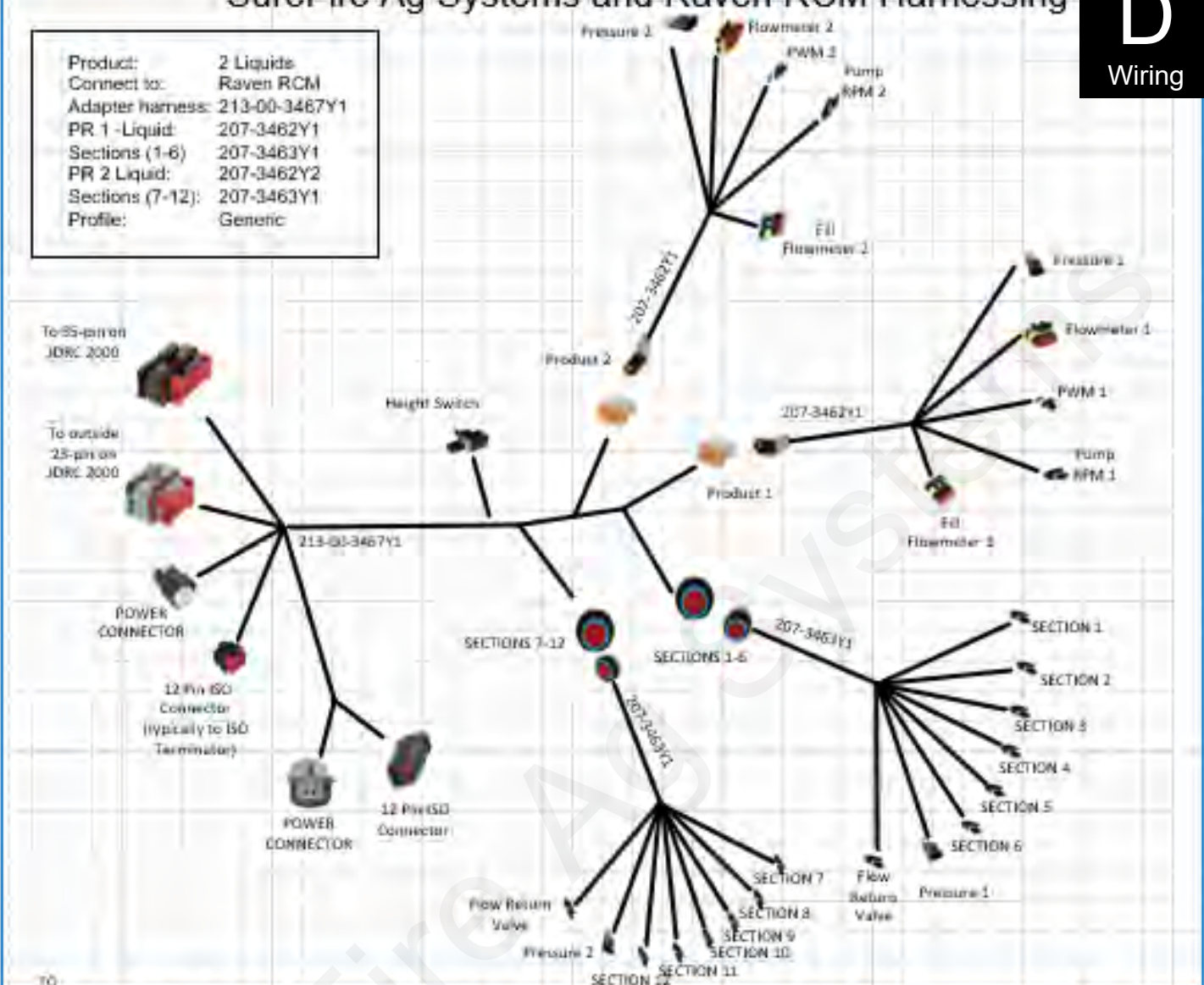
Product:	1 Liquid (up to 6 Sections)
Connect to:	Raven RCM ECU
Adapter harness:	213-00-3417Y1
PR 1 -Liquid:	207-3462Y1
Sections (1-6)	207-3463Y1
Profile:	Liquid Fert Tool



# SureFire Ag Systems and Raven RCM Harnessing

**D**  
Wiring

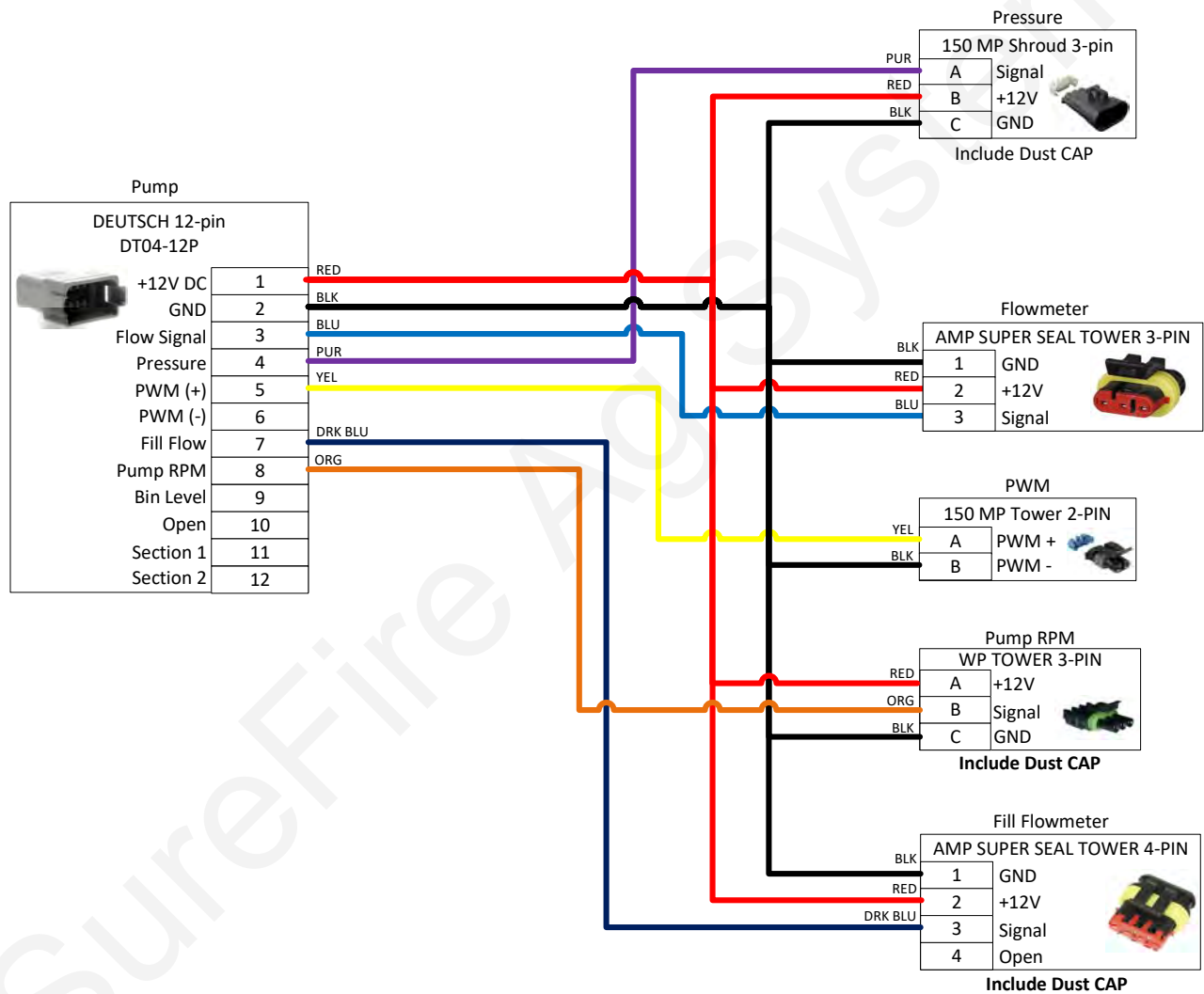
Product:	2 Liquids
Connect to:	Raven RCM
Adapter harness:	213-00-3467Y1
PR 1 -Liquid:	207-3462Y1
Sections (1-6):	207-3463Y1
PR 2 Liquid:	207-3462Y2
Sections (7-12):	207-3463Y1
Profile:	Generic



# 207-3462Y2

## Final Cable for SureFire Liquid Pump System (pwm, flow, pres., pump rpm, fill flow)

**Wire 18AWG  
unless otherwise  
specified**



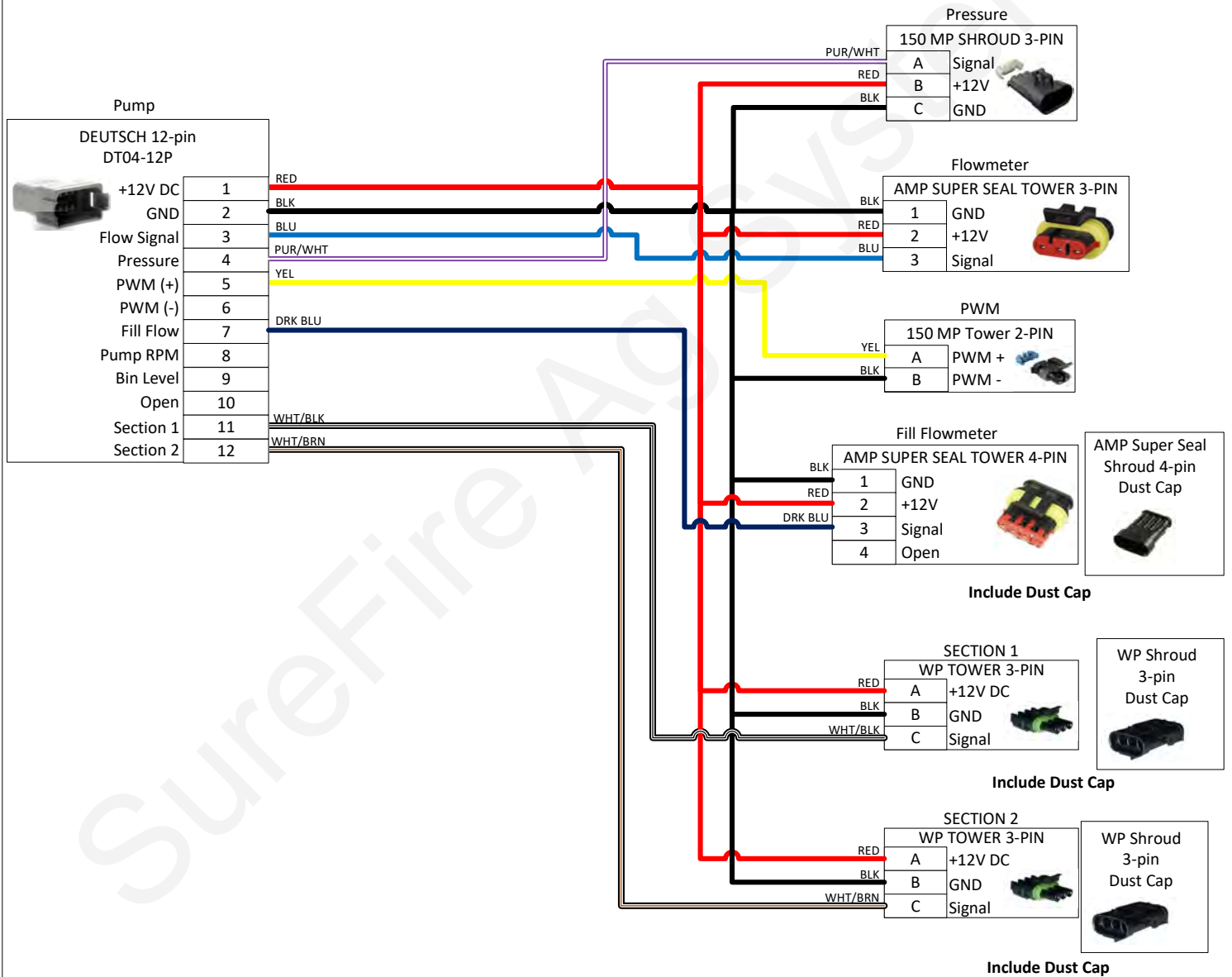
	Part No:	207-3462Y2	Drawn By:	Brandon Cavenee		
	Description:	Final Cable for SureFire Liquid Pump System (pwm, flow, pres., pump rpm, fill flow)	Last Edit Date:	9/4/2018	Revision	A-02
	Copyright 2018 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden			<b>26</b>	1	of 2



# 207-3461Y2

## Final Cable for Tower With 1-2 Section Valves (pwm, flow, pres., sec 1, sec 2, fill flow)

**Wire 18AWG  
unless otherwise  
specified**



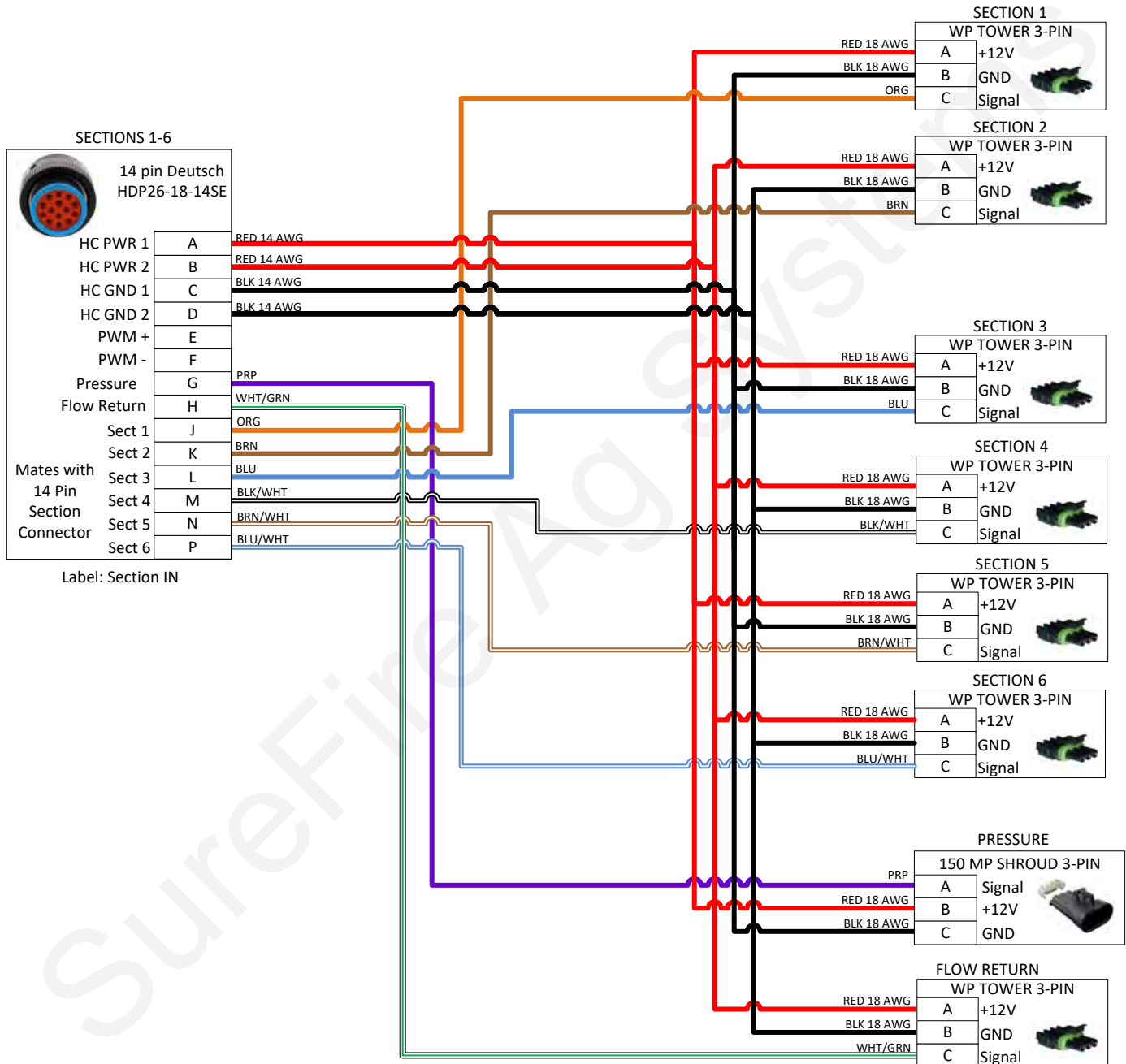
	Part No:	207-3461Y2	Drawn By:	Brandon Cavenee		
	Description:	Final Cable for Tower With 1-2 Section Valves (pwm, flow, pres., sec 1, sec 2, fill flow)	Last Edit Date:	4/3/2019	Revision	A-03
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# 207-3463Y1

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

**Wire 18AWG  
unless otherwise  
specified**

Provide dust caps for WP and MP connectors

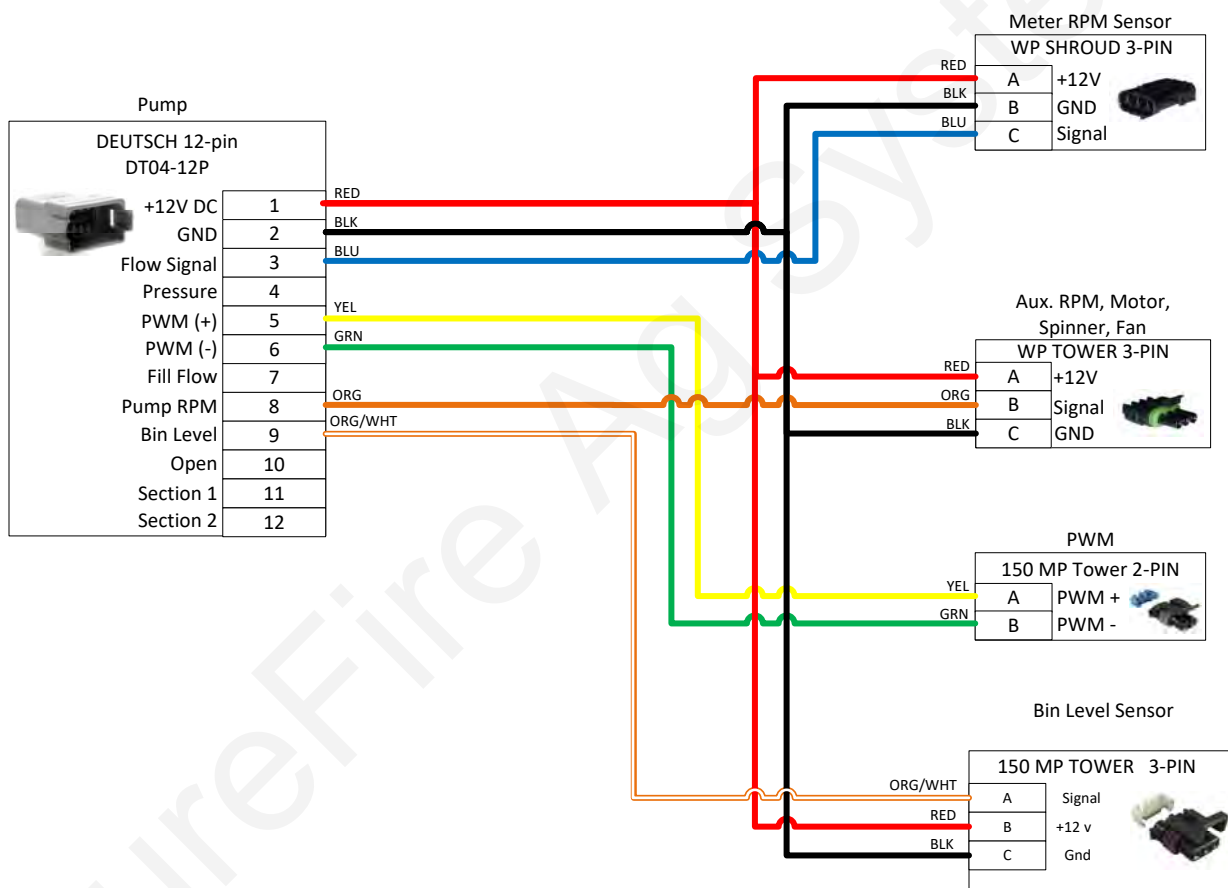


	Part No:	207-3463Y1	Drawn By:	Brandon Cavenee		
	Description:	14-Pin 6-Section Final Cable (6 sections, flow return, pressure)	Last Edit Date:	11/2/2016	Revision	A-01
	Copyright 2016 SureFire Ag Systems, Reproduction or other use of drawing without express written permission from SureFire Ag Systems is forbidden			<b>28</b>	1	of 2

# 207-3492Y2

## 12-pin Final Cable for Basic Dry Fertilizer System (pwm, meter rpm, aux rpm, bin level)

**Wire 18AWG  
unless otherwise  
specified**

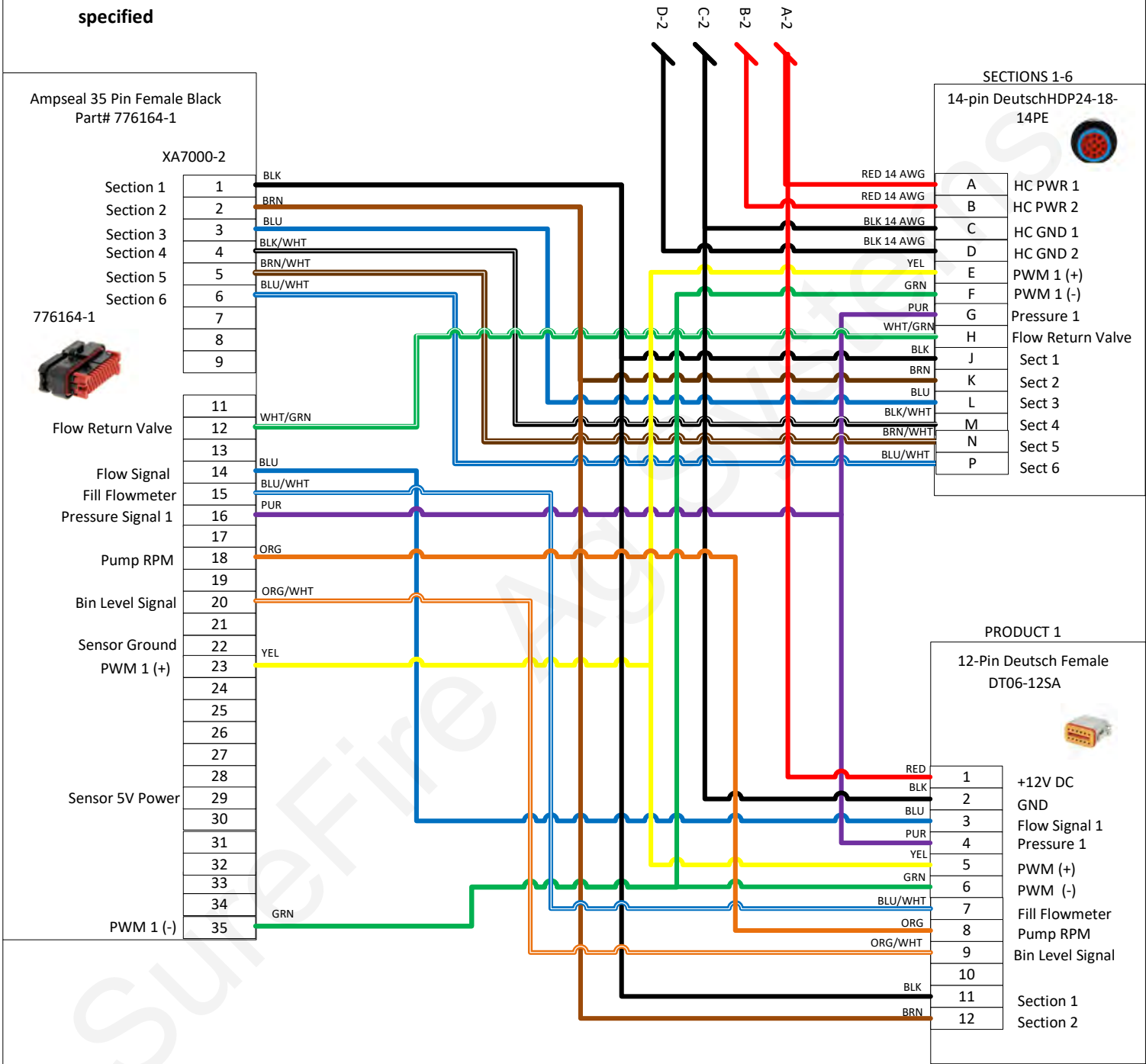


Part No:	207-3492Y2	Drawn By:	Brandon Cavenee, Y2-MAW		
Description:	12-pin Final Cable for Basic Dry Fertilizer System (pwm, meter rpm, aux rpm, bin level)	Last Edit Date:	2/10/2017	Revision	A-02
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213-00-3417Y4

ECU to Liquid Single Product\_6 sections

**Wire 18AWG  
unless otherwise  
specified**




	Part No:	213-00-3417Y4	Drawn By:	Mark Wolters		
	Description:	ECU to Liquid Single Product_6 sections	Last Edit Date:	9/4/2018	Revision	A-06
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# 213-00-3417Y4 ECU to Liquid Single Product\_6 sections

**Wire 18AWG  
unless otherwise  
specified**

**Ampseal 23 Pin  
Female Gray  
Part# 770680-4**




**XA7000-1**

Hi Power15A	1	RED 14 AWG
Hi Power 15A	2	RED 14AWG
Hi Power 15A	3	RED 14 AWG
Hi GND	4	BLK 14 AWG
Hi GND	5	BLK 14 AWG
Hi GND	6	BLK 14 AWG
	7	
	8	
ECU Power	9	RED 14 AWG
	10	
Master Switch	11	BLU
Imp Height Switch	12	GRN
Sensor Return (Gnd)	14	BLK
+5VDC	15	RED
ECU Ground	16	BLK 14 AWG
	17	
ISO CAN LO	18	GRN
ISO CAN HI	19	YEL
	20	
	21	
	22	
+12V Sensor	23	


**12 Pin ISO Connector  
Ampseal 16 (Male)  
12 Pin, Part# 776438-1**

1	ECU GND
2	ECU Power
3	GND
4	ISO CAN Hi
5	
6	Master Switch
7	
8	12 V Batt Power
9	
10	ISO CAN Lo
11	
12	




**POWER CONNECTOR  
Molex MX (Male), 2 PIN  
Part# 19433-0014**

1	HC GND
2	HC PWR




**12 Pin ISO Connector  
Ampseal 16 (Female)  
12 Pin, Part# 776437-1**

1	ECU GND
2	ECU Power
3	GND
4	ISO CAN Hi
5	
6	Master Switch
7	
8	12 V Batt Power
9	
10	ISO CAN Lo
11	
12	



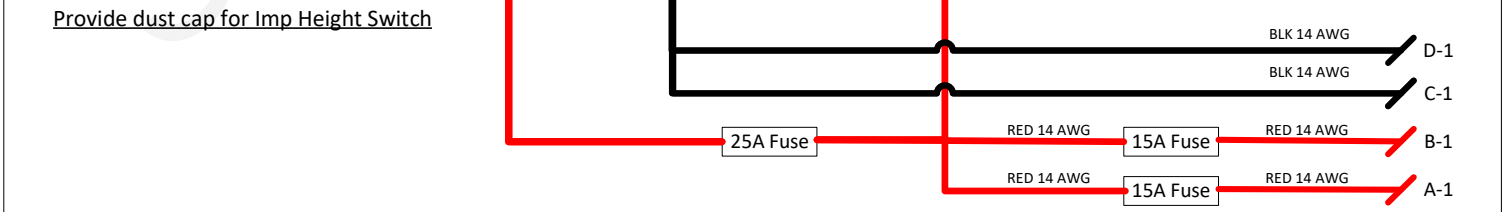
**POWER CONNECTOR  
Molex MX (Female), 2 PIN  
Part# 19432-0014**


1	HC GND
2	HC PWR



**Imp Height Switch  
WP TOWER 3-PIN**

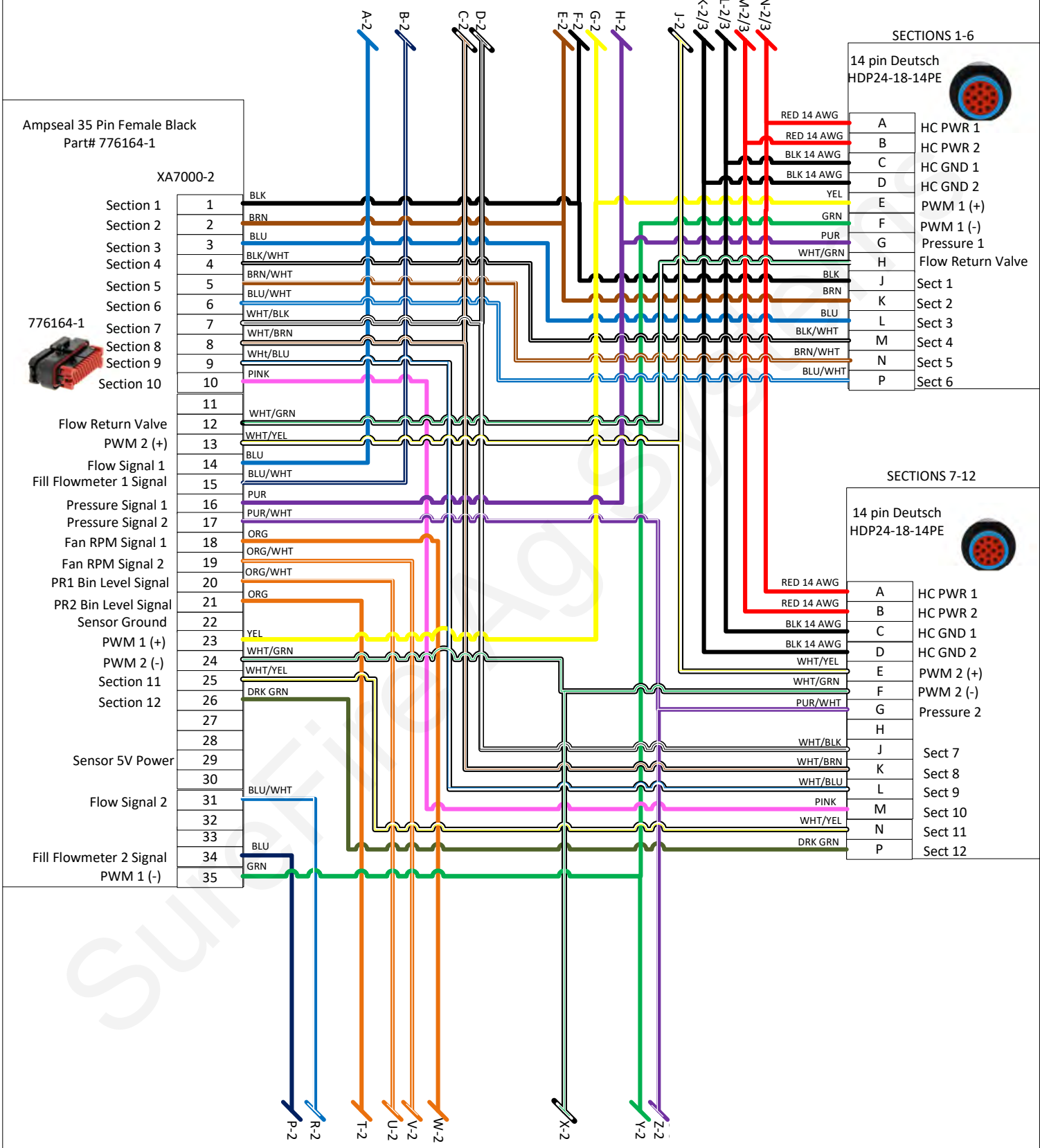
A	GND
B	Imp Sw
C	+5VDC

	Part No:	213-00-3417Y4	Drawn By:	Mark Wolters		
	Description:	ECU to Liquid Single Product_6 sections	Last Edit Date:	9/4/2018	Revision	A-06
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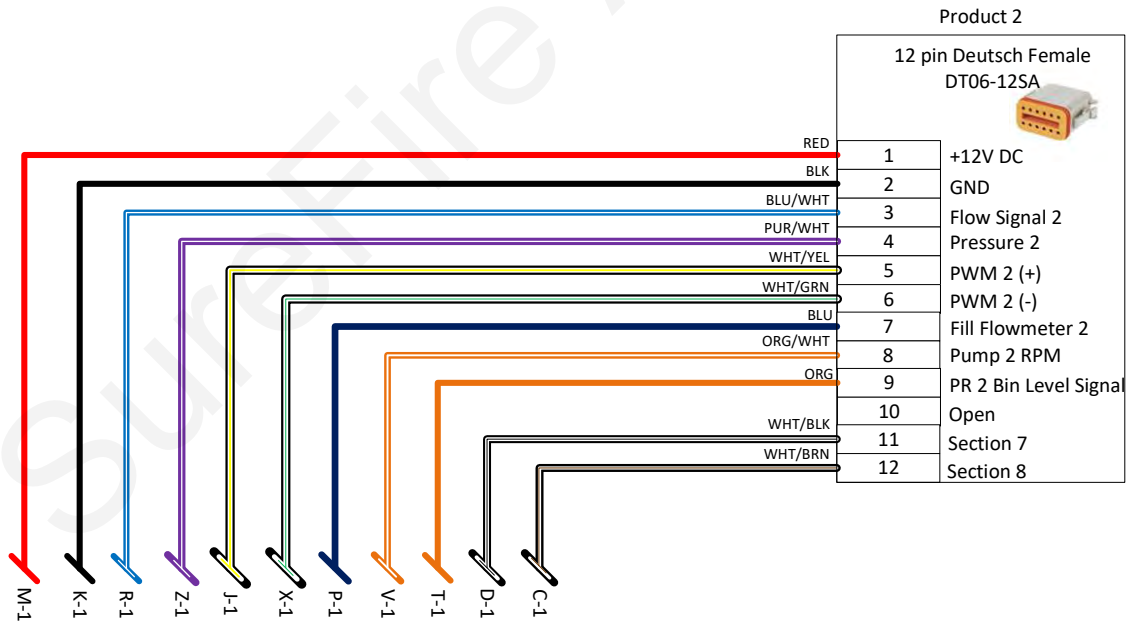
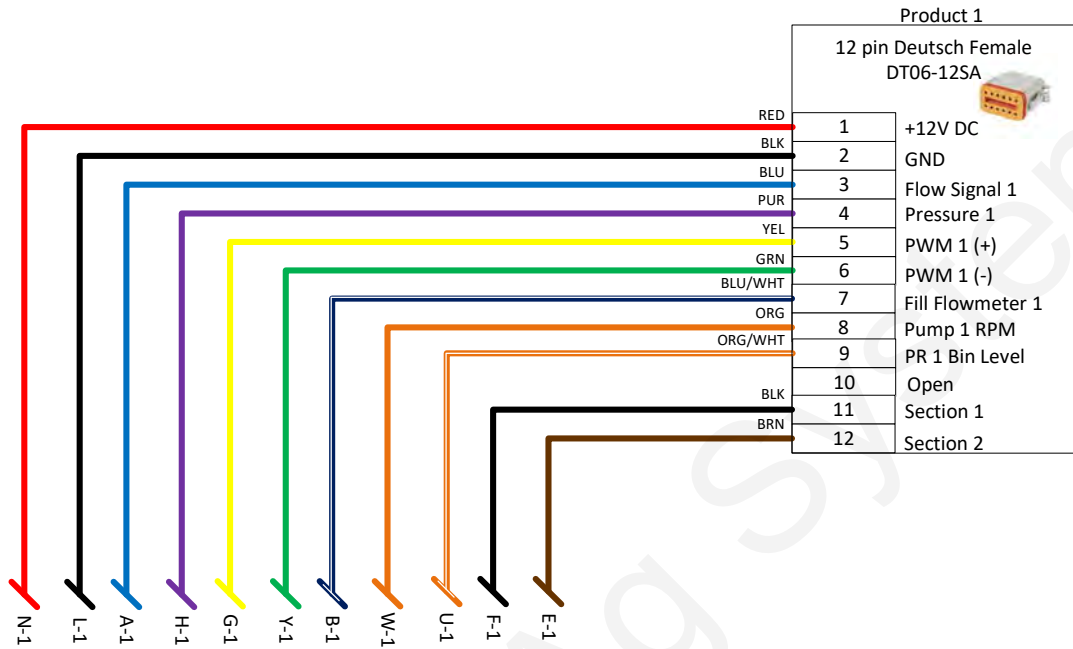
213-00-3467Y4

ECU Direct to Liquid 2 product and 12 sections adapter harness



213-00-3467Y4

ECU Direct to Liquid 2 product and 12 sections adapter harness




Part No:	213-00-3467Y4	Drawn By:	Mark Wolters		
Description:	ECU Direct to Liquid 2 product and 12 sections adapter harness	Last Edit Date:	9/4/2018	Revision	A-06
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# 213-00-3467Y4

## ECU Direct to Liquid 2 product and 12 sections adapter harness

**Wire 18AWG unless otherwise specified**

**Ampseal 23 Pin Female Gray**  
Part# 770680-4




**XA7000-1**

Hi Power15A	1	RED 14 AWG
Hi Power 15A	2	RED 14AWG
Hi Power 15A	3	RED 14 AWG
Hi GND	4	BLK 14 AWG
Hi GND	5	BLK 14 AWG
Hi GND	6	BLK 14 AWG
	7	
ECU Power	9	RED 14 AWG
	10	
Master Switch	12	BLU
Imp Height Switch	13	GRN
Sensor Ground	14	BLK
+5VDC	15	RED
ECU Ground	16	BLK 14 AWG
	17	
ISO CAN LO	18	GRN
ISO CAN HI	19	YEL
	20	
	21	
	22	
+12V Sensor	23	


**ISO Ampseal 16 (Male)**  
12 Pin, Part# 776438-1

1	BLK 14 AWG	ECU GND
2	RED 14 AWG	ECU Power
3	BLK	GND
4	YEL	ISO CAN Hi
5		
6	BLU	Master Switch
7		
8	RED 14 AWG	12 V Batt Power
9	RED	
10	GRN	ISO CAN Lo
11		
12		




**POWER CONNECTOR**  
Molex MX (Male), 2 PIN  
Part# 19433-0014

1	BLK 10 AWG	HC GND
2	RED 10 AWG	HC PWR




**12 Pin ISO Connector**  
Ampseal 16 (Female)  
12 Pin, Part# 776437-1

1	BLK 14 AWG	ECU GND
2	RED 14 AWG	ECU Power
3	BLK	GND
4	YEL	ISO CAN Hi
5		
6	BLU	Master Switch
7		
8	RED 14 AWG	12 V Batt Power
9	RED	
10	GRN	ISO CAN Lo
11		
12		



**POWER CONNECTOR**  
Molex MX (Female), 2 PIN  
Part# 19432-0014

1	BLK 10 AWG	HC GND
2	RED 10 AWG	HC PWR



**Imp Height Switch**  
WP TOWER 3-PIN

A	BLK	Gnd
B	GRN	Imp Sw
C	RED	+5VDC



25A Fuse

15A Fuse

15A Fuse

L-1  
K-1  
N-1  
M-1



Part No:	213-00-3467Y4	Drawn By:	Mark Wolters		
Description:	ECU Direct to Liquid 2 product and 12 sections adapter harness	Last Edit Date:	9/4/2018	Revision	A-06
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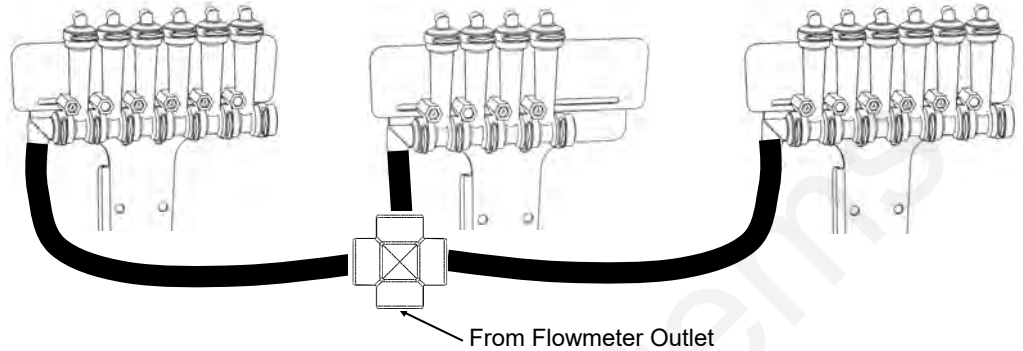
# Floating Ball Flow Indicators

## 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

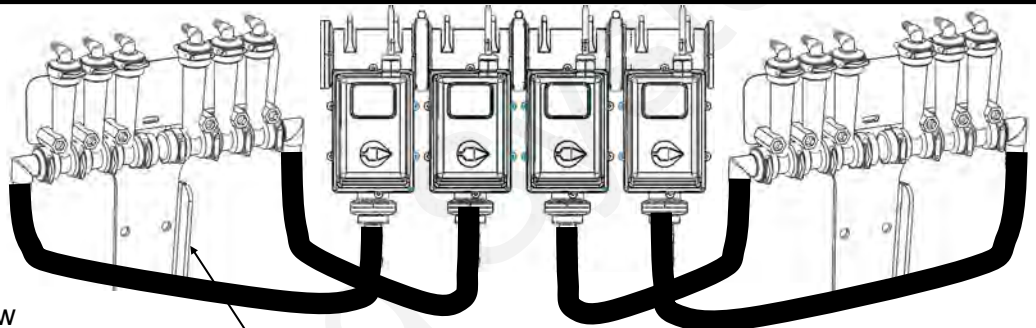
This configuration works well on a 16 row front fold planter. Each flow indicator manifold is shown fed by a cross in a single section installation. Each manifold could be fed by a section valve if desired.



### 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.

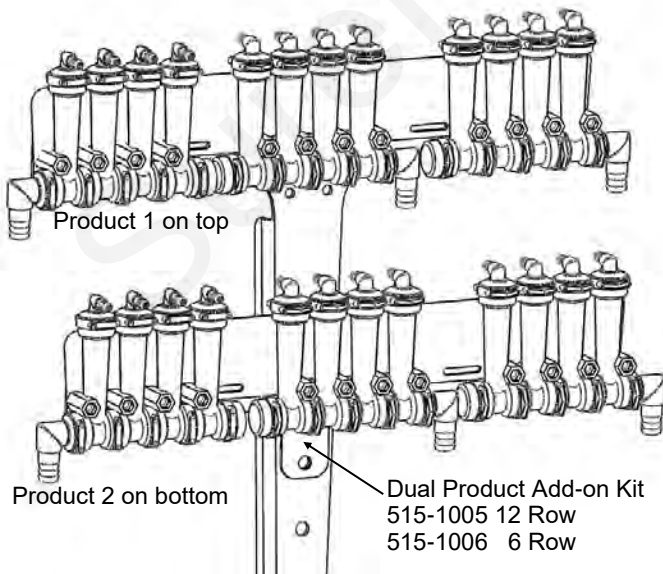
A 4 section 24 row could be similar with four 6 row manifolds on two large T-Brackets.



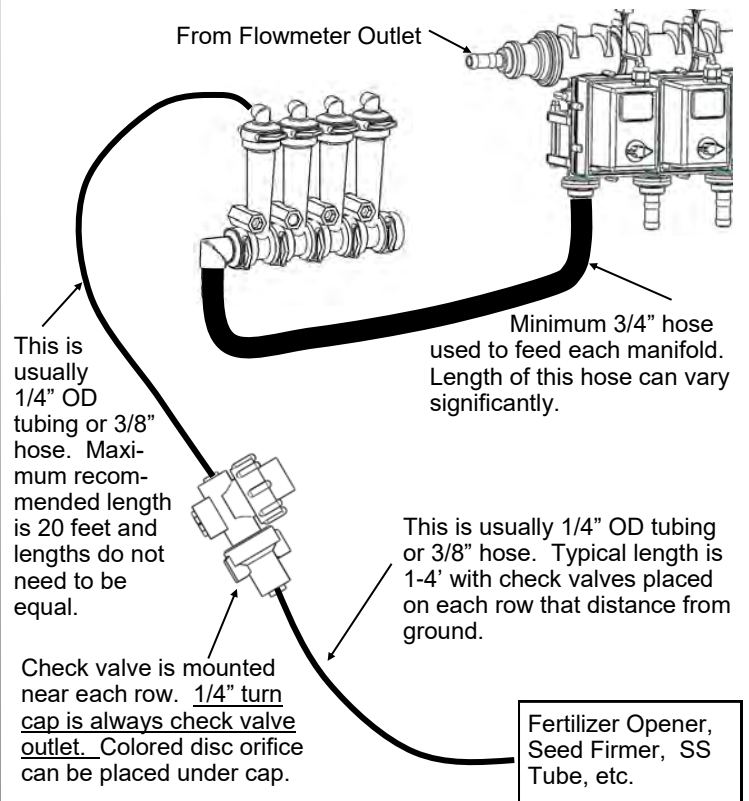
NOTE: Another option is the flange can face forward so the T-Bracket could be mounted on the front side of a bar.

### 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.

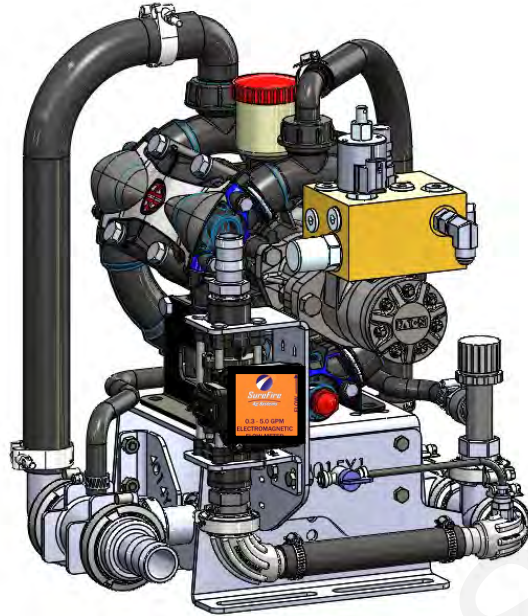


### General Plumbing Guidelines



# PumpRight Installation

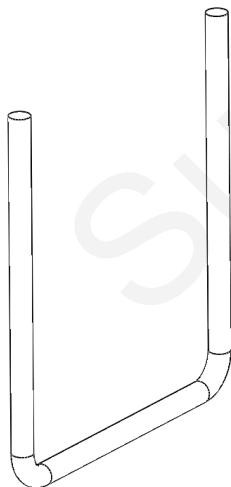
PR17 Pump Shown. Other PumpRight sizes function identically, but will require slightly different mounting due to the different physical size of the pump.



## 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 pump mounting brackets available for many models of planters and for mounting in different locations to fit your system setup.
3. SureFire has U-Bolts available to mount the pump directly to multiple bar sizes shown below. If the U-Bolts will not work, order the universal backer plate, number 400-1973A1 which allows use of 1/2" bolts to clamp to any size tube up to 8" wide.

Mounting Bar	Item Number	Item Description
3" x 3"	380-1022	1/2" U-bolt Kit - 1/2", fits 3" x 3" tube - (3" opening )
4" x 4"	380-1023	1/2" U-bolt Kit - 1/2", fits 4" x 4" tube - (4" opening )
4" x 6"	380-1015	1/2" U-bolt Kit - 1/2", fits 4" x 6" tube - (4" opening )
	380-1017	1/2" U-bolt Kit - 1/2", fits 6" x 4" tube - (6" opening )
5" x 7"	380-1014	1/2" U-bolt Kit - 1/2", fits 5" x 7" tube - (5" opening )
	380-1016	1/2" U-bolt Kit - 1/2", fits 7" x 5" tube - (7" opening )
6" x 7"	380-1018	1/2" U-bolt Kit - 1/2", fits 7" x 6" tube - (7" opening )
7" x 7"	380-1001	1/2" U-bolt Kit - 1/2", fits 7" x 7" tube - (7" opening )
6" x 10"	380-1021	1/2" U-bolt Kit - 1/2", fits 6" x 10" tube - (6" opening )
8" x 12"	380-1019	1/2" U-bolt Kit - 1/2", fits 8" x 12" tube - (8" opening )
8" x 16"	380-1020	1/2" U-bolt Kit - 1/2", fits 8" x 16" tube - (8" opening )



# PumpRight Hydraulic Connections PWM Valve

# E

## Installation Overview

**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.

**Load Sense Port**—For power beyond hydraulic use only.

**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.**

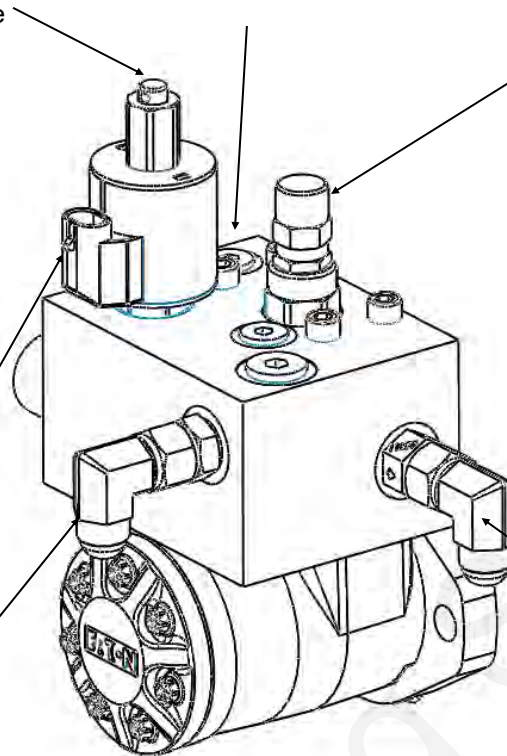
Depending on your tractor and exact hydraulic plumbing scenario your pump may turn very slowly when it should stop. To stop the pump completely, open the bypass valve slightly.

*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.*

Pressure line from Tractor

Return oil to Tank - Check valve included on return port



**▲ 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.

### 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.

Preferred

### Alternate Option - In Series with John Deere CCS Fan or 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 John Deere CCS 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

## Two PumpRights

The preferred method is to plumb the two pumps in series. DO NOT plumb two pumps after the CCS fan. Excessive pressures may damage the CCS fan motor. Run the pressure line from tractor to first pump inlet. Plumb from the outlet of Pump 1 to the Inlet of Pump 2, then from Pump 2 outlet back to the tractor. Open the bypass needle valve on both pumps so each valve controls motor speed independently. Run the flow setting procedure on the next page to minimize the hydraulic flow based on the pump that requires more hydraulic motor flow.



**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.***

# 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)

# E

Installation  
Overview

## 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.

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.



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.

Set the Pump RPM High Limit and Maximum Pressure Alarm as shown in Section F.

Another way to limit the maximum pump speed is to set the High PWM Limit just above what is needed for regular operation. If the pump tries to speed up above that, check for 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

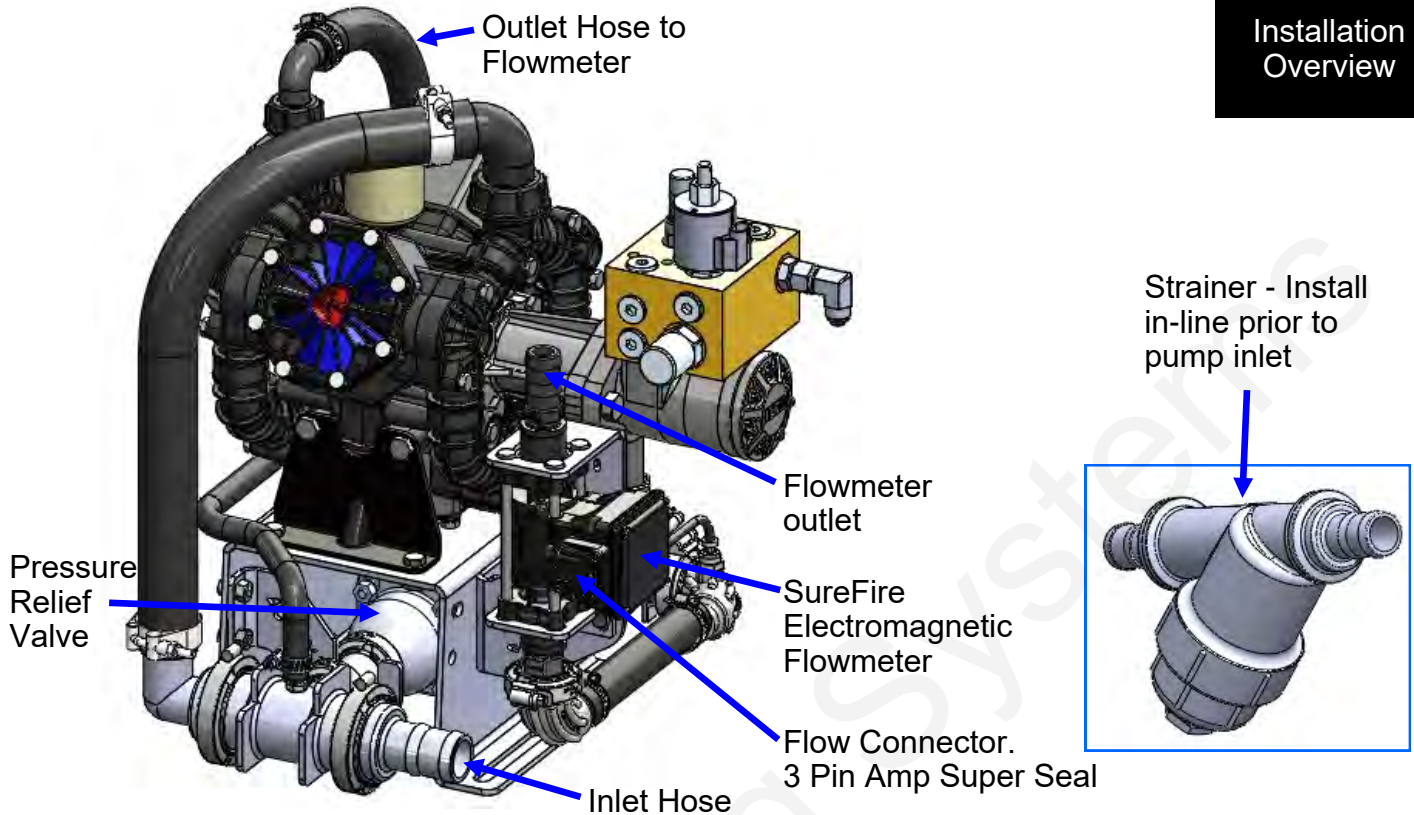
Model D250 - 6 Diaphragms		
Fertilizer Flow (GPM)	Pump Speed (RPM)	Hydraulic Oil Flow (GPM)
10	86	1.6
20	172	3.2
30	258	4.8
40	343	6.4
50	429	8.0
55	472	8.6



# PR17 & PR30 Liquid Plumbing Connections

# E

Installation  
Overview

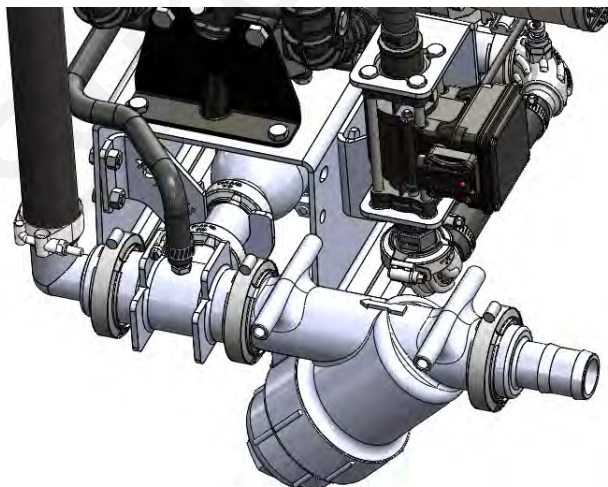


**Inlet:** The PR17 and PR30 PumpRight are shipped with a 1 1/2" inlet hose barb. Attach this to the hose from your supply tank and strainer. A 1 1/2" 90 degree hose barb is included and can be substituted.

**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.



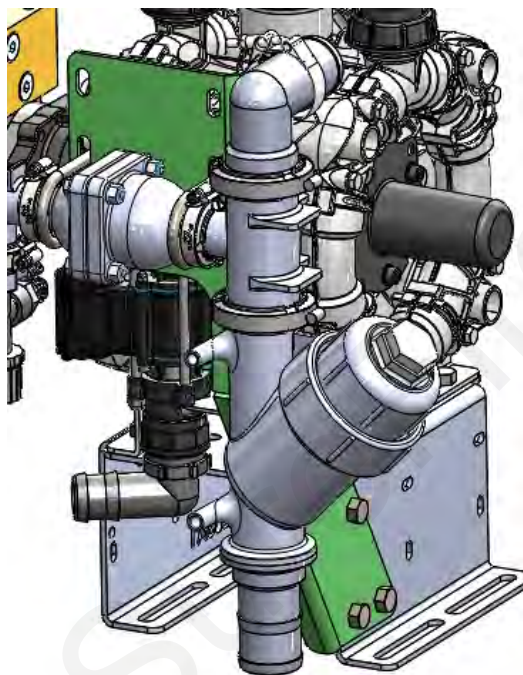
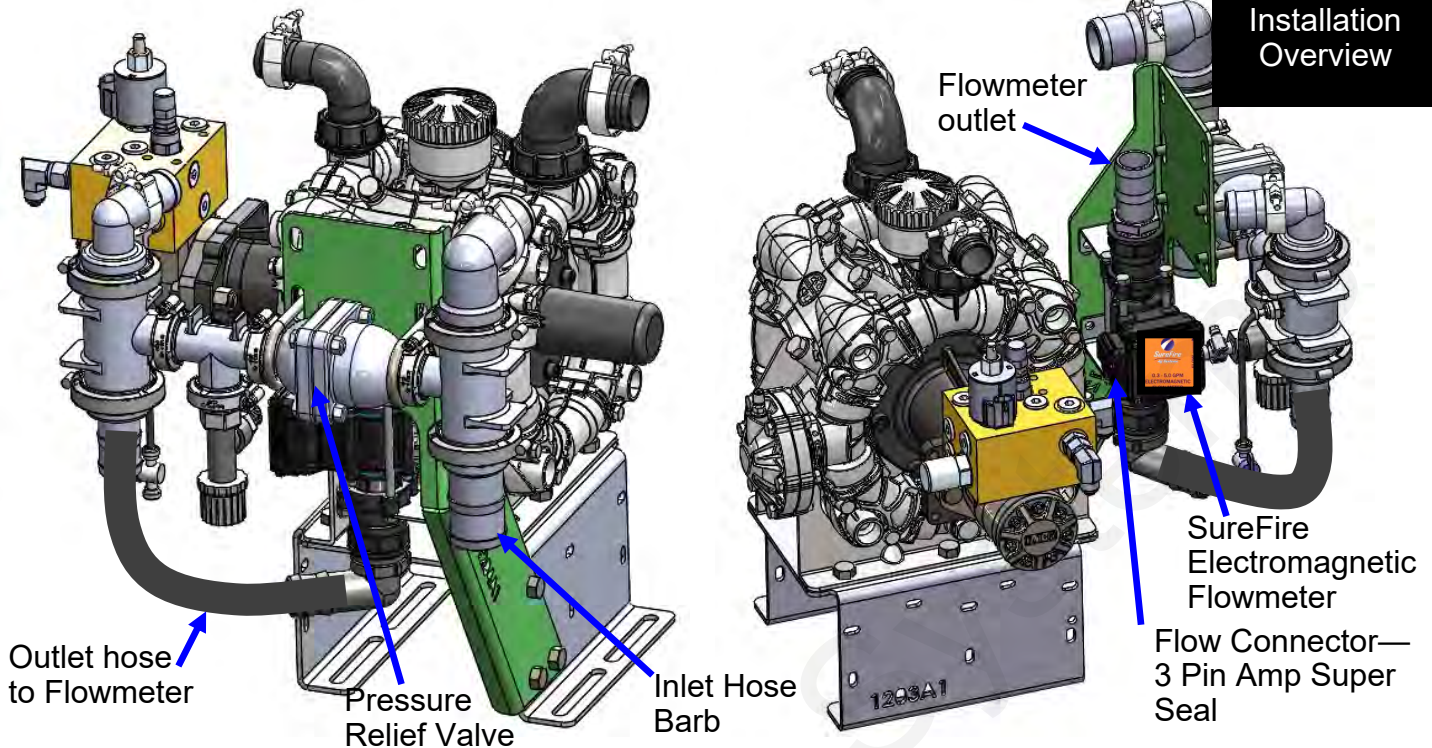
**CAUTION**

*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

# E

Installation Overview



**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.*

# Rate Control Module (RCM) Setup

Following are screen shots typical of a Raven RCM setup. Your setup and screens may vary since the RCM is capable of running many different application scenarios.

To access the RCM, push this button. If this button is not present the rate controller is not communicating with the display.

This button will take you to the Main Run Screen below.



## Main Run Screen

**Actual Rate** (gal/ac): 5.0  
**Target Rate** (gal/ac): 5.0  
**Tractor Speed** (mph): 5.0

**Navigation Buttons:**  
 Raven RCM Run Screen (Home icon)  
 Setup (Gear icon)  
 Totals (1 2 3 icon)  
 Diagnostics (Waveform icon)

**Estimated Volume Remaining / Tank Refill Button** (press to refill tank): 487 (gal)

**Implement Height Switch Indicator:** Arrow will point up or down to indicate implement position if height switch is used.

**Other Data:**  
 PR1: 5.0 (gal/ac)  
 PR2: 0.0 (OFF)  
 97% (Battery)  
 73 (RPM)  
 1.0 (gal/min)  
 5.0 (mph)  
 44.5 DC (%)  
 17 (PSI)  
 97.3 (ac)  
 2.5 (ac)  
 12.1 (ac/h)  
 Master ON  
 Switch Box  
 Quick Start



### Menu Structure



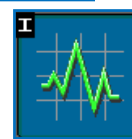
#### Setup

- **Applicator Setup** > Profile > Height Switch > Test Speed
- **System Settings** > Control Valve Setup
  - Rate Sensor Setup
  - Tank Fill Settings
  - Display Setup Menu
  - Pressure Sensor Setup
  - Auxiliary Functions Setup (Advanced Tuning)
- **Alarm Settings**
- **Rates Setup**/ Display Smoothing / Decimal Shift



#### Totals

- Current
- Job Summaries
- Lifetime Totals



#### Diagnostics

- System Information Menu
- Tests
- System Summary
- Product Summary

See the [Raven RCM Operation Manual](#) for safety information and additional setup/operating information.



The operator is responsible for knowing and understanding the safe operation of this equipment. Systems with hydraulic equipment require additional safety precautions to prevent serious injury and/or death.



# Rate Control Module (RCM) Setup



Following are screen shots typical of a Raven RCM 2-product setup. Your setup and screens may vary since the RCM is capable of running many different application scenarios.

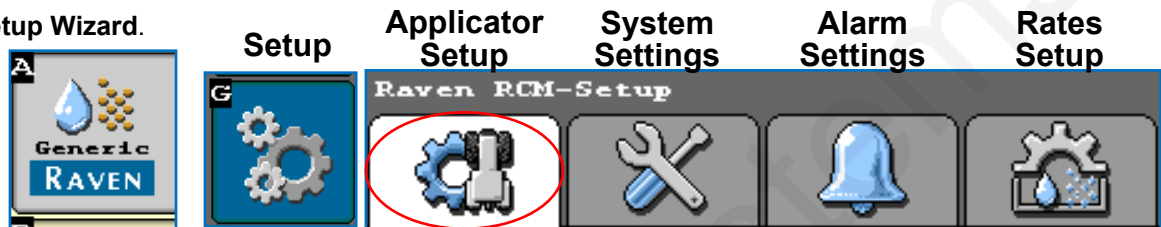
To access the RCM, push this button. If this button is not present the rate controller is not communicating with the display.

This button will take you to the Main Run Screen below.



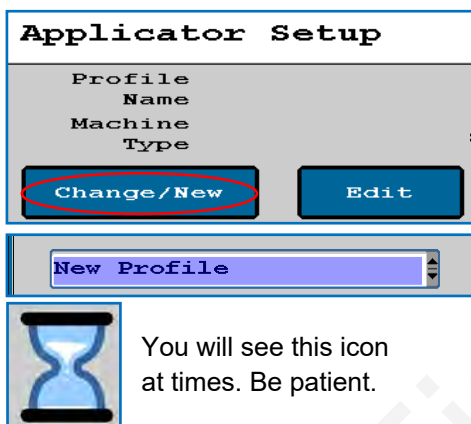
For a single-product setup, use a **Liquid Fert Tool** profile. For two or more products (without NH3), use a **Generic** profile. If using NH3, set up an **NH3** profile.

1. Navigate to the **Setup Wizard**.

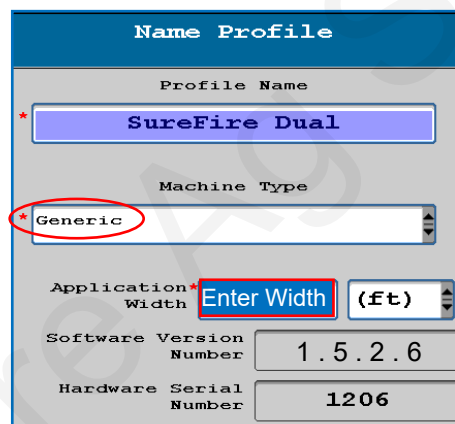


For the initial setup, start a new profile. The Raven RCM allows you to store 8 profiles. Be prepared to wait during this phase of the setup process. The following screens are for a typical 2-product setup. Your setup may vary.

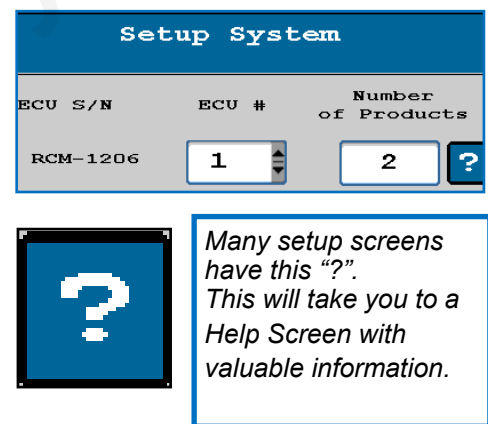
2. Start a **New Profile**.



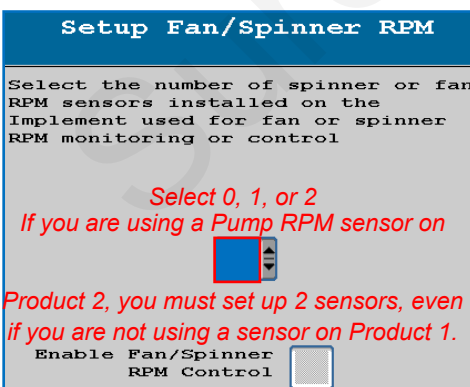
3. Enter a **Profile Name**. **Machine Type > Generic**



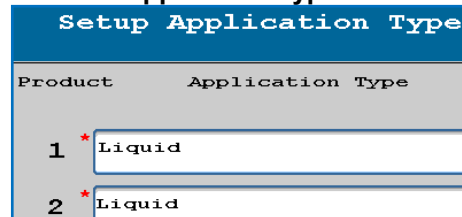
4. **Number of Products = 2**



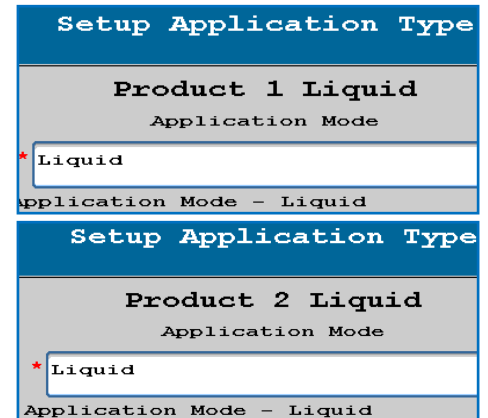
5. **Fan/Spinner RPM**-Use for pump RPM sensor on hydraulic pump. Product 2 uses RPM Sensor # 2 on the SureFire harness.



6. Select **Application Type & Mode**



*If you are applying a Dry product, one or both products could be set up as Granular Fertilizer, with an appropriate Application Mode for that setup.*



See the [Raven RCM Operation Manual](#) for safety information and additional setup/operating information.

# Setup instructions for Raven RCM and SureFire: 2 Liquid Products



**7. Section Group Setup**—Typical setup—Product 1 is Sections 1-6. Product 2 is Sections 7-12. Can have up to 12 sections. Many other setups are possible. For a typical dual product setup, you will say **NO** to sharing section drivers. However, when using a Spartan injection pump that is going into a mixing chamber, say **YES** to sharing section drivers with the main product.

### Setup Section Groups

Are section drivers shared between all products in product harness? ?

Yes  No

Product 1 Sections: 15.00 15.00 15.00 15.00  
 Product 2 Sections: 15.00 15.00 15.00 15.00

See note above on YES or NO

**No**

### Setup Section Groups

Number of Section Groups

### Setup Section Harnessing

Section Group	Starting Section Number	Number Of Sections	Equal Section Widths
1	<input type="text" value="1"/>	<input type="text" value="4"/>	<input checked="" type="checkbox"/>
2	<input type="text" value="7"/>	<input type="text" value="4"/>	<input checked="" type="checkbox"/>

### Setup Section Group Assignment

Product	Section Groups
1	<input type="text" value="Section Group 1"/>
2	<input type="text" value="Section Group 2"/>

### Setup Section Width

Enter the width of the sections

1*	<input type="text" value="10.000"/>	7*	<input type="text" value="10.000"/>
2*	<input type="text" value="10.000"/>	8*	<input type="text" value="10.000"/>
3*	<input type="text" value="10.000"/>	9*	<input type="text" value="10.000"/>
4*	<input type="text" value="10.000"/>	10*	<input type="text" value="10.000"/>
5*	<input type="text" value="0.000"/>		
6*	<input type="text" value="0.000"/>		

Typical setup shown. Many different section setup combinations are possible. The SureFire harness has Sections 1-6 on one connector and Sections 7-12 on another connector. You could set up each product with 12 sections and share section drivers. You do NOT have to have the same number of sections on each product.

## 8. SureFire Pressure Sensors will be CUSTOM.

### Setup Pressure Sensors

Pressure Sensor 1

Pressure Sensor 2

### Setup Pressure Assignment

**Pressure Sensor 1**

Product 1

Product 2

**Pressure Sensor 2**

Product 1

Product 2

### Setup Pressure Alarms

	Min	Max	Alarm?
Pressure 1 (PSI)	<input type="text" value="0"/>	<input type="text" value="85"/>	<input checked="" type="checkbox"/>
Pressure 2 (PSI)	<input type="text" value="0"/>	<input type="text" value="85"/>	<input checked="" type="checkbox"/>

For additional protection, set the Max Pressure at 85 PSI (can be higher if needed). PRV is set for 100 PSI.

## 9. Pump RPM setup-for hydraulic

### Setup Fan/Spinner RPM Calibration

RPM 1 Calibration (Pulse/Revolution)	<input type="text" value="15"/>	Alarm?	<input type="checkbox"/>
RPM 1 Low Limit (RPM)	<input type="text" value="0"/>		<input type="checkbox"/>
RPM 1 High Limit (RPM)	<input type="text" value="500"/>		<input checked="" type="checkbox"/>
RPM 2 Calibration (Pulse/Revolution)	<input type="text" value="15"/>		
RPM 2 Low Limit (RPM)	<input type="text" value="0"/>		<input type="checkbox"/>
RPM 2 High Limit (RPM)	<input type="text" value="500"/>		<input checked="" type="checkbox"/>

### Setup RPM Sensor Assignment

**RPM Sensor 1**

Product 1

Product 2

**RPM Sensor 2**

Product 1

Product 2

RPM Calibration for SureFire Pump RPM sensor is 15 pulses/rev. Set up as needed for your system. Product 2 will be RPM Sensor 2 on the SureFire harness. If using a Pump RPM sensor, you will set up a *Display Setting* on the Run Screen with the Pump RPM readout (described later).

Set the **RPM High Limit at 500** for a SureFire PumpRight hydraulic pump, and **check the Alarm box**. If maximum pump capacity is needed, this may be increased to 550. (Generally, if the pump tries to go over 500 RPM, there is probably another issue such as a plugged strainer or too much recirculation or other problem.)

Read the [Raven RCM Operation Manual](#) for safety information and additional setup/operating information.

# Setup instructions for Raven RCM and SureFire: 2 Liquid Products



## 10. Control Valve Setup (start with the numbers indicated for your system)

**Valve Response Rate:** (Adjust as needed)

- PumpRight (hydraulic) 1
- Tower (electric) 20
- Catalyst and Spartan 5

**Control Deadband:** Start at 2

If pump is slow responding to rate or speed changes, increase **Valve Response Rate**. If product oscillates around rate going across the field, reduce **Valve Response Rate**.

Could set **PWM High Limit** less than 100 to limit pump speed.

**Low Limit** (Adjust in field as needed)

- PumpRight (hydraulic) 25
- Tower (electric) 8
- Catalyst and Spartan 5

**PWM Startup** (Adjust in field as needed)

- PumpRight (hydraulic) 40
- Tower (electric) 30
- Catalyst and Spartan 10

### Setup PWM

#### Product 1 Liquid

Coil Frequency (Hz)

PWM High Limit (%)

PWM Low Limit (%)

PWM Startup (%)

*Fine-tune PWM Low Limit at Diagnostics > Tests > Calibrate PWM Limits*

### Setup Control Valve

#### Product 1 Liquid

Control Valve Type

Valve Response Rate (1-100)

Control Deadband (%)

## 11. Enter appropriate Flowmeter Cal.

### Setup Rate Sensor

#### Product 1 Liquid

Flowmeter Calibration

Flowmeter Pulse/Units

Flowmeter Size (GPM)	Pulses/Gal	Spartan model #	Puls/fl oz
0.08-1.6	22710		
0.13-2.6	3000		
0.3-5.0	3000	110	1760
0.6-13	2000	120	880
1.3-26	2000	130	440
2.6-53	2000	140	220

*SureFire Electromagnetic Flowmeters. Verify pls/gal on Serial Number label.*

**13. Set Rates** as desired. You must enter at least one rate. Check **Display Smoothing** Set the **Decimal Shift** box at 1. Set **Decimal Shift** at 2 for rates such as 0.25 gal/ac.

## 12(a). Tank and Fill Flowmeter setup

### Setup Tank/Bin

#### Product 1 Liquid

Tank Capacity (gal)

Current Tank Level (gal)

*OPTIONAL: Use as desired*

Low Tank Level (gal)  Alarm?

Tank Fill Monitor

Check **Tank Fill Monitor** box if using a fill flowmeter.

## 12(b). Fill Flowmeter Cal setup

### Setup Tank Fill

#### Product 1 Liquid

Tank Fill Flowmeter Calibration

Tank Fill Flowmeter Pulse/Units

Then enter **Tank Fill Flowmeter Calibration**

- SFA 3" Fill Flowmeter 130
- SFA 2" Fill Flowmeter 300

**(Units are 10 gal on SureFire Tank Fill flowmeters.)**

### Setup Rates

#### Product 1 Liquid

Preset Rate Values (gal/ac) Rate 1  Rate 2  Rate 3

Rate Bump (gal/ac)

Rate Selection

Display Smoothing

Decimal Shift

**For high rates, decimal shift can be set at 0, if desired.**

## 14. Set Off-Rate Alarm as desired.

### Setup Alarms

#### Product 1 Liquid

Off Rate Alarm (% off target rate)  Alarm?

If Pressure Sensor 1 has a minimum pressure alarm enabled the system will not drop below that pressure to maintain spray pattern.

**Set up Product 2 in a similar fashion to the Product 1 setup.**

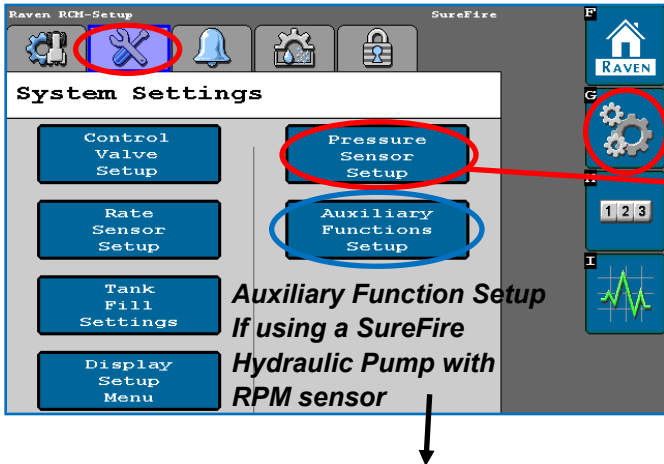
Read the [Raven RCM Operation Manual](#) for safety information and additional setup/operating information.



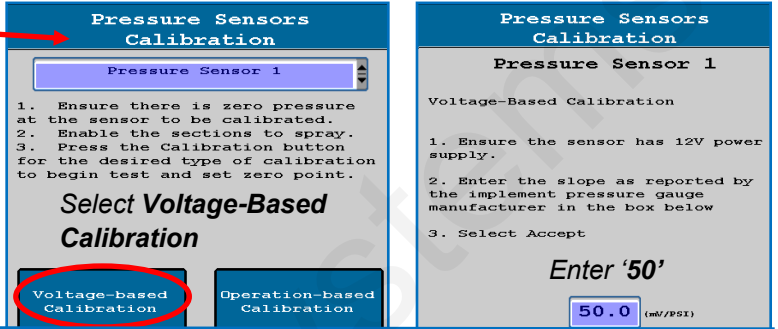
# Setup instructions for Raven RCM and SureFire: 2 Liquid Products



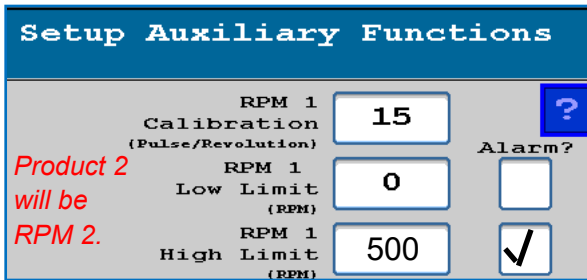
**15. Pressure Sensors** must be calibrated. See the boxes below for the procedure. Enter **50.0 mv/PSI** for SureFire 0 to 5 volt, 0-100 PSI sensor. *If you have 2 sensors, both must be calibrated. Be sure there is no pressure against the sensor when calibrating. Unplug the sensor during the calibration process.*



SureFire recommends putting the Pressure Sensor reading in your **Display Settings** on the Run Screen (see next page). For complete information on how the sensor is operating, go to **Diagnostics > System Information > Pressure Sensors**.



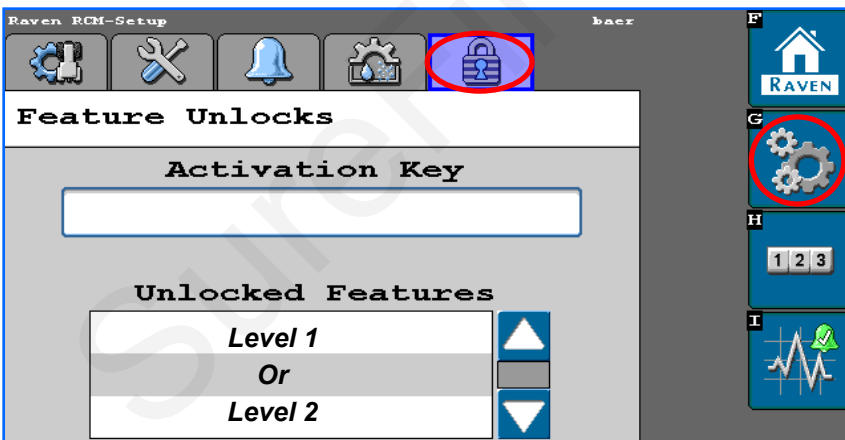
**16. If using a Pump RPM sensor on a SureFire PumpRight Hydraulic Pump**



*Product 2 will be RPM 2.*

*(The SureFire hydraulic pump with an RPM Sensor is 15 pulses/rev as shown above.)*

*These instructions do not cover every possible setup. Your setup may be different. See the [Raven RCM Operation Manual](#) for safety information and complete setup and operating instructions. SureFire harnesses for the Raven RCM are designed for specific operating setups. Pinouts on the Raven RCM change depending on the Profile Setup and the number of products. See the wiring harness diagram for your harness. More information is available at [www.surefireag.com/support](http://www.surefireag.com/support).*



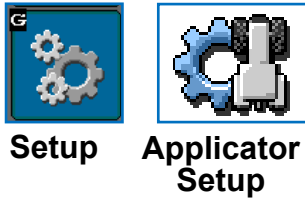
If Profile Setup will not allow you to select a Control Valve Type, check the Unlock Screen. If Level 1 or Level 2 is not shown, contact SureFire to get an Activation Key for the unlock.

This requires knowing the RCM Serial Number (on the RCM or at **Diagnostics > System Information > Hardware/Software > Hardware Serial Number**).

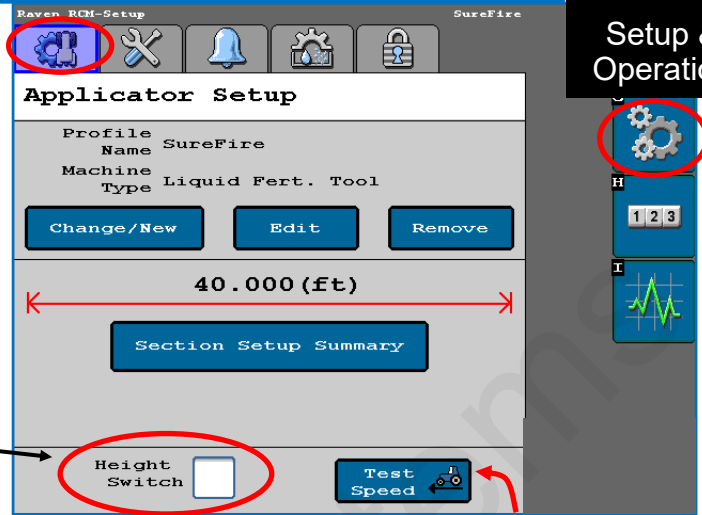
# Setup instructions for Raven RCM and SureFire: 2 Liquid Products



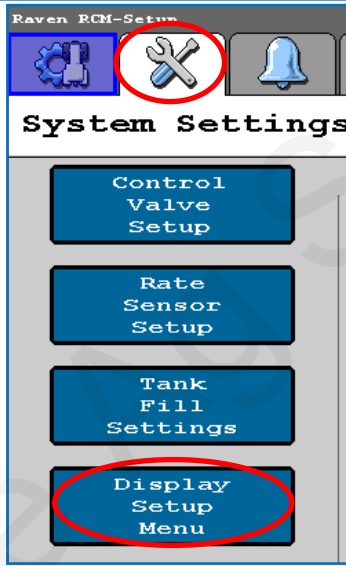
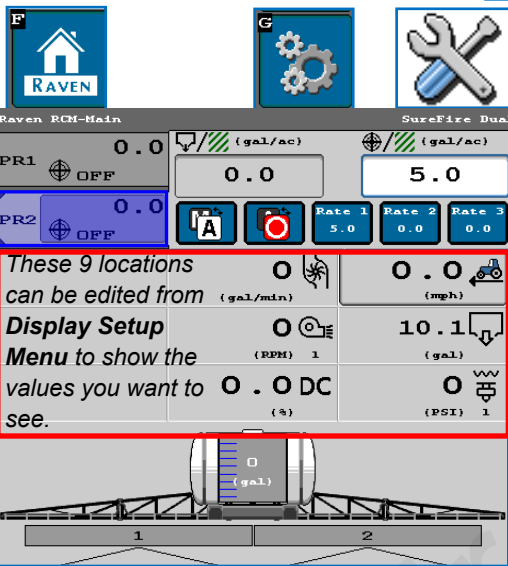
## Implement Height Indicator Setup



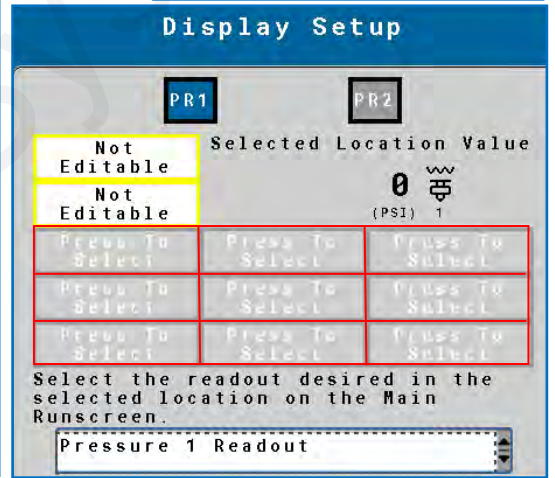
Check the **Height Switch** box if you are using a Mercury Switch or Finger Style Switch for Implement Height Indication.



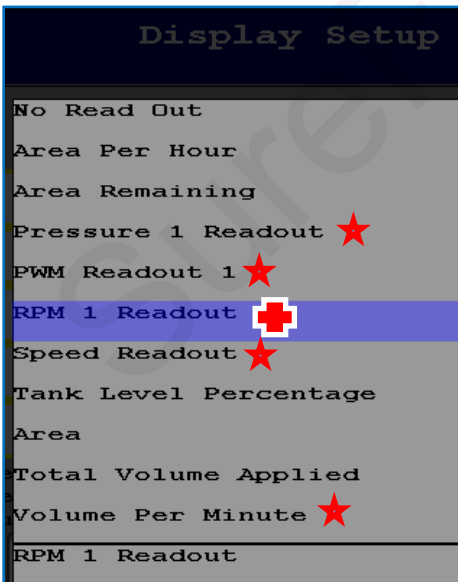
## Run Screen Display Setup



Test Speed will be used later when testing the system.



### Display Setup Menu



### Control Valve Setup Menu

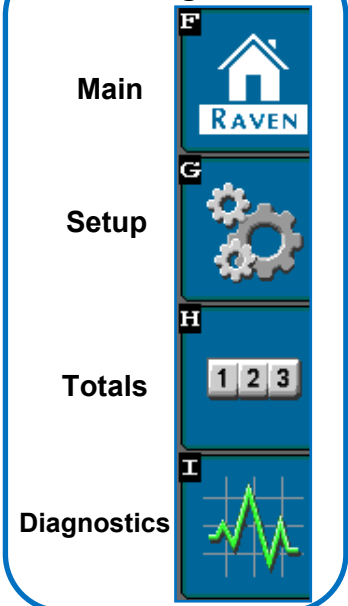
- Valve Response Rate
- Control Deadband
- PWM Setup (Coil Frequency, High Limit, Low Limit, PWM Standby)

### Auxiliary Features Setup Menu

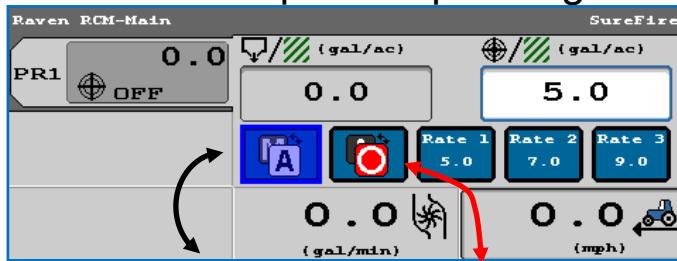
- PPM Calibration Pulse/Rev
- RPM Low Limit
- RPM High Limit
- RPM Sensor Assignment

- ★ Recommended for all systems
- ✚ Recommended for hydraulic pump systems with Pump RPM sensor

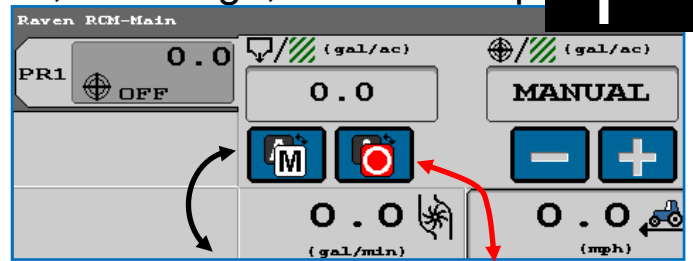
### Navigation



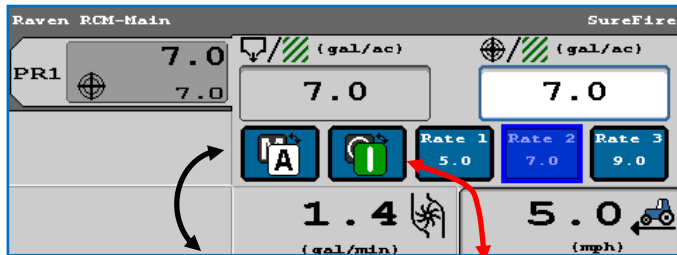
Read the [Raven RCM Operation Manual](#) for safety information and additional setup/operating information.



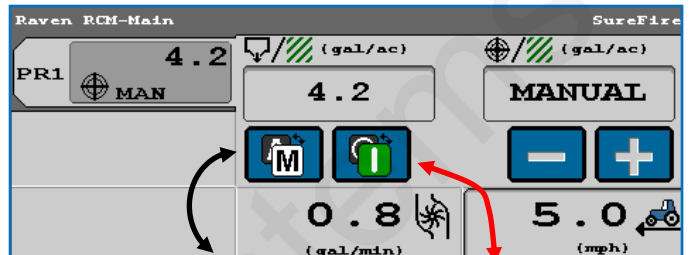
AUTO MODE / DISABLED



MANUAL MODE / DISABLED



AUTO MODE / ENABLED



MANUAL MODE / ENABLED

**CRITICAL**

Solution Pump Dry

Product 1 Liquid

The solution pump is dry. Turn pump off immediately!

If flow or pressure is not immediately detected, the **Solution Pump Dry** warning will come up and the system will shut down.

**Solution Pump Dry** is NOT a problem for SureFire electric pumps or for SureFire PumpRight hydraulic diaphragm pumps. It is a problem for centrifugal pumps.

**Solution Pump Dry** will not come up in **Diagnostics > Tests > Calibrate PWM Limits**.

- Initial Operation in MANUAL mode: (See Optional Manual Pump Operation below)**
1. Fill the system with water. For first time startup, open air bleed valve until a steady stream comes out.
  2. Enter a **Test Speed** by pressing on the **Speed (mph)** window or at **Setup > Applicator Setup**.
  3. Navigate to **MANUAL MODE** as shown above (toggle between Auto and Manual with the Auto/Manual button).
  4. **ENABLE** system (toggle between Enable / Disable with the Enable / Disable button).
  5. Height switch must be **DOWN** (or uncheck Height Switch box).
  6. Turn on **Master Switch**. Press and hold + to increase flow.
  7. Monitor Flow (gal/min), PSI, DC, Pump RPM (if using Hydraulic pump with RPM sensor).
  8. Go to **Switch Box**. Turn Sections OFF and ON.
  9. Turn Master Switch OFF.
- 

**OPTIONAL MANUAL PUMP OPERATION:**

Go to **Diagnostics > Tests > Calibrate PWM LIMITS**. Here you can manually run the pump without the system shutting down if it doesn't read flow immediately. Turn on Master Switch, Start the test, hold + button to increase pump speed.

- Initial Operation in AUTO mode: (Could also do Nozzle Flow Check).**
1. Enter a **Test Speed** by pressing on the **Speed (mph)** window or at **Setup > Applicator Setup**.
  2. Toggle system to **AUTO / ENABLED**. Select a Rate.
  3. Height switch must be **DOWN** (or uncheck Height Switch box).
  4. Turn on **Master Switch**.
  5. Monitor Actual Rate (gal/ac), Flow (gal/min), PSI, DC, Pump RPM.
  6. Go to **Switch Box** (above). Turn Sections OFF and ON.
  7. Turn Master Switch OFF. (NOTE: Pressure will be much less with water than with heavier, thicker fertilizer.)

Read the [Raven RCM Operator's Manual](#) for safety information and additional setup/operating information.

### Main Screen / Run Page

The Main Screen / Run Page displays the following data:

- PR1: 7.0 (gal/ac)
- PR2: 0.0 (OFF)
- Rate 1: 5.0, Rate 2: 7.0, Rate 3: 9.0
- Flow: 1.4 (gal/min), 5.1 (mph)
- RPM: 73 (RPM) 1, 11.8 (gal)
- DC: 40.0 DC (A), 26 (PSI) 1

Buttons at the bottom include: Master ON, Switch Box, Quick Start.

### Diagnostics

**Diagnostics > System Information Menu**

- Hardware / Software
- Switchbox
- Delivery System
- Section Status
- System Voltages
- Working Parameters
- Switches / Status
- Pressure Sensors
- Bin Level Sensors
- RPM Sensors
- Tank Fill Monitor

**Diagnostics > Tests Menu**

- Nozzle Flow Check
- Rinse Cycle
- Control / Section Test
- Calibrate PWM Limits

Additional options: System Summary, Product Summary.

### Frequently Used System Information Screens

#### Pressure Sensor Information

System Information

Pressure Sensors

Pressure Sensor 1

- Pressure Voltage (V): 0.00 (Should be 0)
- Pressure Sensor (V): 0.0
- Pressure (PSI): 0
- Slope (mV/PSI): 50.0

#### Delivery System Information

System Information

Delivery System

- Application Width (ft): 40.000
- Flow Meter (Hz): 55.0
- Flow Rate (gal/min): 1.1
- Application Rate (gal/ac): 5.0
- PWM Duty Cycle (%): 29.7

Tap Test look here

#### Set PWM Limits

Tests > Calibrate PWM Limits

- Turn Master Switch ON.
- Press the Start button.
- Adjust setting until minimum acceptable flow/pressure is achieved, and press Set Low Limit.
- Adjust setting until maximum acceptable flow/pressure is achieved, and press Set High Limit.

Note: Turn the Master Switch off to stop product application.

Buttons: - (Set Low Limit), + (Set High Limit)

Current values: 1.2 (gal/min), 31.0 DC (A), 21 (PSI) 1

These tests can be run at initial system startup or for troubleshooting. Similar tests can also be run from the Run Page using Manual and Auto Mode with a Test Speed.

#### Section Test

Tests > Control / Section Test

- Select the section outputs to be activated.
- Turn the Master Switch on.
- Press the Start button.
- Toggle Sections using the buttons.

Note: Turn the Master Switch off to stop product application.

Buttons: 1, 2, 3, 4, Start, Master OFF

Press and hold the - or + button to operate the control valve.

When testing with water, the system pressure will be much less than it will be with a fertilizer product.

#### Nozzle Flow Check

Tests > Nozzle Flow Check

- Enter test speed and rate.
- Turn Master Switch ON.
- Press the Start button.

Note: Turn the Master Switch off to stop product application.

Test Speed (mph): 4.0

Rate (gal/ac): 6.0

Master ON

Current values: 1.9 (gal/min), 6.0 (gal/ac), 0 (PSI) 1

Read the [Raven RCM Operator's Manual](#) for safety information and additional setup/operating information.

## TROUBLESHOOTING TIPS:

**1. Pump Won't Run**—Start the Calibrate PWM Limits Test. Press (+) to run the PWM Duty Cycle (DC) to 100%. With a voltmeter check voltage at the 2-pin PWM connector at the EPD or hydraulic valve solenoid. You should have 12-13 volts. If there is voltage here, but the pump won't run, check the pump using the following tests:

**Electric Pump**—Start Calibrate PWM Limits Test to open Section Valves. Unplug the two big connectors that plug into the black EPD module on the pump tower. Plug these together. This will take power from the battery directly to the pump(s). The pump(s) should run full speed.

**Hydraulic Pump**—On the hydraulic valve block, pop up the Manual Override button (red knob on top of solenoid). If unit has been in the field, you may need to loosen the dirt to move the knob. In cab, turn hydraulic flow to very low. Start Calibrate PWM Limits Test to open Section Valves. Engage hydraulics. Pump should begin turning. Slowly increase hydraulic flow to speed up pump.

**2. Pump runs and liquid flows, but display is not reading flow.** Unplug the flowmeter. With a voltmeter, check for 12 volts between pins 1 (black) and 2 (red) of the connector that plugs into the flowmeter. (You may have to remove the red keeper to get access to the pins with your voltmeter. Be careful not to break the sides of the red keeper.) You should also have 4-5 volts between pins 1 (black) and 3 (red).

If the voltage is OK, conduct a tap test. Have one person on the display go to Diagnostics > System Information > Delivery System, watching Flow Meter (Hz). The second person will tap repeatedly between pins 1 and 3 on the flowmeter connector with a bent paper clip or short piece of wire. As the person taps, the display should show some numbers on Flow Meter (Hz).

If the voltages are good, and the tap test shows on the display, but the system does not read flow when liquid is flowing, the flowmeter is not working.

**3. PWM Startup**—For best startup performance, set the PWM Startup at or slightly above the DC% that the system will be running at in the field.

### Using the Quick Start button:



Use the Quick Start button to get the system primed and ready to apply when entering a field or starting in a field corner. Turn on the Master Switch, push Quick Start, the system will begin applying as if the Speed is 3 mph. Start driving. The Auto Rate Control will take over when the speed reaches the Minimum Application speed. Quick Start runs for 15 seconds. For additional time, push Quick Start again.

### Virtual Terminal (VT), Universal Terminal (UT), and Task Controller (TC)

VT or UT software allows the display to show the ISOBUS Implement (the Raven RCM) on the display screen. This usually comes with the display, but be sure the software is installed if the display has not previously been used as a Virtual Terminal.

Task Controller software is necessary to do Section Control, Variable Rate Application using prescriptions, and/or As-Applied Mapping. Task Controller is typically purchased from the display manufacturer as an Unlock.

See the Task Controller documentation from your display manufacturer for more information on setup and operation.

**For more information, see the *SureFire Manual for your Raven RCM system* at [www.surefireaq.com/support](http://www.surefireaq.com/support).**

**Read the [Raven RCM Operator's Manual](#) for safety information and additional setup/operating information.**



# Hydraulic Pump Will Not Turn

Turn hydraulics off, go to the **SureFire PWM valve** and use the manual override (red knob) on top of the electric coil to **manually open the valve** (Manual Override UP = valve fully open). There may be dirt in here that needs to be cleaned out before you can turn and raise the override. Turn hydraulics on **at a low flow only** as the valve is 100% open. If 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

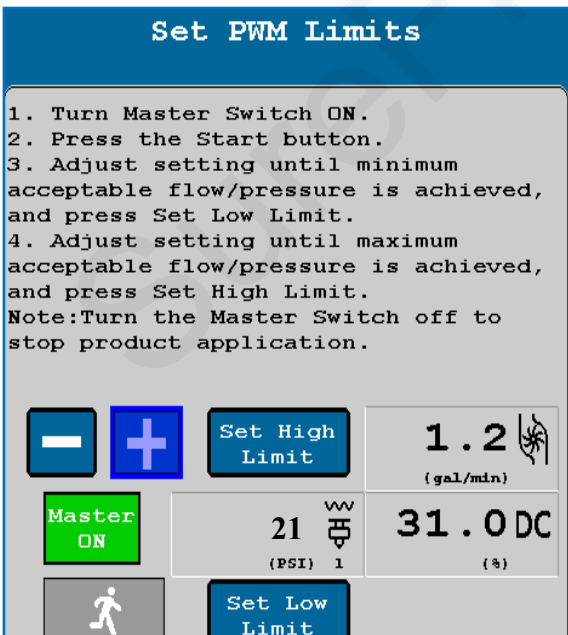
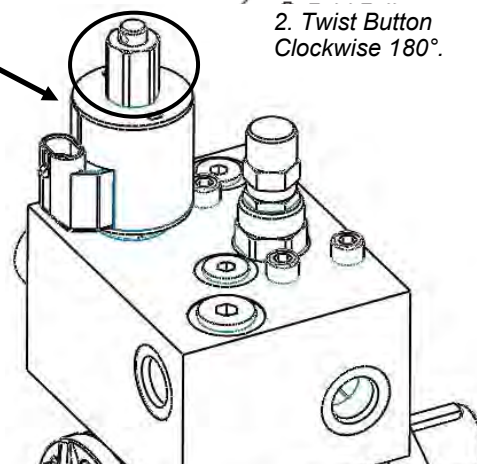
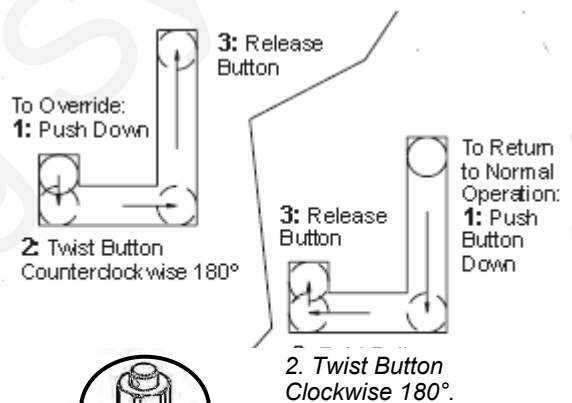
1. Close manual override (lock down)
2. Go to **Diagnostics, Calibrate PWM Limits Test** to investigate this issue (this is a place where you can turn the pump on).
3. Verify hydraulics are on.
4. Start test. Hold down "+" button for a few seconds. A single tap of this button produces a very small change in signal to the valve, so you must hold it.
5. 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.
6. 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.
7. If 6-12 volts is not present, check harnesses and review control valve type setup.
8. Go back to the 12-pin connector that plugs into the Pump harness. Check voltage between pins 5 & 6 (or 2).
9. At 35-pin connector on ECU, PR 1 PWM—pins 23 & 35; PR 2 PWM—pins 13 & 24). Contact SureFire for further assistance.
10. You can remove the electromagnetic solenoid with proportional valve to see if the valve moves when a PWM signal is sent to it.

## 11. Diagnostics > Tests > Calibrate PWM Limits

## 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



The **Section Test** is another place to run the system. Or, enter a Test Speed and run the system in Manual Mode from the Run Screen.

**Tests > Nozzle Flow Check** is a good screen to try a Speed and Target Rate to see if it will lock on to a rate. *When testing with water, the pressure will be a lot less than it will be when using a fertilizer product.*

*You can also enter a Test Speed and run the system in Auto Mode from the Run Screen.*

## Application Rate Fluctuates

First, you need to determine if the fluctuation is caused by the controller sending fluctuating signals to the valve or because of something else.

1. **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.

OR

1. Run the system in Manual Mode with a Test Speed.
2. Turn the system on. Watch the flow in GPM.
3. Is the flow steady within a very small range? For example, a fluctuation from 12.3 to 12.6 GPM would be considered normal. A fluctuation from 10-14 GPM is a problem. If only a small normal fluctuation is seen in section test, skip steps 4-8 and proceed to "Application Rate Fluctuates in Field ..... " below.
4. If there is a large fluctuation, observe the system flow. Is the discharge a steady stream; are the flow indicator balls floating steady?
5. If visually the flow is steady, but the display reports a fluctuation in GPM, inspect the flowmeter. See section B of manual for flowmeter information. Check connections between tank and pump. A loose connection may not show up as a leak, but it can be a place where air can be sucked in. Air in the system will cause erratic flowmeter operation.
6. If visually the flow is unsteady, the flowmeter is working correctly reporting a flow problem. Is the pump turning steady or surging?
7. If the pump is turning steady, the hydraulic circuit is functioning correctly. Look for any type of obstruction in the pump inlet. Clean the strainer. If continually plugging the strainer investigate fertilizer quality and necessary strainer size.
8. If the pump speed is surging, there is a hydraulic problem.

## Application Rate fluctuates in field, but flow in Section Test mode is stable.

This problem indicates the valve calibration needs changed. The system is surging because the Rate Controller is moving the hydraulic valve too much.

1. Go to **Setup - System Settings - Control Valve Setup**.
2. Lower the Valve Response Rate. You can do this on the go and see how the change affects the rate.
3. In extreme cases, it may be necessary to go to Advanced Tuning and adjust some other parameters.

## Application Rate is slow to get to the Target Rate

1. To get system to Target Rate faster on startup, go to **Setup - System Settings - Control Valve Setup > PWM Setup > PWM Startup**. Set PWM Startup (%) so that pump starts up at or slightly above the normal PWM Duty Cycle.
2. If system is slow responding to rate or speed changes, you may need to increase the Valve Response Rate. Go to **Setup - System Settings - Control Valve Setup**. Increase Valve Response Rate. You can do this while going across the field and observe the effects of each change. If Valve Response Rate is at 100 and system is still slow getting to Target, go to Advanced Tuning and increase P and S.

## Helpful Operating and Troubleshooting Information on the Raven RCM

1. **Flow (gal/min), Pressure (PSI), PWM Duty Cycle (DC%), and Pump RPM** (if equipped on your hydraulic pump) are important indicators of system performance. It is good to know what these values are in normal field operation. They provide good troubleshooting information if there is a problem.
2. These items can be placed on the Run Screen with Display Settings.

1.4 (gal/min)	5.1 (mph)
73 (RPM) 1	11.8 (gal)
40.0 DC (%)	26 (PSI) 1

# 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 > Settings > Flow/Rate Sensor Setup** and change the flow cal to 1. Have a second person watch GPM on the 1,2,3 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 indicating the wiring is not damaged. (If alone, note or reset a volume counter to 0, and start Calibrate PWM Limits Test. 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**

**$(\text{Volume shown on display}) / (\text{Volume actually applied}) \times \text{flow cal number in display} = \text{new flow cal}$**

Example: Display shows 727 gallons was applied. Weigh ticket shows 750 gallons was actually applied. Flow cal number in display was 3000. (*We applied too much, so we will decrease the flow cal.*)

$$727 / 750 \times 3000 = 2908 \text{ (new flow cal number to set in display)}$$

*(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.

# Section Valve(s) will not move

1. Go to **Diagnostics > Tests > Control/Section Test** to investigate this issue. If system shuts off with Solution Pump Dry warning, use the Calibrate PWM Limits Test.
2. Start Section Test. Check and uncheck the boxes. With the box checked the valve should turn on. The valve should be off with the box not checked.
3. If none of the valves are working, or if half of the valves are working, it may be a Power (or Ground) issue. The odd-numbered sections have one power source, the even-numbered sections have another power source. (See harness diagrams)

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

4. If a valve does not open, switch the connector that is plugged into that valve with a connector that is plugged into a working valve. Also, plug in the connector to the non-working valve to a valve that is working.
5. Check the harness connection to the non-working valve. It is a 3-Pin Weather Pack connector. Check voltage pin A to Pin B. Must be 12 volts, if not, go back to the next harness connection and check the voltage there. (See harness diagrams for pins)
6. 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 when valve is off or closed.
7. If signal voltage is not present to open valve, use diagrams to check at the 14-pin connector, then the 47-pin for voltage on the proper pin for that section.
8. If harnesses and voltages are good, but valve still will not open, remove the actuator from the valve and see if the actuator will work when it is not connected to the valve. Use a wrench to turn the valve to be sure it is moving freely. Be sure actuator and valve are oriented correctly when you put them back together.
9. If constant voltage (Pins A&B) and switched voltage (Pins C&B) are present, inspect, repair or replace the valve.



**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 180°, and replace actuator. Product should flow through the port closest to the Indicator light when the valve is open (green).

# Pressure Sensor is not reading

1. Be sure the Pressure Sensor that is displayed on your screen is the same sensor that is plugged into your harness for that product (Sensor 1 or Sensor 2).
2. Make sure the pins where the harness screws on to the end of the sensor have not been bent.
3. Be sure Pressure Sensor is set up and calibrated in the display. Unplug the pressure harness before doing this.  
**Setup > Settings > Pressure Sensor Setup. Select the sensor you want. > Calibrate Pressure Sensor > Voltage-based Calibration > 50 mv/PSI.**
4. There should be a green LED light on the end of the pressure sensor. This may be difficult to see in daylight. The sensor needs 12 v. Check between pins B&C on the Pressure connector on the harness that connects to the pressure sensor. If there is no voltage here, check the voltage between pins 1 & 2 on the 12-pin connector labeled PUMP.
5. **Testing Pressure Sensor Harnessing:** If the pressure sensor is not reading, you can use a AA or AAA battery to test the harnessing. Connect the (-) end of the battery to pin C and the (+) end to pin A of the pressure connector. The 1.5 v should show up as 30 psi on the screen. You can check this at *Diagnostics > System Information > Pressure Sensors*. (0 PSI should be 0.0v)

## Other issues

# G

Trouble-  
shooting

### 1. “My rate won’t go low enough. I want 8 gpa, but it won’t put down less than 11 gpa.”

- A. Check **Setup > System Settings > Rates > Minimum Flow Rate**. This can be set at 0.0 or at the low range of your flowmeter. This is **gal / min** not **gal / acre**.
- B. Check **Setup > System Settings > Control Valve Setup > PWM Settings > Low Limit**. Default setting is 10 for electric pumps and 25-30 for hydraulic pumps. If set too high, the pump cannot slow down enough when your speed drops or when sections close.
- C. On a hydraulic pump, be sure the red manual override knob is down and locked on the hydraulic valve.

### 2. “I can’t get up to my rate. I want 12 gpa, and I can’t get more than 10 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 (or lower) on an electric system. Is a recirculation valve open, allowing too much liquid to recirculate?
- B. On a dual electric pump system, check each pump individually to see that each one is working at capacity.
- 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.
- 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.
- E. Check **Setup > System Settings > Control Valve Setup > PWM Setup > PWM Settings > High Limit**. This should be 100.
- F. Check the PWM DC % (Duty Cycle). This can be placed on the Run Screen.
- G. Check the Pump RPM. Maximum RPM should be 500-550 RPM.
- H. Run the pump with a Test Speed in Manual Mode. Press the + button to increase flow. Observe flow (GPM), PWM DC%, PSI, and Pump RPM (if equipped).
- I. Run a Nozzle Flow Check. See gal/ac, PSI, gal/min, and PWM Duty Cycle.
- J. Is the flow cal correct? Is the width of the implement set correctly?

### 3. “It’s pretty close to the rate, but it won’t ever lock in to the rate.”

- Go to **Setup > System Settings > Rates > Display Smoothing**. Check the box for Display Smoothing.
- Without Display Smoothing it is normal for the system to show the rate constantly changing small amounts as you go across the field. With Display Smoothing, if the Applied Rate is close to the Target Rate, the display does not show all the small changes.

### 4. “When I start up, I get a screen that says “Solution Pump Dry”.

This is not unusual on the RCM. If the flowmeter does not show flow immediately when you start, this screen pops up. It is made to protect centrifugal pumps that can be harmed quickly if they are dry. This is not a problem for SureFire diaphragm pumps. To get to Target Rate quicker on startup, set the PWM Startup % so the pump starts at or near where it will be running.

## 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. 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”?**

There are a few products that may have flow characteristics that are better at lower rather than higher pressures. With most products that is not a concern.

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 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.

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.

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 that 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” for more information on how metering tube works.**

**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](http://www.surefireag.com).**

**Read the [Raven RCM Operator’s Manual](#) for safety information and additional setup/operating information.**

# Recommended Care and Maintenance

# H

Maintenance  
& Parts

## 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 Manual mode (Section Test or Calibrate PWM Limits Test) 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 37).
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 Nozzle Flow Check to verify that system will lock on to a Target Rate.

# H

Maintenance  
& Parts



**⚠ 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.***



**⚠ 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.***



# 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

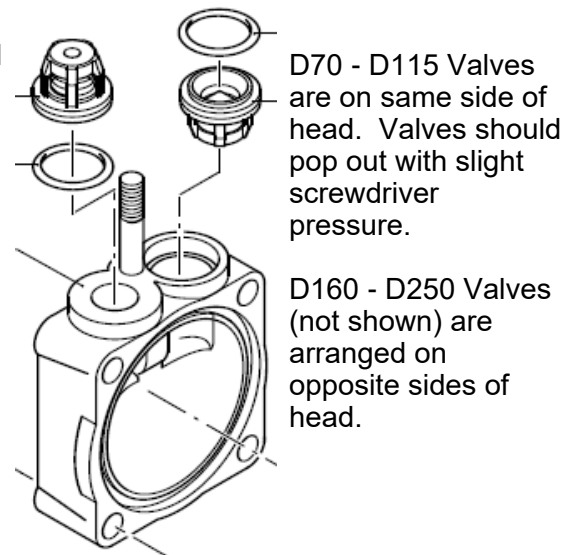
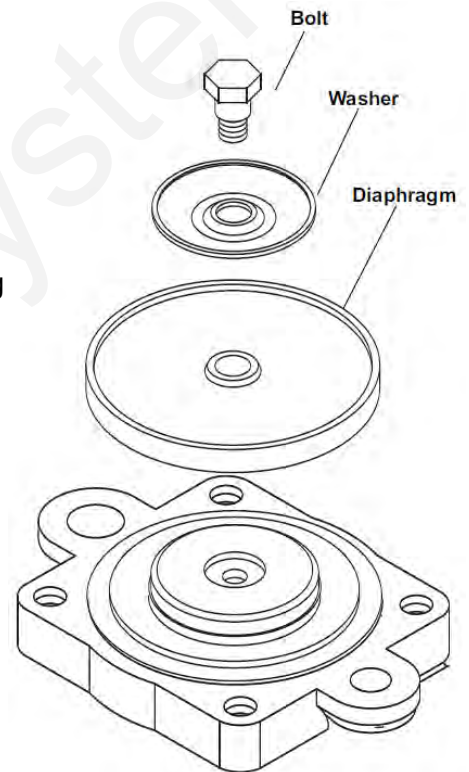
1 Kit contains 1 diaphragm and 2 valves to service a single pumping diaphragm. Order multiple kits to service all the diaphragms in your pump per chart at right.

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.



## 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
<b>PR17 Pump Service Kit - 3 Diaphragm</b>		
<b>KIT #: 291-13-100100</b>		
1	1040083	BlueFlex Diaphragm
2	2429051	Valve
2	3460380	Gasket/O-ring

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

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

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

# PumpRight Valves & Diaphragms

## Diaphragm Pump Service Kit Replacement Instructions for PR Pumps



Visit [www.surefireag.com](http://www.surefireag.com) for PumpRight Diaphragm Pump Repair and Maintenance Video or [support.surefireag.com](mailto:support.surefireag.com)

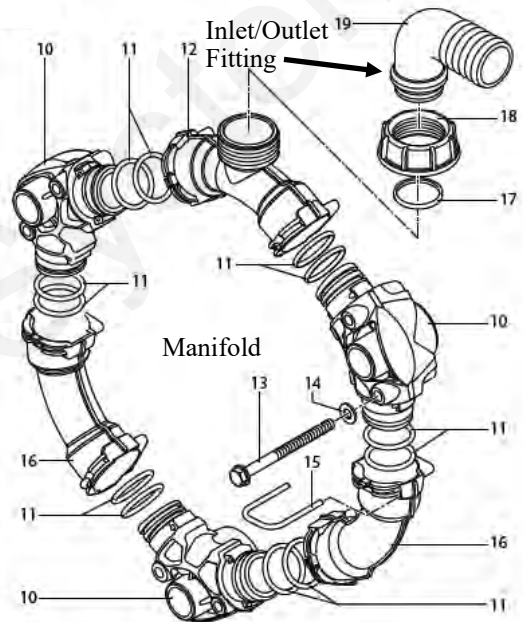
### Diaphragm & Valve Service Steps:

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.

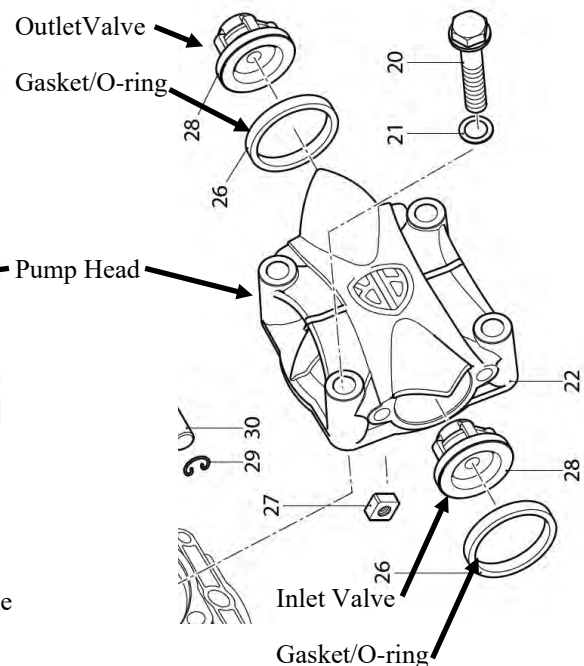
**NOTE: See individual Part Breakout Charts for Bolt/Nut Torque Specs.**

	Number of Diaphragms
PR17	3
PR30	3
PR40	4
D250	6

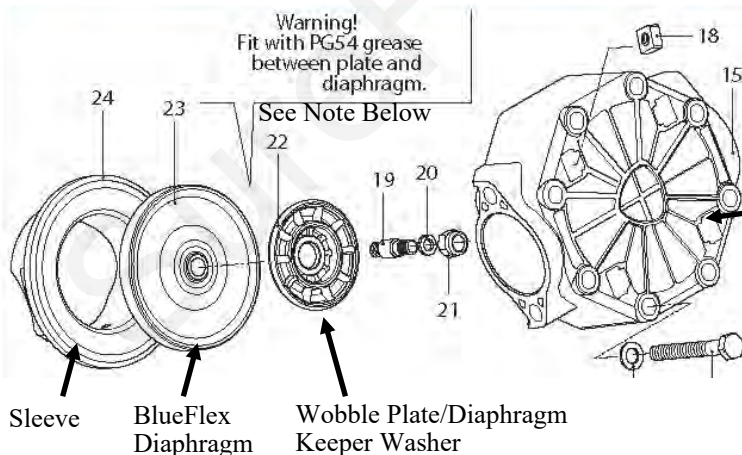
**Typical Manifold—2 per pump—  
inlet and outlet**



**Typical Valve Assembly**



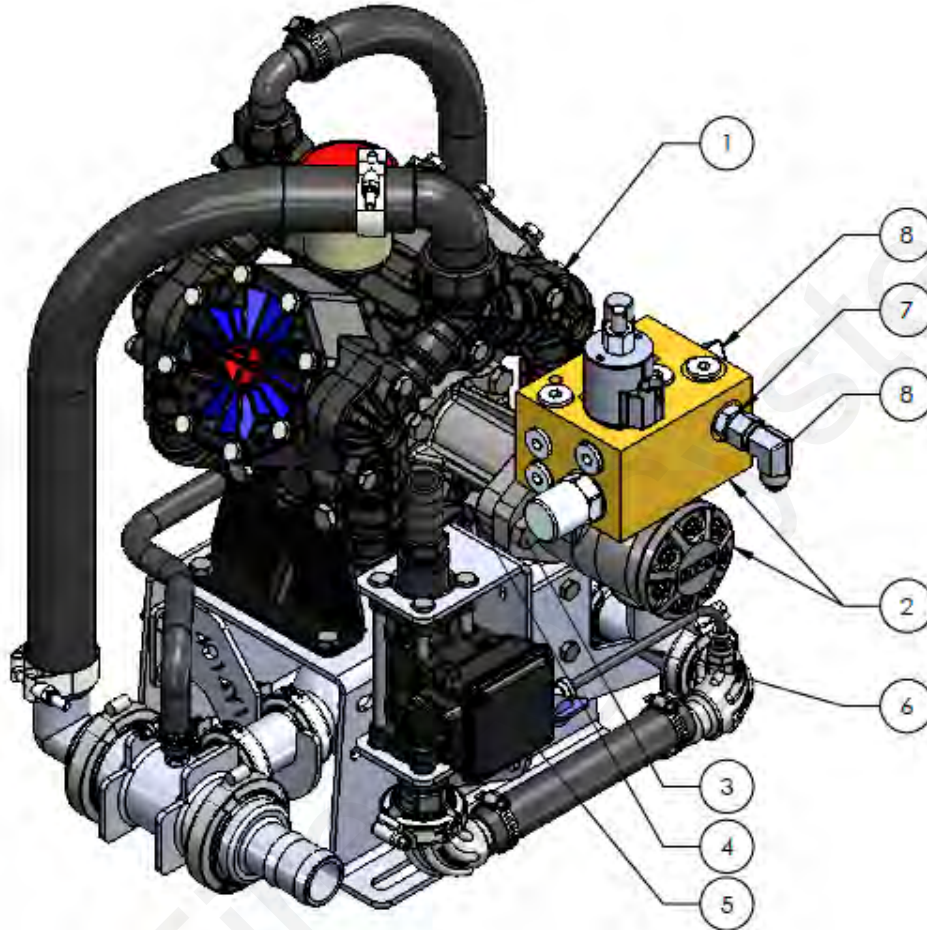
**Typical Diaphragm Assembly**



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

# PR17 Assembly and Part Breakdowns

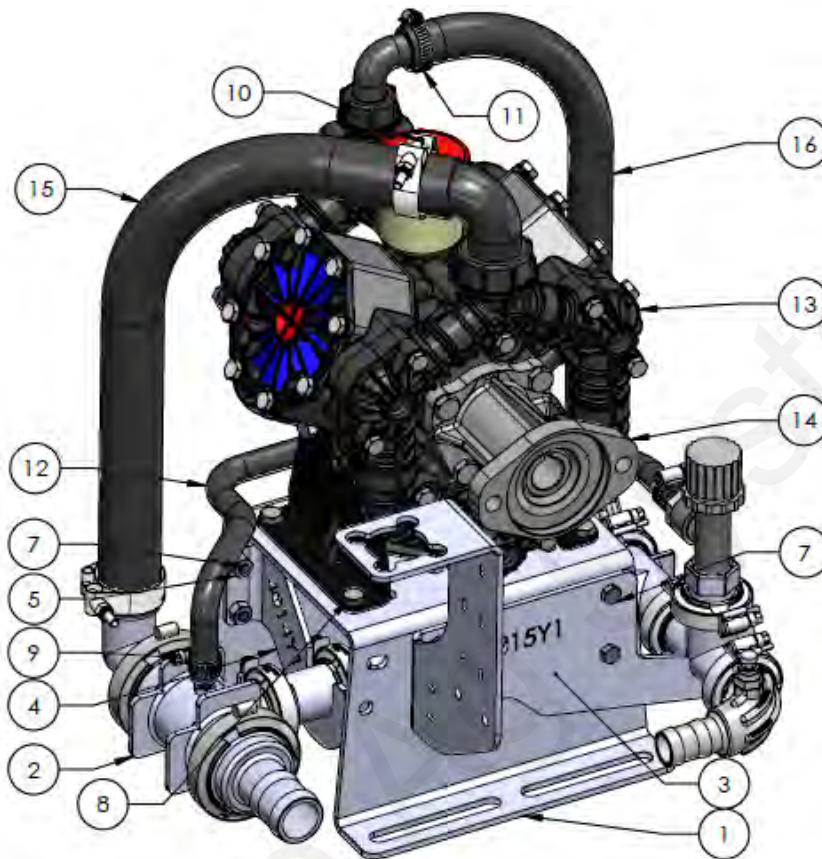
Complete PR17 Pump Assembly w/ Hydraulic Motor and PWM Valve  
Kit: 500-01-4700



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	
1	500-40-200017	PR17 Pre-Build Assembly (Minus Flowmeter and Hydraulics)	1	See Page 63
2	164-FTA1609	4.0 CID Hydraulic Motor with PWM Valve, Speed Sensor, and Bypass Valve, CW Rotation	1	See Page 92
	164-FTA0994	4.0 CID Hydraulic Motor with PWM Valve and Bypass Valve, CW Rotation		
3	300-080200-5	1/2" x 2" G5 Bolt	2	
4	321-08	1/2" Nylock Nut	2	
5	500-02-2082	EMag PR17 Flowmeter Kit (.13 - 2.6 GPM) - 1" HB	1	See Page 65
	500-02-2085	EMag PR17 Flowmeter Kit (.3 - 5 GPM) - 1" HB		
	500-02-2090	EMag PR17/PR30 Flowmeter Kit (.6 - 13 GPM) - 1" HB		
6	521-00-100250	Pump Priming and Air Bleed Assembly	1	
7	161-01-8MB-8MJ	Adapter - #8 male O-Ring Boss to #8 male JIC	1	
8	161-02-8MJ-8FJX-90	Elbow - #8 female JIC to #8 male JIC - 90	2	

# PR17 Assembly and Part Breakdowns

PR17 Pump Pre-Build Assembly  
(Minus Flowmeter and Hydraulics)  
Kit: 500-40-200017



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	400-1117A4	Diaphragm Pump Bracket	1
2	520-00-3013	Plumbing Assembly - PR17/30 Hydraulic Diaphragm Pumps	1
3	410-4015Y1	PR17/30 - Flow Meter Support Bracket	1
4	410-4014Y1	PRV Support Bracket - PR17/30	1
5	323-05-SS	5/16" Flange Nut SS	6
6	323-06-SS	3/8" Flange Nut SS	4
7	300-050012-SS	5/16" x 3/4" HCS SS	6
8	300-060012-SS	3/8" x 3/4" HCS SS	4
9	350-0605	SS Hose Clamp - Size 6 - 7/8" Diameter	2
10	350-TC181	T-Bolt Hose Clamp - 1.81 - 2.06" Diameter (fits 1 1/2" Enforcer or AG200)	2
11	350-1608	1" Hose Clamp	2
12	280-05-AG200-25L	1/2" AG200 - PR17/30 - 25" L	1
13	290-02-PR17	PR17 Poly BlueFlex Diaphragm Pump - 17 GPM - 290 PSI	1
14	291-02-AR55375	Flange Adapter Kit - PR17	1
15	280-150-ENF-25L	1-1/2" Enforcer Hose - PR17	1
16	280-100-AG200-25L	1" AG200 Hose - PR17 - 25 inches	1

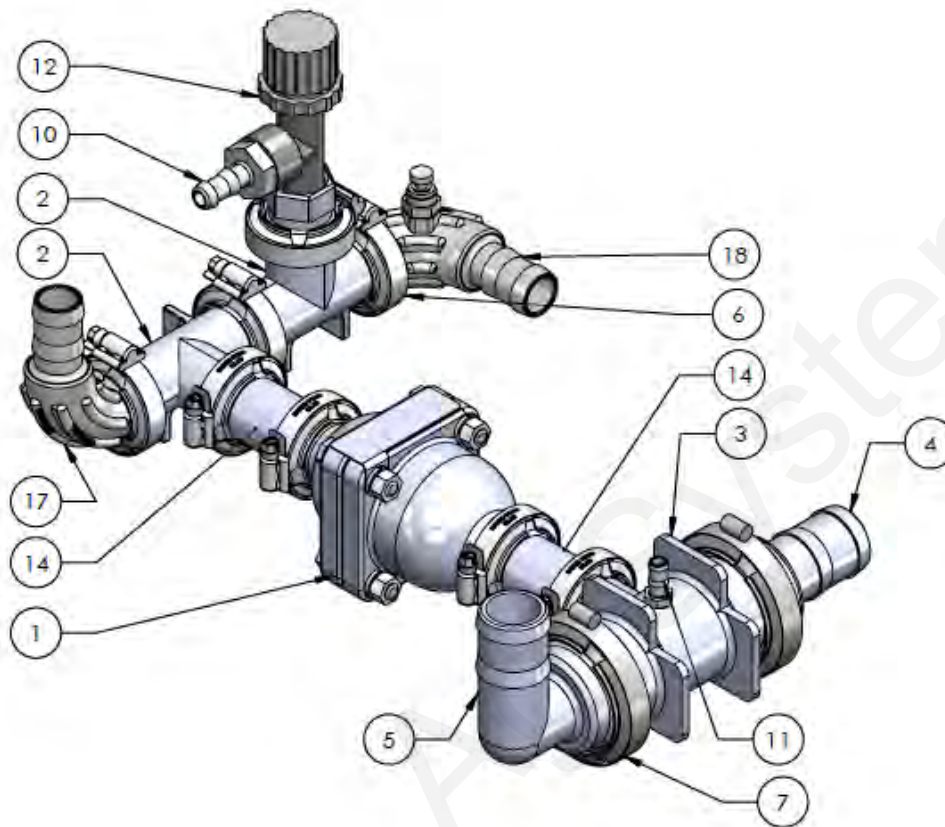
See Page 64

See Page 66



# PR17 Assembly and Part Breakdowns

PR17 & PR30 Pump Plumbing Assembly  
Kit: 520-00-3013



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	102-MPRV100-100	Pressure Relief Valve - 100 PSI	1
2	105-100TEE	1" Manifold Tee	2
3	105-200100TEE038	2"Std Port x 1" Flanged Tee	1
4	105-200150BRB	2" Manifold X 1-1/2" Barb	1
5	105-200150BRB90	2" Manifold Flng 1-1/2 Barb 90	1
6	105-FC100	1" Manifold Clamp	8
7	105-FC200	2" Manifold Clamp	2
8	113-05-025	Plug - 1/4" QC	1
9	113-06-025025	QC to MPT - 1/4" QC x 1/4" MPT	1
10	101-075050	3/4" MPT x 1/2" HB	1
11	101-038050	3/8" MPT x 1/2" HB	1
12	102-23520-3-4	3/4" Throttling Valve with out spring - 150 PSI	1
13	105-100075FPT	1" Manifold x 3/4" FPT	1
14	105-100CPG	1" MANIFOLD COUPLING	2
15	105-100G	1" EPDM Manifold Gasket	8
16	105-150G	1 1/2" EPDM Gasket	2
17	105-100BRBSWP90	1" Flange X 90° Sweep Hose Barb	1
18	105-100BRBSWPG90	1" Manifold x 1" Hose Barb - 1/4" Gauge Port - 90 Degree Sweep	1

# PR17 Assembly and Part Breakdowns

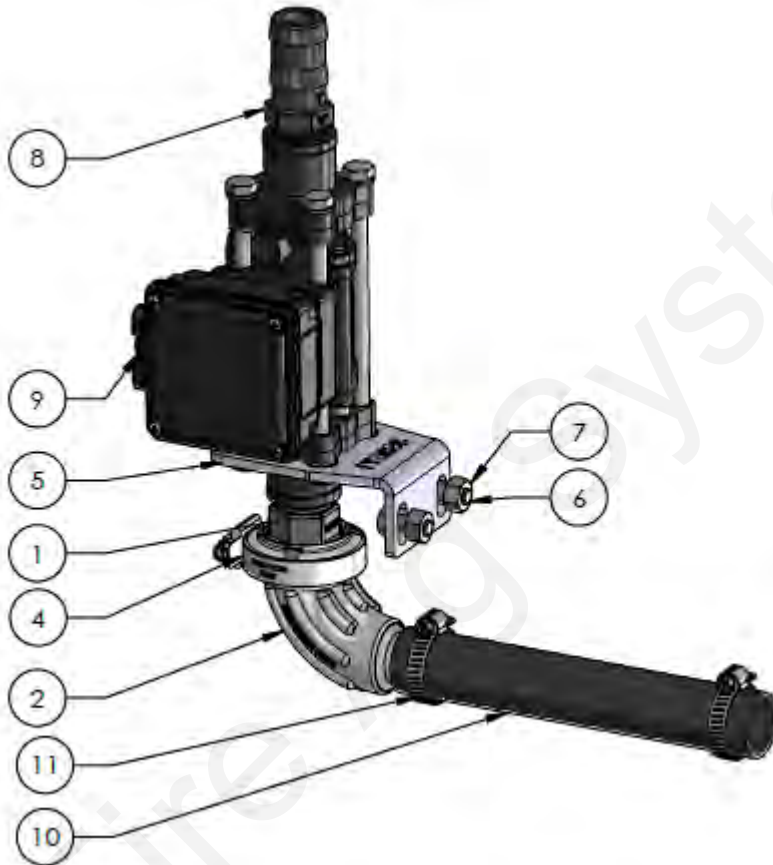


## PR17 Flowmeter Kits

Kit: 500-02-2082 EMag PR17 Flowmeter Kit (.13 - 2.6 GPM)

Kit: 500-02-2085 EMag PR17 Flowmeter Kit (.3 - 5 GPM)

Kit: 500-02-2090 EMag PR17/PR30 Flowmeter Kit (.6 - 13 GPM)

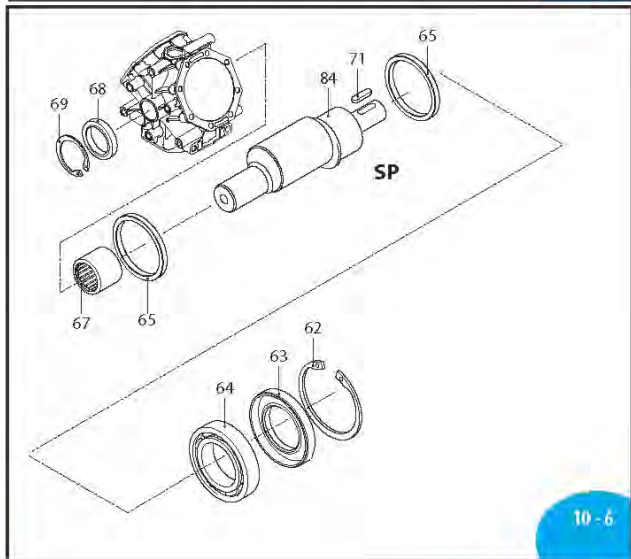
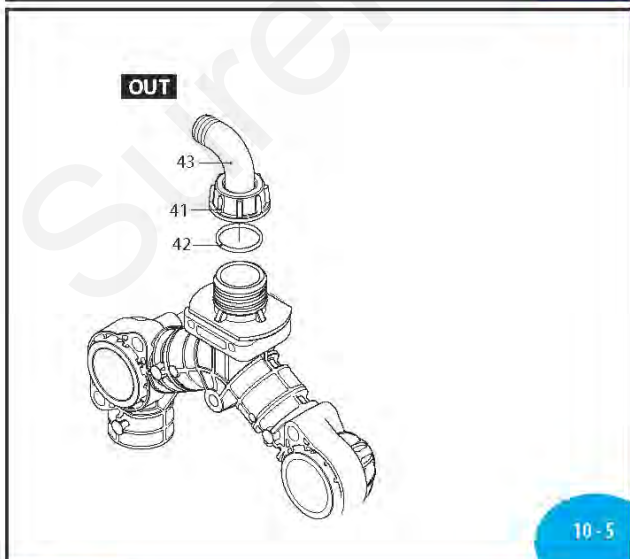
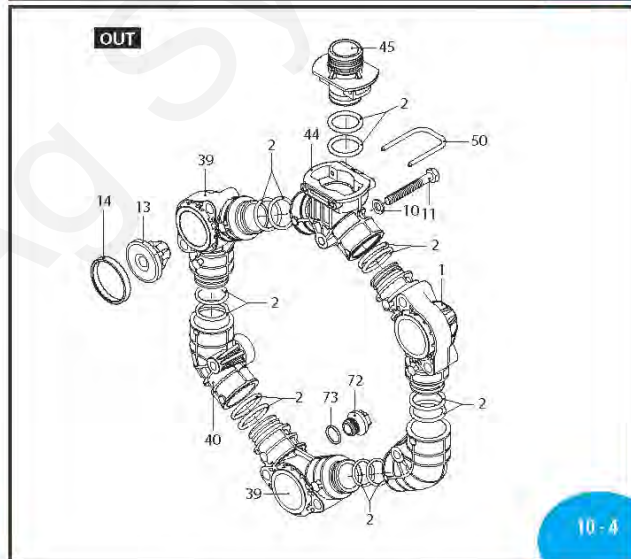
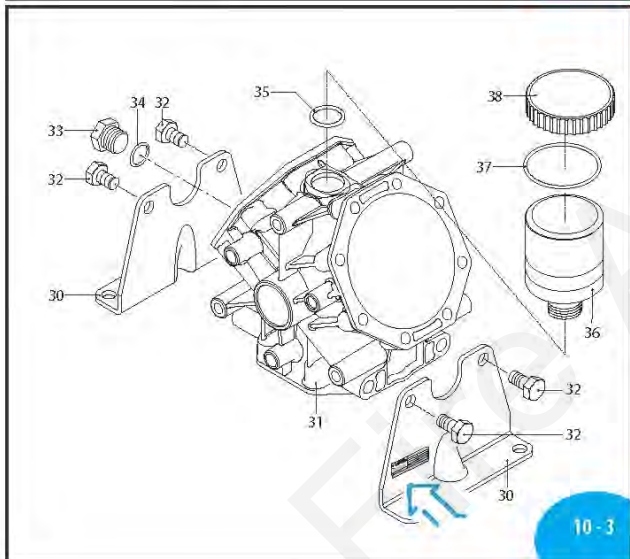
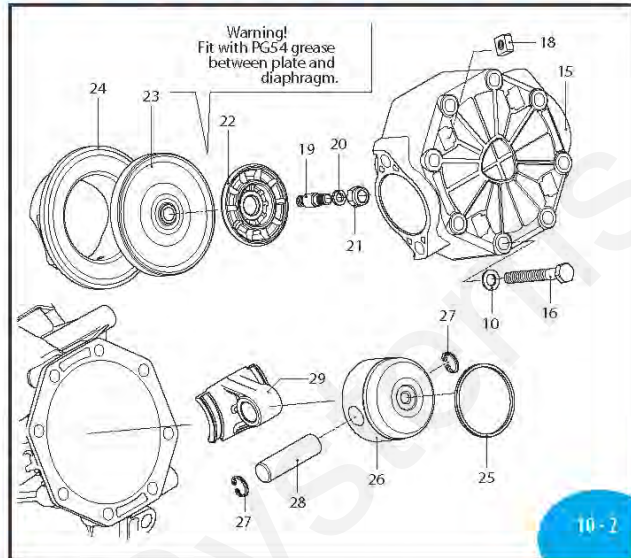
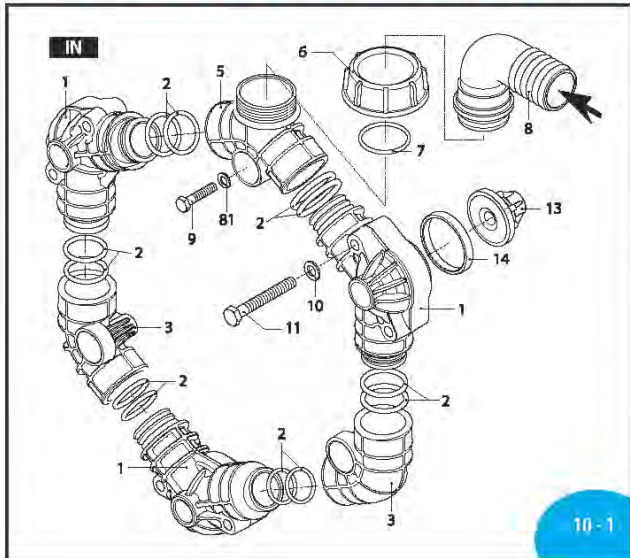


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	105-100075MPT	1" Flange X 3/4" Male Thread	1
2	105-100BRBSWP90	1" Flange X 90° Sweep Hose Barb	1
3	105-100G	1" EPDM Manifold Gasket	1
4	105-FC100	1" Manifold Clamp	1
5	400-3826Y1	SS Flowmeter Mounting Bracket	1
6	300-050012-SS	5/16" x 3/4" HCS SS	2
7	323-05-SS	5/16" Flange Nut SS	2
8	101-075100	3/4" MPT x 1" HB	1
9	204-01-46211CUF00	Electro Magnetic Flow meter 0.13-2.6 GPM	1
	204-01-46211CUF01	Electro Magnetic Flow meter 0.3-5 GPM	
	204-01-46211CUF02	Electro Magnetic Flow meter 0.6-13 GPM	
10	280-100-AG200-8L	1" AG200 Hose	1
11	350-1608	1" Hose Clamp	2

# PR17 Assembly and Part Breakdowns

## PR17 Polypropylene BlueFlex Diaphragm Pump—17 GPM

P/N: 290-02-PR17 (SP)





# PR17 Assembly and Part Breakdowns

## PR17 Polypropylene BlueFlex Diaphragm Pump—17 GPM P/N: 290-02-PR17 (SP)



Pos	Code	Description	Qty	Note
1	3240030	Line valve closed	4	
2	390292	O-ring Ø 28.25x2.62	24	Viton LFP
3	3240040	Manifold	3	
5	3240050	Line asp. threaded	1	
6	750670	Ring nut 1 1/2" G	1	
7	1880460	O-ring Ø 29x3	1	Viton LFP
8	50267	Elbow 1 1/2"	1	
9	3240280	Screw TE M8x55	6	SS T105*
10	3120760	Washer	36	SS
11	380211	Screw TE M8x75	12	SS T90*
13	2429051	Valve AISI 316L	6	LFP
14	3460380	Gasket	6	Viton LFP
15	3240020	Head	3	
16	621771	Screw TE M8x80	24	SS T125*
17	395870	Washer	4	SS
18	3120510	Nut M8	12	SS
19	3240101	Hub pin AISI 316L	3	LFP T265* (a)
20	320622	Washer	3	SS
21	2240670	Nut M10 AISI 316L	3	LFP T220*
22	3240110	Plate	3	
23	1040083	Diaphragm	3	BlueFlex™
24	3240130	Sleeve	3	
25	650190	Piston ring	1	
26	1040120	Piston Ø 63	3	
27	1040270	Ring circlip Ø15	2	
28	1040070	Pin	3	
29	3240120	Connecting-rod	3	
30	3240090	Foot	2	
31	3240010	Pump body	1	
32	620342	Screw TE M10x20	4	SS T265*
33	880530	Plug 3/8" G	1	T180*
34	740290	O-ring Ø 14x1.78	1	
35	720030	O-ring Ø 22.22x2.62	1	
36	3120240	Tank	1	T180*
37	650920	O-ring Ø 53.65x2.62	1	
38	1040324	Plug rosso	1	
39	3240031	Line	2	
40	3240060	Line	1	
41	3120440	Ring nut 1" G	1	
42	1140451	O-ring Ø 20.24x2.62	1	Viton
43	3120460	Elbow 1"	1	
44	3240080	Line	1	For GS35 controler
45	880311	O-ring Ø 26.65x2.62	2	Viton LFP
50	3460210	Fork	1	
62	961790	Ring circlip Ø168	1	
63	3120160	Ring seal	1	
64	961780	Bearing	1	
65	3240320	Ring connecting rod	2	
67	3460110	Bearing	1	
68	1300230	Ring seal	1	
69	480900	Ring circlip Ø135	1	
71	2280950	Key	1	(d)
72	3120690	Plug 3/8" G	1	
73	2840891	O-ring Ø 14x2	1	Viton LFP

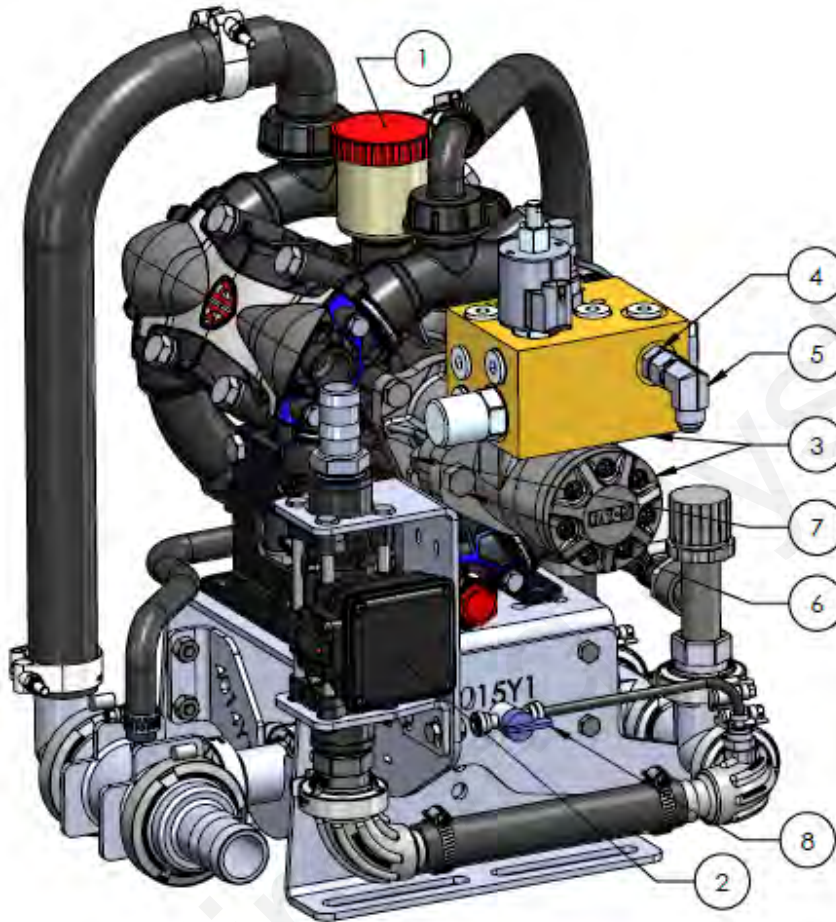
Pos	Code	Description	Qty	Note
74	621782	Screw TE M8x40	6	SS T180*
81	390315	Washer	6	SS
84	3240190	Shaft SP marked EB	1	AR80
85	3240460	Complete Discharge assembly	1	AR80bp
86	550351	Shaft SP	1	AR60

\* Torque: in-lbs +/- 10%



# PR30 Assembly and Part Breakdowns

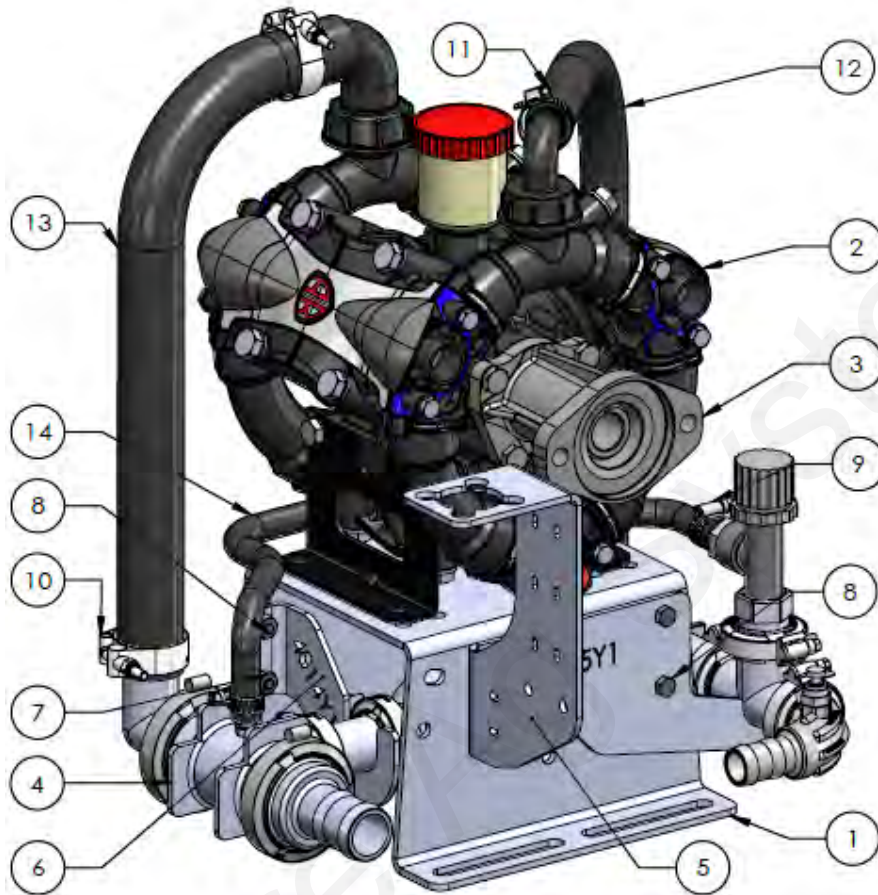
Complete PR30 Pump Assembly w/ Hydraulic Motor and PWM Valve  
Kit: 500-01-5700



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	
1	500-40-200030	PR30 Poly Pre-Build Assembly (Minus Flowmeter and Hydraulics)	1	See Page 69
2	500-02-2090	EMag PR30 Flowmeter Kit (.6 - 13 GPM) - 1" HB	1	See Page 71
	500-02-2095	EMag PR30 Flowmeter Kit (1.3 - 26 GPM) - 1" HB		
3	164-FTA1609	4.0 CID Hydraulic Motor with PWM Valve, Speed	1	See Page 92
	164-FTA0994	4.0 CID Hydraulic Motor with PWM Valve and Bypass Valve, CW Rotation		
4	161-01-8MB-8MJ	Adapter - #8 male O-Ring Boss to #8 male JIC	1	
5	161-02-8MJ-8FJX-90	Elbow - #8 female JIC to #8 male JIC - 90	2	
6	300-080200-5	1/2" x 2" G5	2	
7	321-08	1/2" Nylock Nut	2	
8	521-00-100250	Pump Priming and Air Bleed Assembly	1	

# PR30 Assembly and Part Breakdowns

**PR30 Pump Pre-Build Assembly  
(Minus Flowmeter and Hydraulics)  
Kit: 500-40-200030**



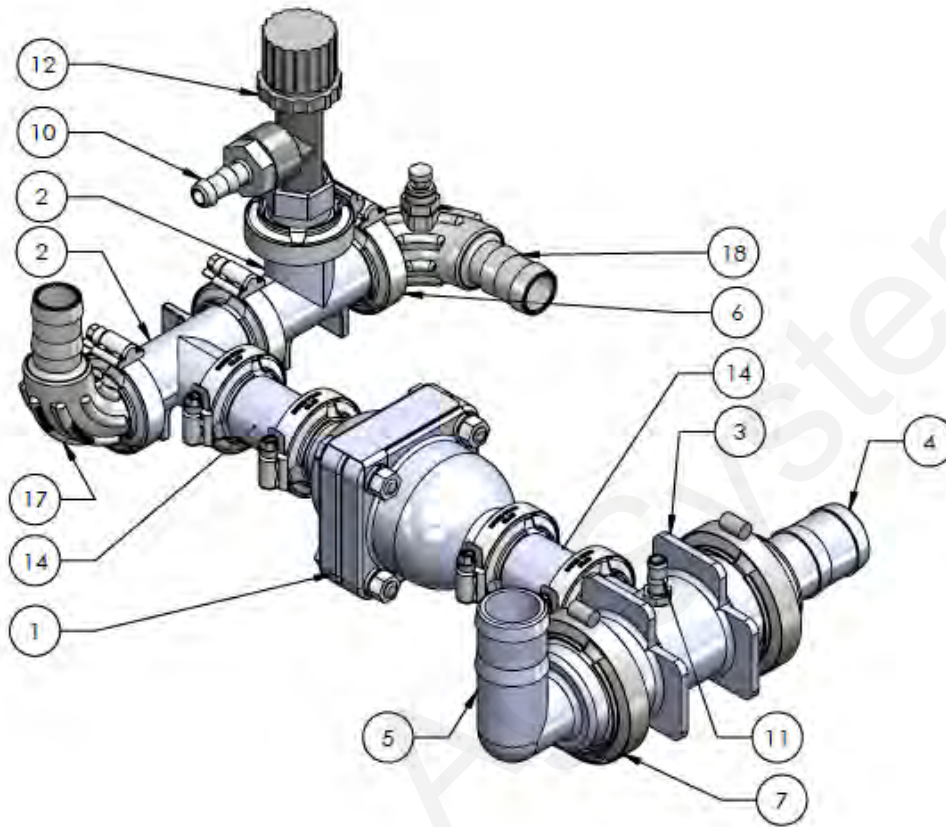
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	400-1117A4	Diaphragm Pump Bracket	1
2	290-02-PR30	PR30 Poly BlueFlex Diaphragm Pump - 30GPM	1
3	291-02-AR55376	Flange Adapter Kit - PR30	1
4	520-00-3013	Plumbing Assembly - PR17/30 Hydraulic Diaphragm Pumps	1
5	410-4015Y1	PR17/30 - Flow Meter Support Bracket	1
6	410-4014Y1	PRV Support Bracket - PR17/30	1
7	323-05-SS	5/16" Flange Nut SS	6
8	300-050012-SS	5/16" x 3/4" HCS SS	6
9	350-0605	SS Hose Clamp - Size 6 - 7/8" Diameter	2
10	350-TC181	T-Bolt Hose Clamp - 1.81 - 2.06" Diameter (fits 1 1/2" Enforcer or AG200)	2
11	350-1608	1" Hose Clamp	2
12	280-100-AG200-25L-PR30	1" AG200 Hose - 25 inches	1
13	280-150-ENF-25L-PR30	1-1/2" Enforcer Hose - AR 140	1
14	280-05-AG200-25L	1/2" AG200 - PR17/30 - 25" L	1

See Page 72

See Page 70

# PR30 Assembly and Part Breakdowns

PR17 & PR30 Pump Plumbing Assembly  
Kit: 520-00-3013



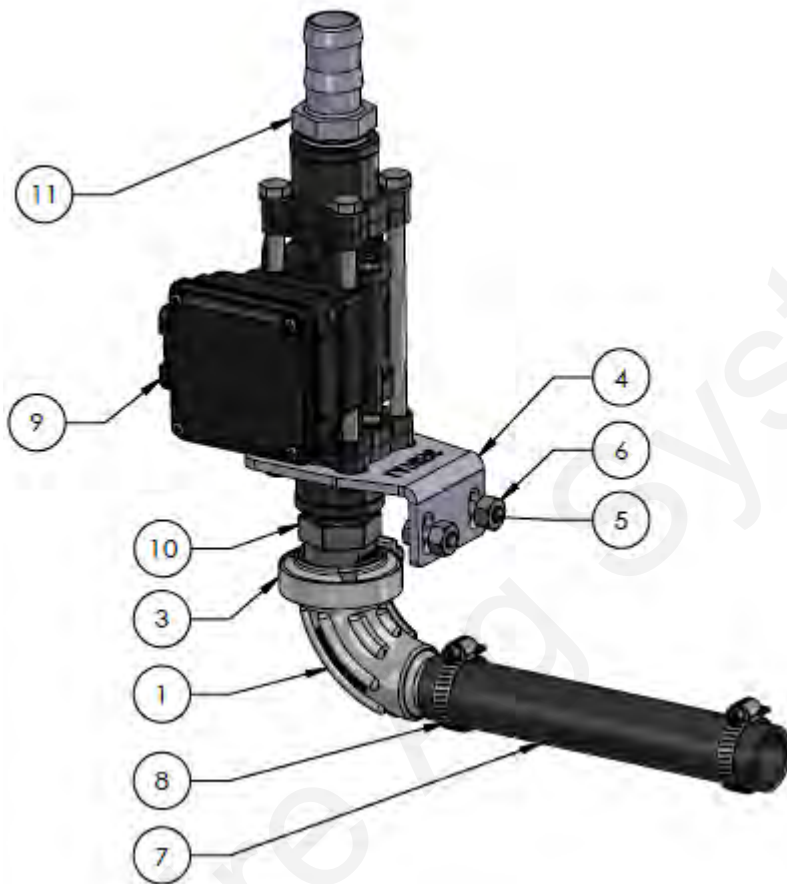
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	102-MPRV100-100	Pressure Relief Valve - 100 PSI	1
2	105-100TEE	1" Manifold Tee	2
3	105-200100TEE038	2"Std Port x 1" Flanged Tee	1
4	105-200150BRB	2" Manifold X 1-1/2" Barb	1
5	105-200150BRB90	2" Manifold Flng 1-1/2 Barb 90	1
6	105-FC100	1" Manifold Clamp	8
7	105-FC200	2" Manifold Clamp	2
8	113-05-025	Plug - 1/4" QC	1
9	113-06-025025	QC to MPT - 1/4" QC x 1/4" MPT	1
10	101-075050	3/4" MPT x 1/2" HB	1
11	101-038050	3/8" MPT x 1/2" HB	1
12	102-23520-3-4	3/4" Throttling Valve with out spring - 150 PSI	1
13	105-100075FPT	1" Manifold x 3/4" FPT	1
14	105-100CPG	1" MANIFOLD COUPLING	2
15	105-100G	1" EPDM Manifold Gasket	8
16	105-150G	1 1/2" EPDM Gasket	2
17	105-100BRBSWP90	1" Flange X 90° Sweep Hose Barb	1
18	105-100BRBSWPG90	1" Manifold x 1" Hose Barb - 1/4" Gauge Port - 90 Degree Sweep	1

# PR30 Assembly and Part Breakdowns

## PR30 Flowmeter Kits

Kit: 500-02-2090 EMag PR17/PR30 Flowmeter Kit (.6 - 13 GPM)

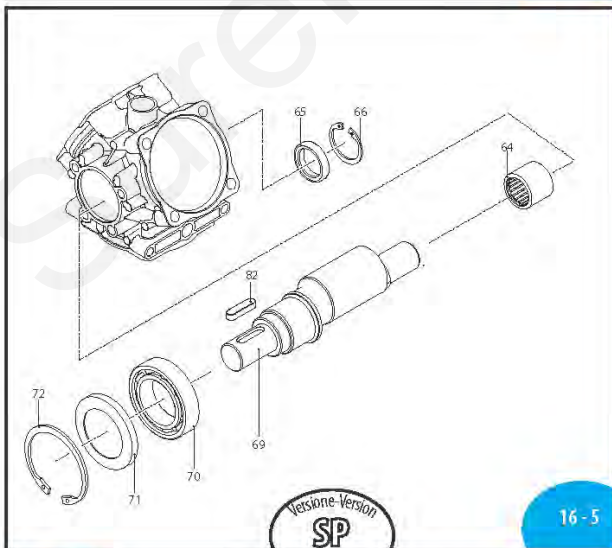
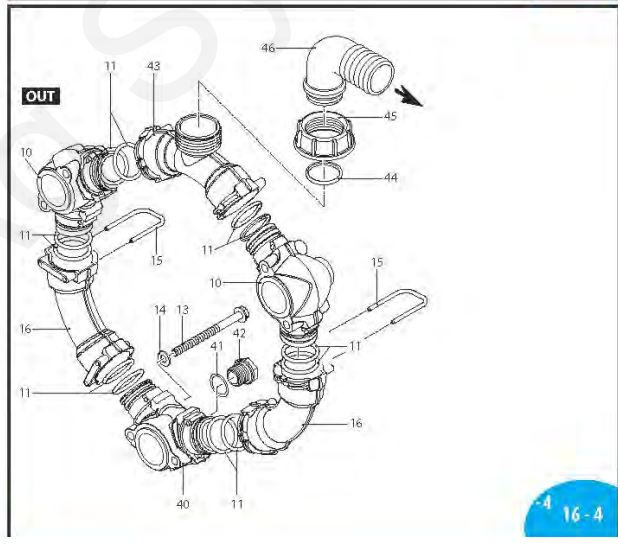
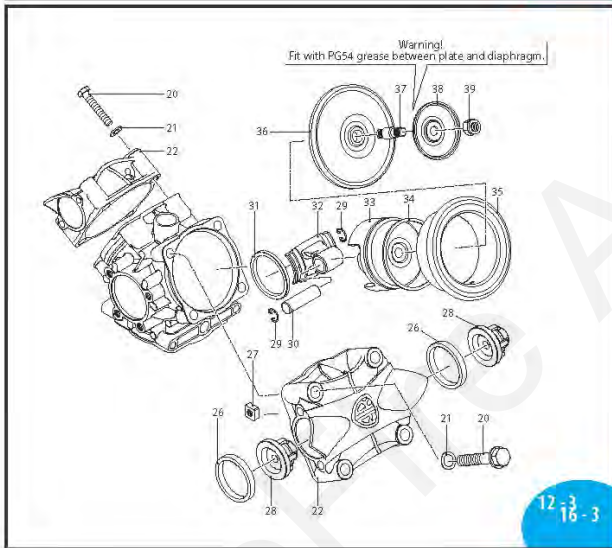
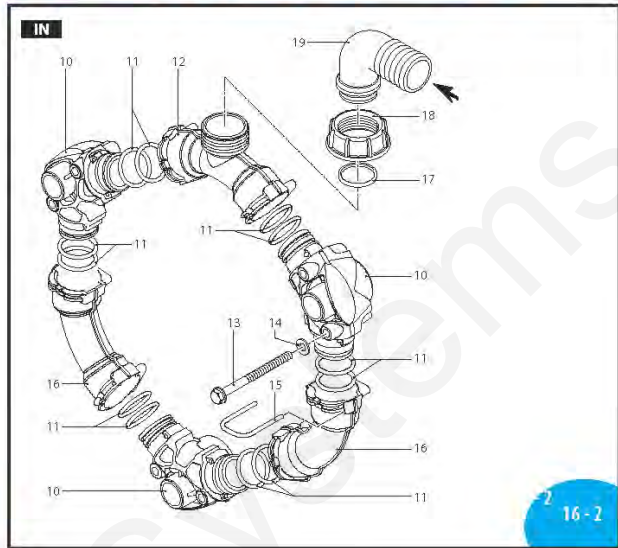
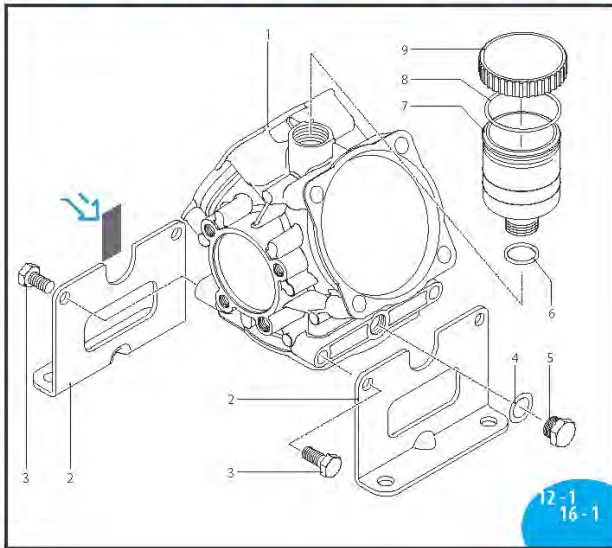
Kit: 500-02-2095 EMag PR30 Flowmeter Kit (1.3 - 26 GPM)



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	105-100BRBSWP90	1" Flange X 90° Sweep Hose Barb	1
2	105-100G	1" EPDM Manifold Gasket	1
3	105-FC100	1" Manifold Clamp	1
4	400-3826Y1	SS Flowmeter Mounting Bracket	1
5	300-050012-SS	5/16" x 3/4" HCS SS	2
6	323-05-SS	5/16" Flange Nut SS	2
7	280-100-AG200-8L	1" AG200 Hose - 8" L	1
8	350-1608	1" Hose Clamp	2
9	204-01-46211CUF02	Electro Magnetic Flow meter .6 - 13 GPM Non-visual	1
	204-01-46211CUF03	Electro Magnetic Flow meter 1.3 - 26 GPM Non-visual	
10	105-100MPT	1" Flange X 1" Male Thread	1
11	101-100100	1" MPT x 1" HB	1

# PR30 Diaphragm Pump Parts

PR30 Polypropylene BlueFlex Diaphragm Pump—30 GPM  
P/N: 290-02-PR30 (SP)



# PR30 Diaphragm Pump Parts

PR30 Polypropylene BlueFlex Diaphragm Pump—30 GPM  
P/N: 290-02-PR30 (SP)



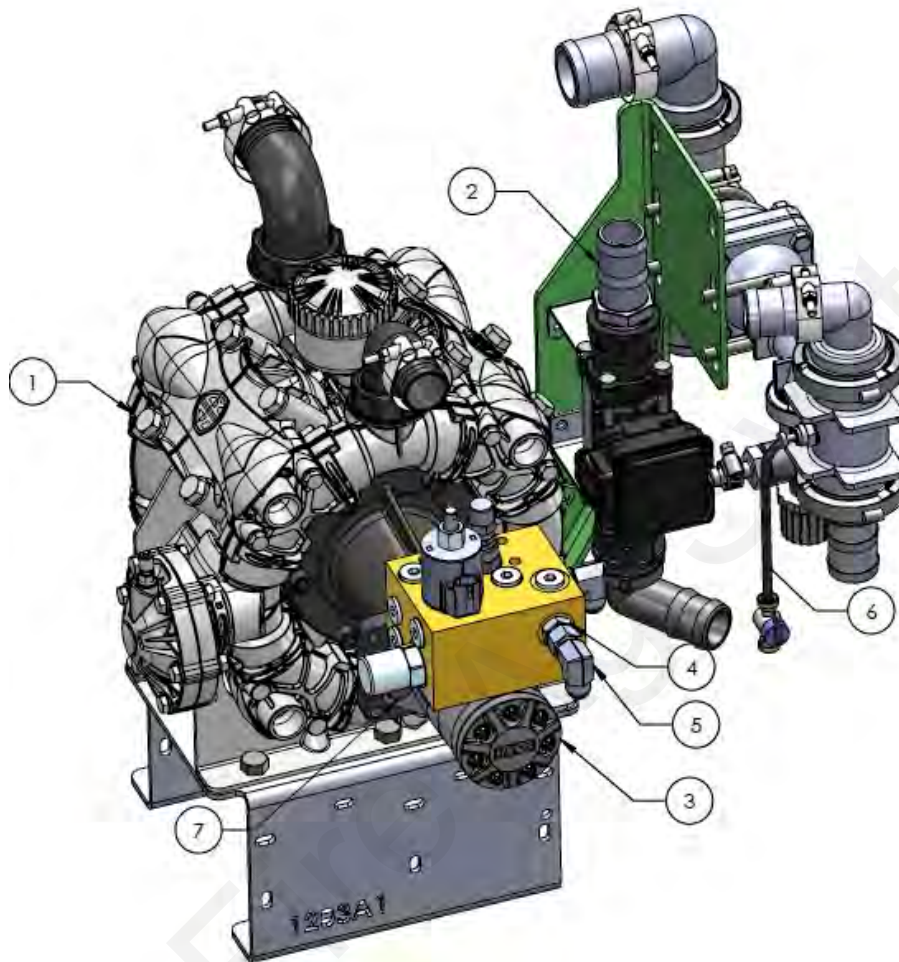
Pos	Code	Description	Qty	Note
1	3460010	Pump body	1	
2	3460100	Foot	2	Cataphoresis
3	160673	Screw TE M10x25	4	SS T265* LFP
4	740290	O-ring Ø 14x1.78	1	
5	880530	Plug 3/8" G	1	T180*
6	720030	O-ring Ø 22.22x2.62	1	
7	3120240	Tank	1	T180*
8	650920	O-ring Ø 53.65x2.62	1	
9	1040324	Plug red	1	
10	3460030	Line	4	
11	2680141	O-ring Ø 32.93x3.53	24	Viton LFP
12	3460050	Line suction	1	
13	3460201	Screw TE M8x100	12	SS T105* LFP
14	390315	Washer	24	SS LFP
15	3460210	Fork	13	
16	3460040	Line	3	
17	1880460	O-ring Ø 29x3	1	Viton LFP
18	750670	Ring nut 1 1/2" G	1	
19	50267	Elbow 1 1/2"	1	
20	750072	Screw TE M12x70	12	SS T310* LFP
21	390092	Washer	12	SS LFP
22	3460020	Head	3	
23	3240290	Shield	2	
26	3460380	Gasket	6	Viton LFP
27	3120510	Nut M8	12	SS LFP
28	2429051	Valve AISI 316L	6	LFP
29	380080	Ring circlip Ø 14	6	
30	380300	Pin	3	
31	3460090	Ring connecting rod	2	
32	3460080	Connecting-rod	3	
33	580120	Piston Ø 80	3	
34	500260	Piston ring	3	
35	750110	Sleeve	3	
36	550081	Diaphragm	3	BlueFlex
37	2240101	Hub pin	3	T265* LFP
38	580090	Wobbleplate	3	
39	2240670	Nut M10 AISI 316L	3	T220* LFP
40	3460031	Line	2	
41	1140451	O-ring Ø 20.24x2.62	1	Viton LFP
42	3460220	Plug 1/2" G	1	T90*
43	3460060	Line manifold	1	
44	880311	O-ring Ø 26.62x2.62	1	Viton LFP
45	651100	Ring nut 1" 1/4 G	1	
46	651460	Elbow 1"	1	
64	3460110	Bearing	1	
65	1300230	Ring seal	1	
66	480900	Ring circlip Ø 35	1	
69	3460260	Shaft marked DV	1	AR 140bp /LFP SP
70	961781	Bearing	1	
71	3120160	Ring seal	1	
72	961790	Ring circlip Ø 68	1	
82	3469002	Complete Inlet assembly	1	AR120bp

\* Torque in-lbs +/- 10%



# PR40 Assembly and Part Breakdowns

Complete PR40 Pump Assembly w/ Hydraulic Motor and PWM Valve  
Kit: 500-01-6700

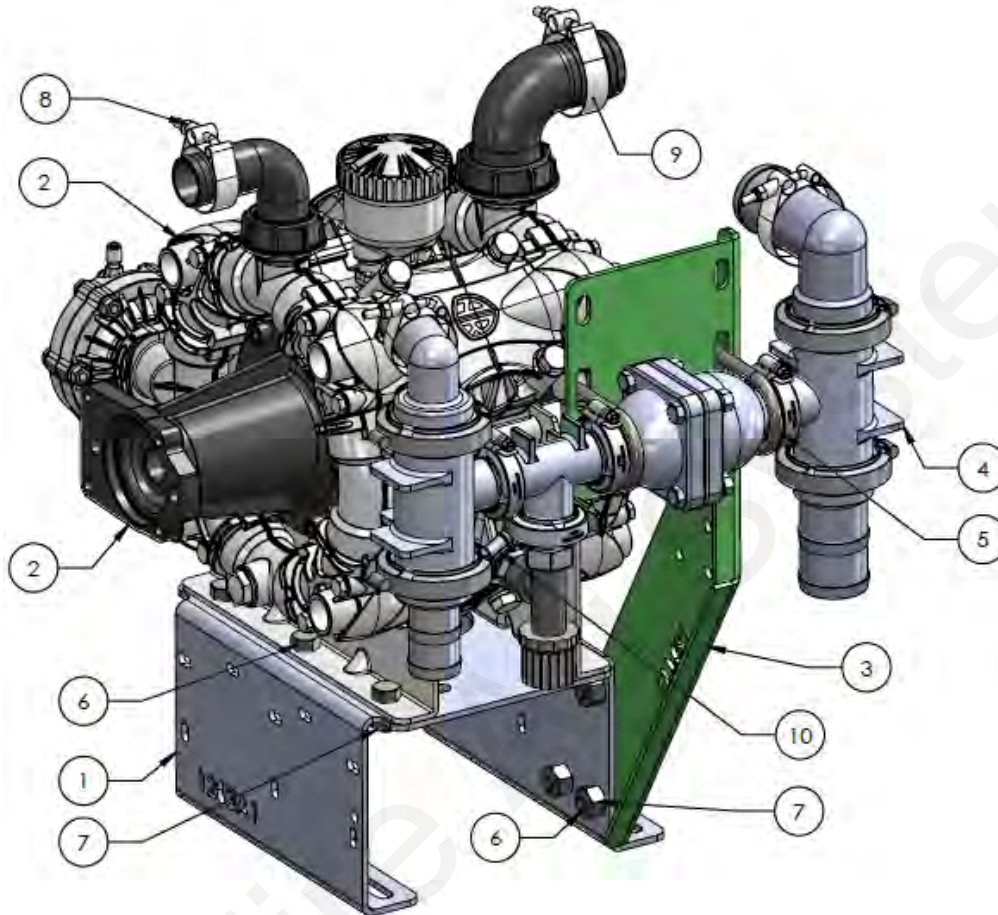


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	
1	500-40-200040	PR40 Pre-Build Assembly (Minus Flowmeter and Hydraulics)	1	See Page 75
2	500-02-2080	Arag Ion Flowmeter Kit (2.6 - 53 GPM) with adapter cable - 1 1/2" HB	1	See Page 77
3	164-FTA1609	4.0 CID Hydraulic Motor with PWM Valve and Bypass Valve, SPEED Sens	1	See Page 92
	164-FTA0994	4.0 CID Hydraulic Motor with PWM Valve and Bypass Valve, CW Rotation		
4	161-01-8MB-8MJ	Adapter - #8 male O-Ring Boss to #8 male JIC	1	
5	161-02-8MJ-8FJX-90	Elbow - #8 female JIC to #8 male JIC - 90	2	
6	521-00-100250	Pump Priming and Air Bleed Assembly	1	
7	300-080200-5	1/2" x 2" G5	2	
8	321-08-SS	1/2" Nylock Nut-SS	2	



# PR40 Assembly and Part Breakdowns

PR40 Pump Pre-Build Assembly  
(Minus Flowmeter and Hydraulics)  
Kit: 500-40-200040



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	400-1203A1	D160 - D250 Diaphragm Pump Bracket	1
2	290-02-PR40	PR40 Poly BlueFlex Diaphragm Pump - 40GPM - 290 PSI	1
3	400-1204A1	D160 - D250 MPRV Support	1
4	520-00-3015	Plumbing Assembly - D160 & D250 Hydraulic Diaphragm Pump	1
5	302-UB101	M100 U-Bolt Assembly - 1 SS Ubolt, 2 SS lock washers, 2 SS nuts	2
6	300-080100-5	1/2" x 1" HCS G5	9
7	323-08	1/2" Flange Nut	9
8	350-TC181	T-Bolt Hose Clamp - 1.81 - 2.06" Diameter (fits 1 1/2" Enforcer or AG200)	2
9	350-TC231	T-Bolt Hose Clamp - 2.31 - 2.62" Diameter (fits 2" Enforcer)	2
10	350-0605	SS Hose Clamp - Size 6 - 7/8" Diameter	2
11	291-02-9910-HYD1570	Hydraulic Flange Kit - D160, D250, PR40 & AR330	1

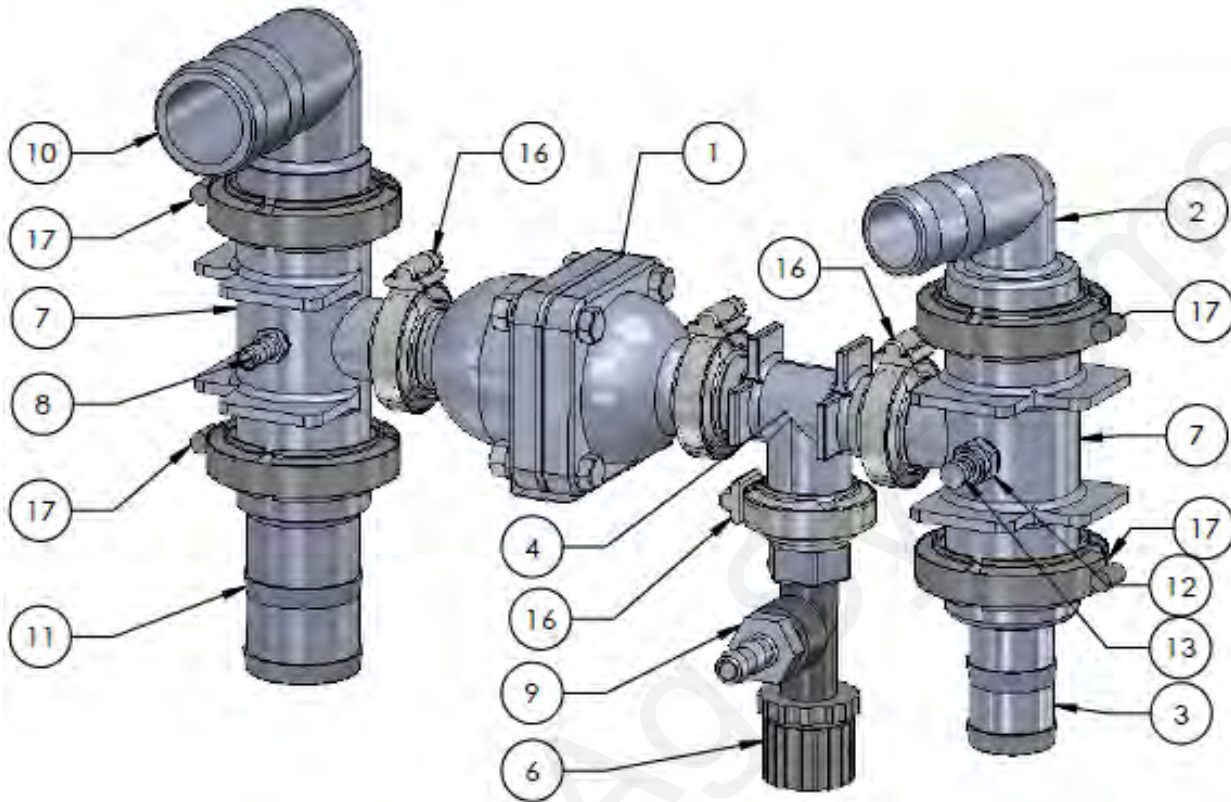
See Page 78

See Page 76

# PR40 Assembly and Part Breakdowns

## PR40 & D250 Pump Plumbing Assembly

Kit: 520-00-3015

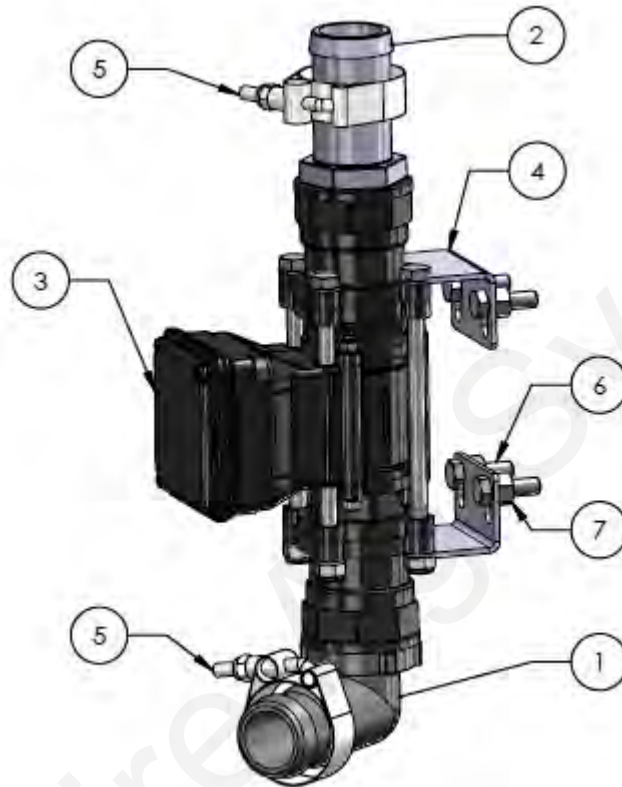


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	102-MPRV100-100	Pressure Relief Valve - 100 PSI	1
2	105-200150BRB90	2" Manifold Flng 1-1/2 Barb 90	1
3	105-200150BRB	2" Manifold X 1-1/2" Barb	1
4	105-100TEE	1" Manifold Tee	1
5	105-100075FPT	1" Manifold x 3/4" FPT	1
6	102-23520-3-4	3/4" Throttling Valve with out spring - 150 PSI	1
7	105-200100TEE038	2"Std Port x 1" Flanged Tee	2
8	101-038050	3/8" MPT x 1/2" HB	1
9	101-075050	3/4" MPT x 1/2" HB	1
10	105-200BRB90	2" Manifold x 2" HB - 90 Degree	1
11	105-200BRB	2" Manifold x 2" HB	1
12	113-06-025038	QC to MPT - 1/4" QC x 3/8" MPT	1
13	113-05-025	Plug - 1/4" QC	1
14	105-100G	1" EPDM Manifold Gasket	4
15	105-150G	1 1/2" EPDM Gasket	4
16	105-FC100	1" Manifold Clamp	4
17	105-FC200	2" Manifold Clamp	4

# PR40 Assembly and Part Breakdowns

PR40/D250 EMag Flowmeter Kit (2.6-53 GPM)

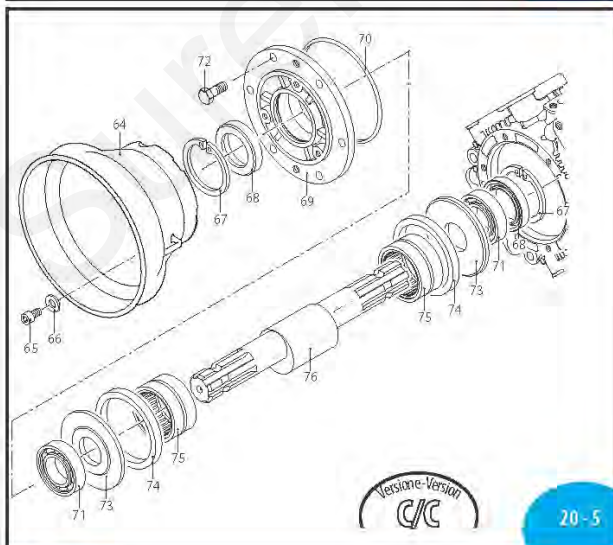
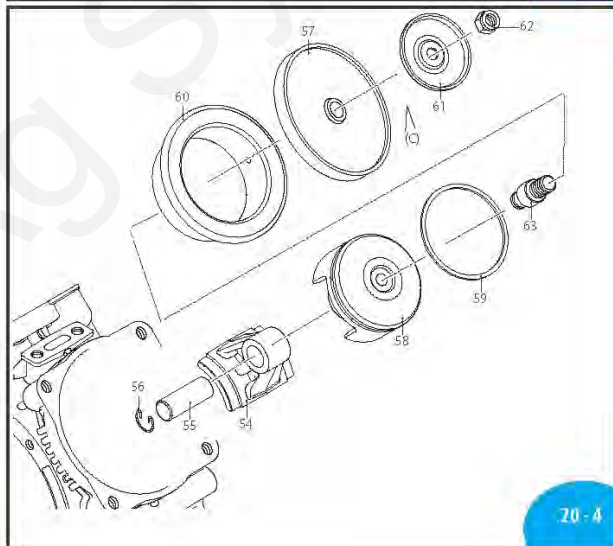
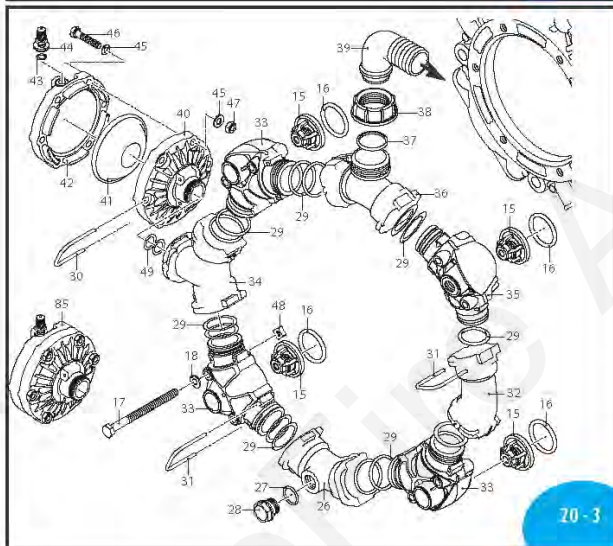
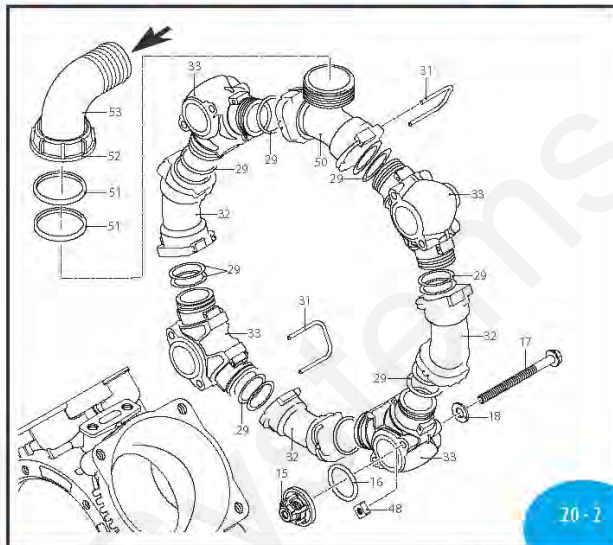
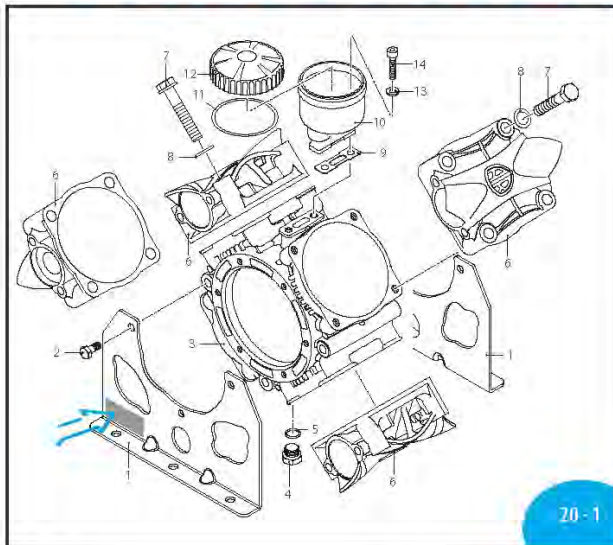
Kit: 500-02-2080



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	101-125150-90	1-1/4"MPT X 1-1/2"Hse Shnk-90D	1
2	101-125150	1-1/4" MPT x 1-1/2" HB	1
3	204-01-46211CUF04	Electro Magnetic Flow meter 2.6 - 53 GPM Non-visual	1
4	400-3335Y1	SS Flowmeter Mounting Bracket	2
5	350-TC181	T-Bolt Hose Clamp - 1.81 - 2.06" Diameter	2
6	300-050100-SS	5/16" x 1" HCS SS	4
7	323-05-SS	5/16" Flange Nut SS	4
-	280-150-AG200	1 1/2" AG200 Hose - 2 feet	
-	201-17842	Adapter Cable - AMP Superseal to MT Controller	

# PR40 Diaphragm Pump Parts

PR40 Polypropylene BlueFlex Diaphragm Pump—40 GPM  
P/N: 290-02-PR40 (C/C)



# PR40 Diaphragm Pump Parts

## PR40 Polypropylene BlueFlex Diaphragm Pump—40 GPM

# H

Maintenance  
& Parts

Pos	Cod.	Description	Q.ty	Note
1	761031	Foot	2	
2	160673	Screw	6	Inox T355*
3	761010	Pump body	1	
4	880530	Plug	1	T180*
5	740290	O-ring	1	
6	3460020	Head	4	
7	750072	Screw	16	Inox T265*
8	390092	Washer	16	Inox
9	750040	Gasket	1	
10	750030	Tank	1	
11	1040060	O-ring	1	
12	751183	Plug	1	AR 185 bp
13	380243	Washer	2	
14	680350	Screw	2	T90*
15	2429051	Valve	8	
16	3460380	Gasket	8	Viton
17	3460201	Screw	16	Inox T90*
18	390315	Washer	16	Inox
26	761240	Line	1	
27	1140451	O-ring	1	Viton
28	3460220	Plug	1	T90*
29	230061	O-ring	32	Viton
30	3460210	Fork	1	
31	761250	Fork	16	
32	761200	Line	4	asp. / mandata
33	761190	Line	7	portavalvola/chiuso
34	761230	Line	1	camera aria
35	761191	Line	1	filettato 1/2" G
36	761220	Line	1	mandata 1" 1/2G.
37	1880460	O-ring	1	Viton
38	750670	Ring nut	1	1" 1/2 G
39	3040160	Elbow	1	AR 185 bp
40	3460180	Semi air chamber	1	Nylon
41	800192	Diaphragm	1	Blueflex
42	3460190	Semi air chamber	1	Nylon
43	650542	Gasket	1	
44	180020	Air valve	1	C <sub>2,5</sub>
45	390315	Washer	12	Inox
46	621782	Screw	6	Inox T180*
47	3120260	Nut	6	Inox T180*
48	3120510	Nut	16	Inox
49	880311	O-ring	2	Viton
50	761210	Line	1	asp. / filettato 2" G
51	3040471	O-ring	2	Viton
52	3040450	Ring nut	1	2" G
53	3040440	Elbow	1	AR 185 bp
54	760140	Connecting-rod	4	
55	160700	Pin	4	
56	160691	Ring	8	seeger Ø18
57	550081	Diaphragm	4	BlueFlex
58	750122	Piston	4	Ø80
59	500260	Piston ring	4	

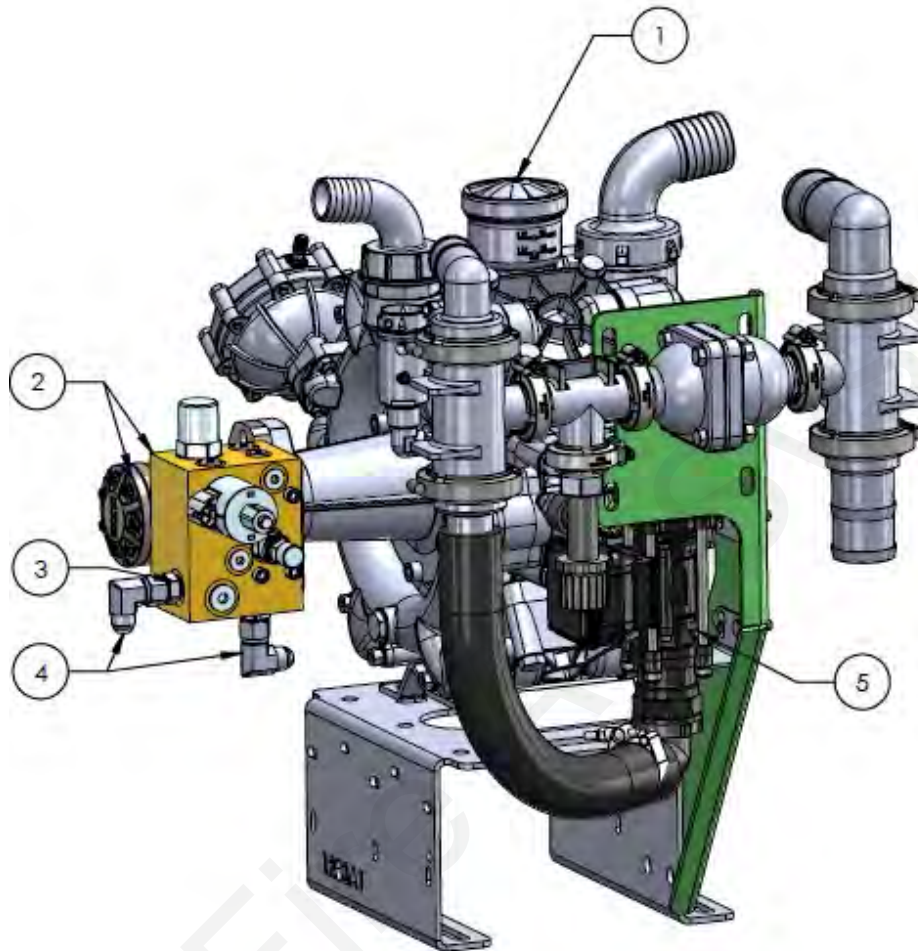
Pos	Cod.	Description	Q.ty	Note
60	750115	Sleeve	4	AR 185 bp
61	751251	Wobble plate	4	
62	2240670	Nut	4	M10 AISI 316L
63	2240101	Hub pin	4	AISI 316L
64	1500470	Cardan protection	1	(a) T265*
65	850252	Screw	3	TCEI M8x12
66	390315	Washer	3	Inox
67	200390	Ring	2	seeger Øi 62
68	160740	Ring	2	tenuta
69	680020	Support	1	
70	851360	O-ring	1	Ø120,32x2,62
71	230350	Bearing	1	
72	160673	Screw	6	TE M10x25
73	540040	Plate	2	
74	750130	Ring	2	biella
75	750090	Bearing	2	
76	750174	Shaft	1	C/C m-AV
85	43067	Air chamber	1	LFP BlueFlex™

\* Torque: in-lbs +/- 10%



# D250 Assembly and Part Breakdowns

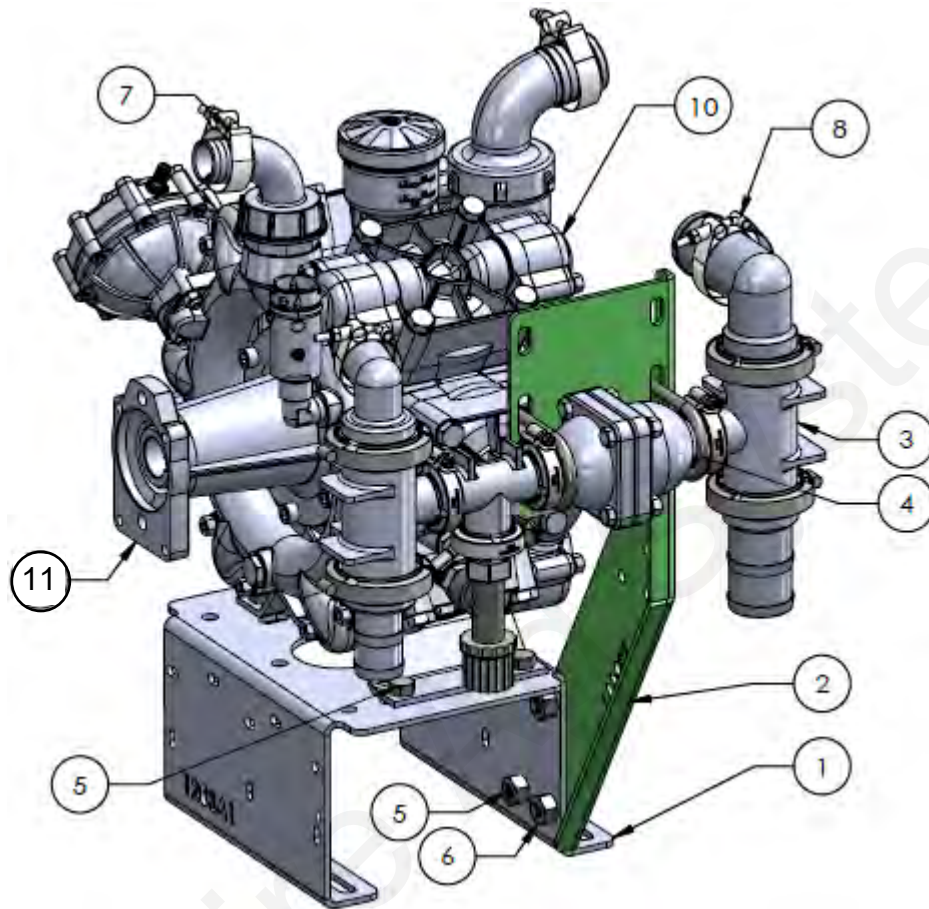
Complete D250 Pump Assembly w/ Hydraulic Motor and PWM Valve  
Kit: 500-01-2700



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.	
1	500-40-100250	D250 Pre-Build Assembly ( minus flowmeter and hydraulics)	1	See Page 81
2	164-FTA1609	4.0 CID Hydraulic Motor with PWM Valve and Bypass Valve, SPEED Sens	1	See Page 92
	164-FTA0994	4.0 CID Hydraulic Motor with PWM Valve and Bypass Valve, CW Rotation		
3	161-01-8MB-8MJ	Adapter - #8 male O-Ring Boss to #8 male JIC	1	
4	161-02-8MJ-8FJX-90	Elbow - #8 female JIC to #8 male JIC - 90	2	
5	500-02-2080	Arag Ion Flowmeter Kit (2.6 - 53 GPM) with adapter cable - 1 1/2" HB	1	See Page 83
6	280-150-AG200	1 1/2" AG200 Hose	1	

# D250 Assembly and Part Breakdowns

**D250 Pump Pre-Build Assembly  
(Minus Flowmeter and Hydraulics)  
Kit: 500-40-100250**



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	400-1203A1	D160 - D250 Diaphragm Pump Bracket	1
2	400-1204A1	D160 - D250 MPRV Support	1
3	520-00-3015	Plumbing Assembly - D160 & D250 Hydraulic Diaphragm Pump	1
4	302-UB101	M100 U-Bolt Assembly - 1 SS Ubolt, 2 SS lock washers, 2 SS nuts	2
5	300-080100-5	1/2" x 1" HCS G5	7
6	323-08	1/2" Flange Nut	7
7	350-TC181	T-Bolt Hose Clamp - 1.81 - 2.06" Diameter (fits 1 1/2" Enforcer or AG200)	2
8	350-TC231	T-Bolt Hose Clamp - 2.31 - 2.62" Diameter (fits 2" Enforcer)	2
9	350-0605	SS Hose Clamp - Size 6 - 7/8" Diameter	2
10	290-02-9910-D250	D250-6 Chamber Diaphragm Pump 55 GPM-Pump Only	1
11	291-02-9910-HYD1570	Hydraulic Flange Kit - D160, D250, PR40 & AR330	1

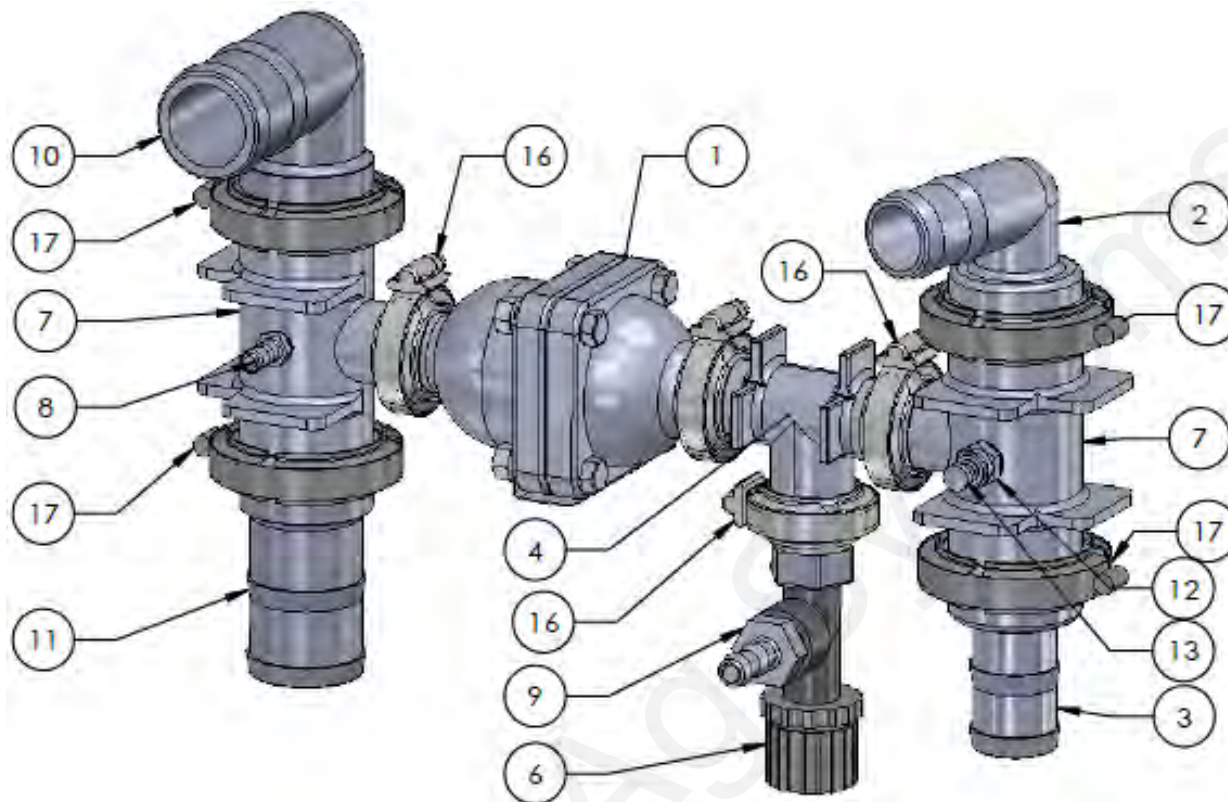
See Page 82

See Page 84

# D250 Assembly and Part Breakdowns

## D250 & PR40 Pump Plumbing Assembly

Kit: 520-00-3015



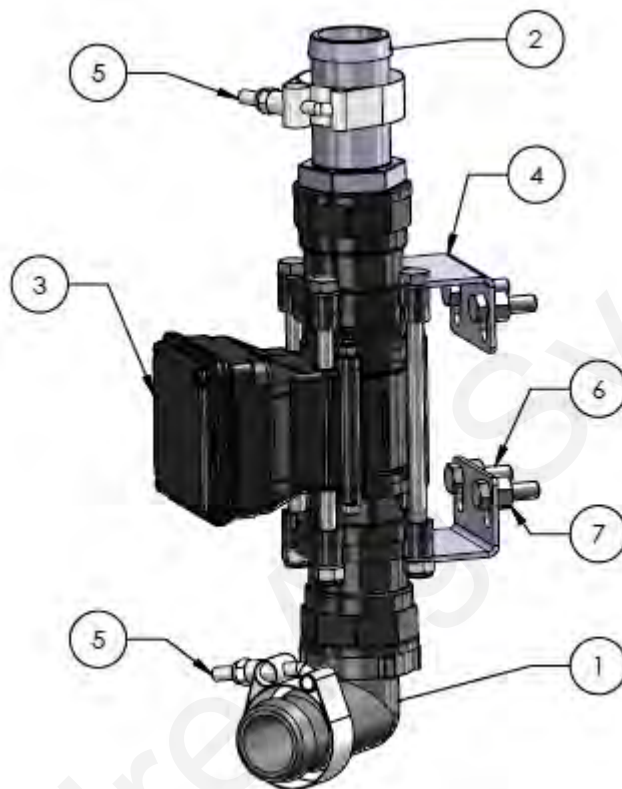
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	102-MPRV100-100	Pressure Relief Valve - 100 PSI	1
2	105-200150BRB90	2" Manifold Flng 1-1/2 Barb 90	1
3	105-200150BRB	2" Manifold X 1-1/2" Barb	1
4	105-100TEE	1" Manifold Tee	1
5	105-100075FPT	1" Manifold x 3/4" FPT	1
6	102-23520-3-4	3/4" Throttling Valve with out spring - 150 PSI	1
7	105-200100TEE038	2"Std Port x 1" Flanged Tee	2
8	101-038050	3/8" MPT x 1/2" HB	1
9	101-075050	3/4" MPT x 1/2" HB	1
10	105-200BRB90	2" Manifold x 2" HB - 90 Degree	1
11	105-200BRB	2" Manifold x 2" HB	1
12	113-06-025038	QC to MPT - 1/4" QC x 3/8" MPT	1
13	113-05-025	Plug - 1/4" QC	1
14	105-100G	1" EPDM Manifold Gasket	4
15	105-150G	1 1/2" EPDM Gasket	4
16	105-FC100	1" Manifold Clamp	4
17	105-FC200	2" Manifold Clamp	4



# D250 Assembly and Part Breakdowns

D250/PR40 EMag Flowmeter Kit (2.6-53 GPM)

Kit: 500-02-2080



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	101-125150-90	1-1/4"MPT X 1-1/2"Hse Shnk-90D	1
2	101-125150	1-1/4" MPT x 1-1/2" HB	1
3	204-01-46211CUF04	Electro Magnetic Flow meter 2.6 - 53 GPM Non-visual	1
4	400-3335Y1	SS Flowmeter Mounting Bracket	2
5	350-TC181	T-Bolt Hose Clamp - 1.81 - 2.06" Diameter	2
6	300-050100-SS	5/16" x 1" HCS SS	4
7	323-05-SS	5/16" Flange Nut SS	4
-	280-150-AG200	1 1/2" AG200 Hose - 2 feet	
-	201-17842	Adapter Cable - AMP Superseal to MT Controller	

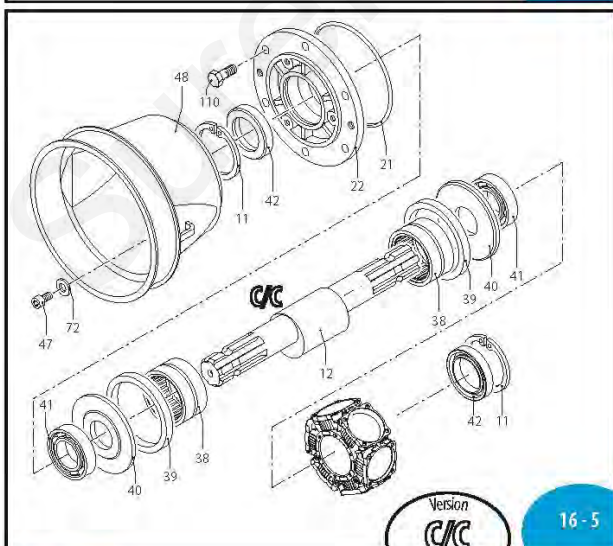
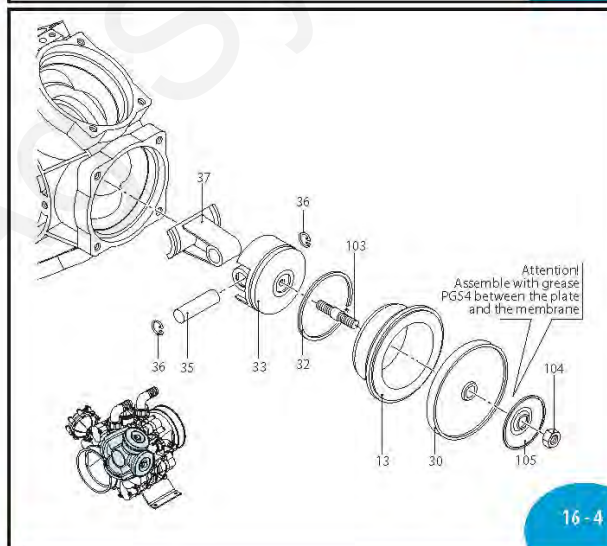
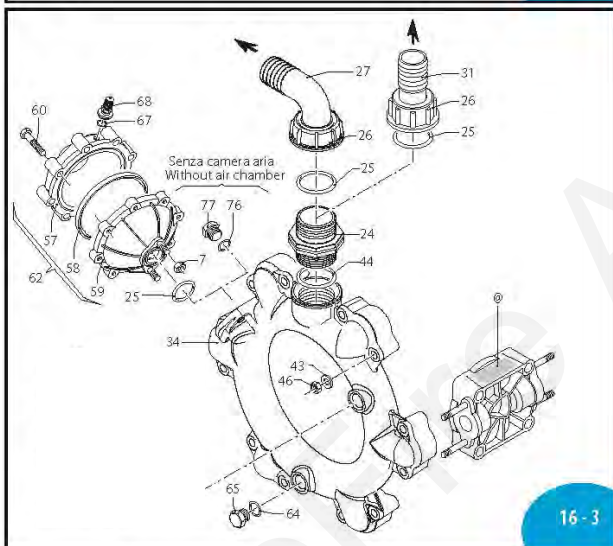
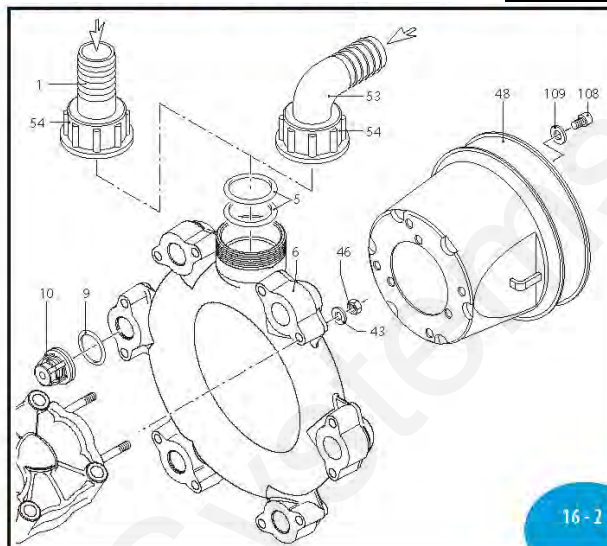
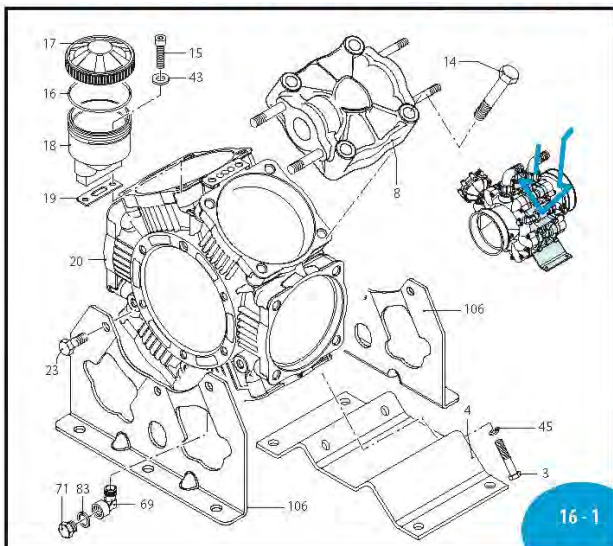
# D250 Diaphragm Pump Parts

D250 BlueFlex Diaphragm Pump—55 GPM

P/N: 290-02-9910-D250

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Maintenance  
& Parts



# D250 Diaphragm Pump Parts

D250 BlueFlex Diaphragm Pump—55 GPM  
P/N: 290-02-9910-D250

# H

Maintenance  
& Parts

Pos	Code	Description	Qty	Note
1	750870	Hose tail 2"	1	Optional
	750730	Hose tail Ø 60	1	Optional
3	750071	Screw TE M12x70	4	Geomet T445*
4	750200	Foot	1	
5	750740	O-ring Ø 56.74x3.53	2	
6	751070	Line suction	1	
7	380242	Nut M8	2	Geomet T220*
8	751350	Head black plasticized	6	
9	680070	O-ring Ø 31.5x4.25	12	
10	759051	Valve	12	
11	200390	Ring circlip Øi62	2	
12	750176	Shaft marked AZ	1	AR 215 bp C/C
	750170	Shaft marked AU	1	AR 250 bp C/C
	750174	Shaft marked AV	1	AR 280 bp C/C
13	750117	Sleeve	6	AR 215 bp C/C
	750110	Sleeve	6	AR 250 bp C/C
	750115	Sleeve	6	AR 280 bp C/C
14	750061	Screw TE M12x65	24	Geomet T445*
15	680350	Screw TCEI M8x35	2	T90*
16	1040060	O-ring Ø 72.69x2.62	1	
17	750051	Plug green	1	AR 215 bp
	1800060	Plug black	1	AR 250 bp
	750050	Plug red	1	AR 280 bp
18	750030	Tank	1	
19	750040	Gasket	1	
20	751300	Pump body	1	
21	851360	O-ring Ø 120.32x2.62	1	
22	680020	Support	1	
23	160672	Screw TE M10x25	6	Geomet T355*
24	751130	Fitting 1" 1/2 G M-M	1	T90*
25	390290	O-ring Ø 29x3	2	
26	750670	Ring nut 1 1/2" G	1	
27	750660	Elbow 1 1/2"	1	
28	2420181	Support	1	
29	650640	Screw TCEI M10x25	6	Geomet T310*
30	550081	Diaphragm	6	BlueFlex
	550080	Diaphragm	6	NBR
	550084	Diaphragm	6	Viton
	550085	Diaphragm	6	Desmopan
	550086	Diaphragm	6	HPDS
31	760940	Hose tail Ø 35	1	
32	500260	Piston ring	6	
33	750122	Piston Ø 80	6	
34	751080	Line manifold	1	
35	160700	Pin	6	
36	160691	Ring circlip Øi 18	12	
37	750140	Connecting-rod	6	
38	750090	Bearing	2	
39	750130	Ring connecting rod	2	
40	540040	Plate	2	
41	751280	Bearing	2	
42	160740	Ring seal	2	

Pos	Code	Description	Qty	Note
43	380243	Washer	26	Geomet
44	751140	O-ring Ø 47.22x3.53	1	
45	250143	Washer	4	Geomet
46	380242	Nut M8	24	Geomet T180*
47	850251	Screw TCEI M8x12	3	Geomet T90*
48	1500470	Shield	1	
49	750850	Elbow 2"	1	AR 215 bp-AR 250 bp
	750720	Elbow Ø 60	1	AR 280 bp
54	750710	Ring nut 2" 1/2 G	1	
57	620232	Semi air chamber upper	1	Black
58	550194	Diaphragm air chamber	1	Blueflex
	550190	Diaphragm air chamber	1	NBR
	550192	Diaphragm air chamber	1	Viton
	550193	Diaphragm air chamber	1	HPDS
59	680180	Semi air chamber lower	1	
60	621781	Screw TE M8x40	8	Geomet T220*
61	629230	Air chamber BlueFlex*	1	
	629216	Air chamber NBR	1	
64	180101	O-ring Ø 17.5x2	1	
65	330173	Plug 1/2" G	1	Geomet T180*
67	650542	Gasket	1	
68	180020	Air valve	1	T25*
69	750370	Fitting 1/4" G M-F	1	
71	880581	Plug 1/4" G	1	T180*
72	390314	Washer	3	Geomet
76	740290	O-ring Ø 14x1.78	1	
77	880530	Plug 3/8" G	1	T180*
78	881560	Fitting 1/2" G M-F	1	
79	1609000	Safety valve	1	290 PSI
80	880831	O-ring Ø 15.54x2.62	1	Viton
81	550450	Ring nut 3/4" G	1	
82	550460	Elbow Ø 18	1	
83	880820	Washer	1	
84	620330	Ring circlip Øi65	1	
85	1800090	Ring seal	1	
86	230310	Bearing	1	
87	760510	Plate	1	
103	2240100	Hub pin	6	T265*
104	2240110	Nut M10 SS	6	SS T220*
105	751250	Wobble plate	6	
106	751291	Foot	2	
108	820673	Screw TCEI M10x16	3	Geomet T90*
109	320621	Washer	3	Geomet
110	160672	Screw TE M10x25	6	Geomet T310*
111	1300280	Spacer	3	
112	760360	Guard	1	
113	320621	Washer	3	Geomet
114	650640	Screw TCEI M10x25	3	Geomet T90*

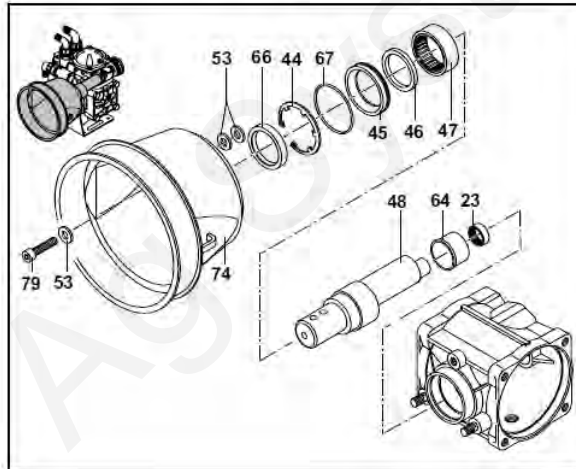
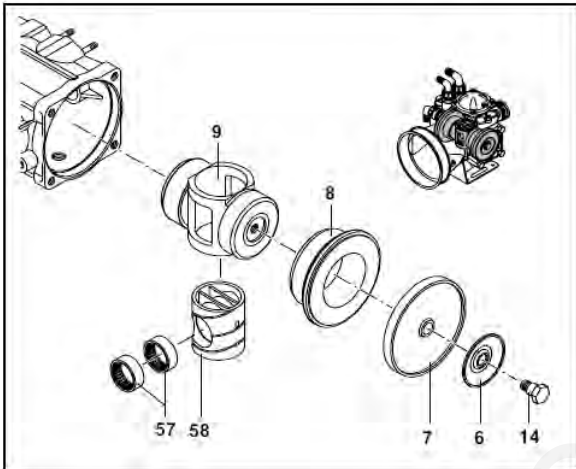
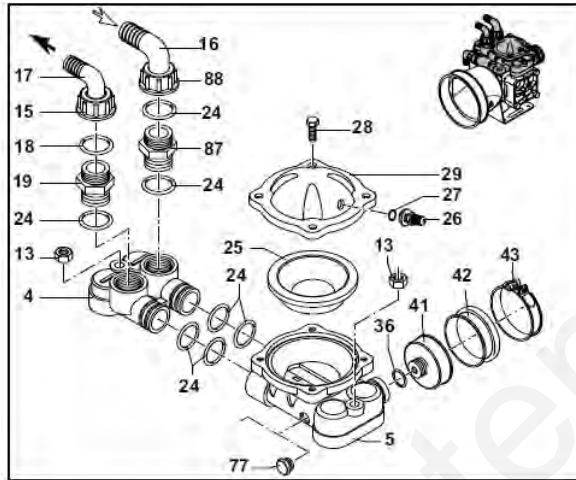
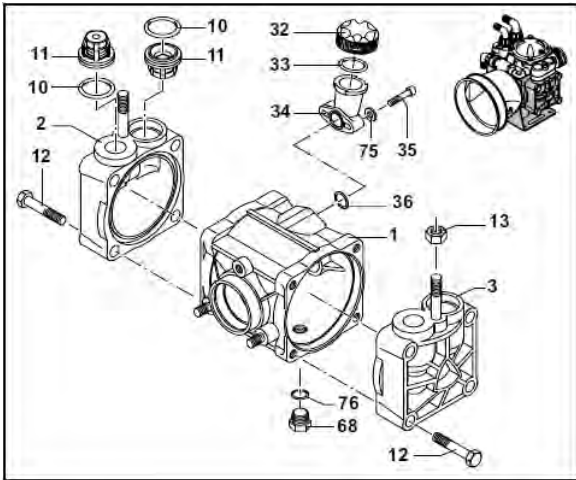
\*Torque: in-lbs +/- 10%



# D70 Diaphragm Pump Parts

# H

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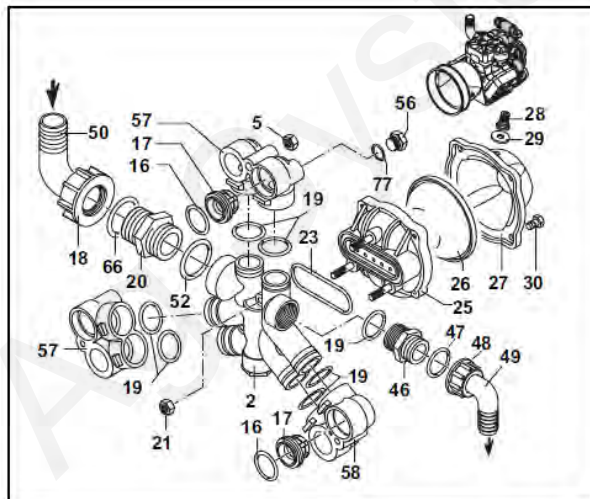
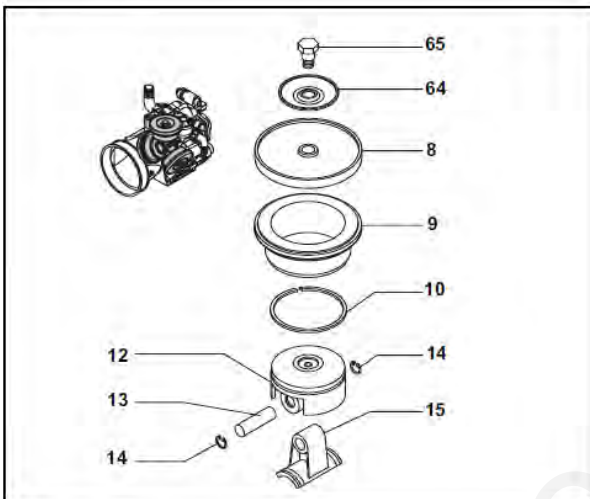
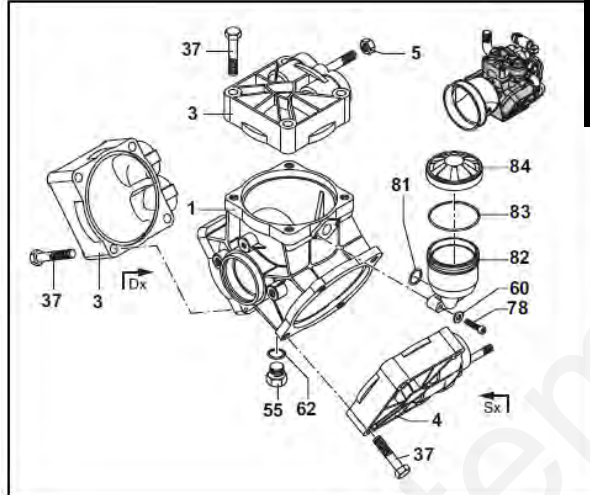
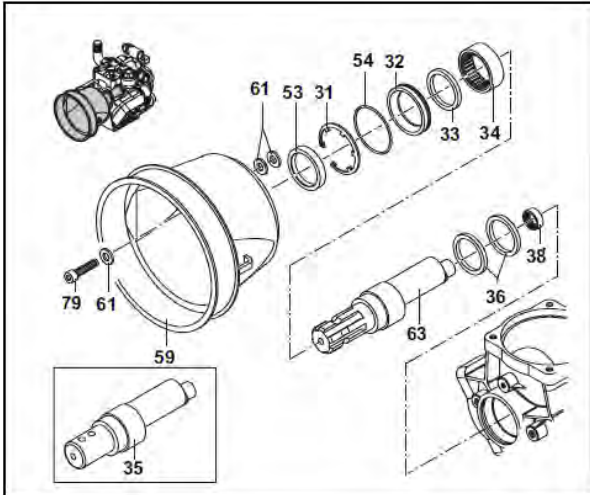
REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
1	9910-550011	Pump Body with bolts	1
2	9910-550101	Right head DX	1
3	9910-550102	Left head SX	1
4	9910-550150	Manifold	1
5	9910-559200	Accumulator manifold	1
6	9910-580370	Plate	2
7	9910-550080	Diaphragm (Buna) Optional	2
7a	9910-550085	Diaphragm (Desmopan) Standard	2
8	9910-550110	Sleeve	2
9	9910-550120	Piston	1
10	9910-320030	O-ring	4
11	9910-759051	Complete valve assembly	4
12	9910-551040	M10 x 55 Bolt	8
13	9910-180152	Nut	4
14	9910-580360	Diaphragm bolt	2
15	9910-550880	Ring nut	1
16	9910-580040	Elbow 1-1/4"	1
17	9910-550370	Elbow 1"	1
18	9910-550350	O-ring	1
19	9910-550340	Threaded adapter	1
23	9910-550310	Roller bearing	1
24	9910-390290	O-ring	7
25	9910-550190	Accumulator diaphragm	1
26	9910-550300	Air valve	1
27	9910-650542	O-ring	1
28	9910-550680	Bolt	4
29	9910-559204	Upper air chamber	1

REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
32	9910-550057	Sight glass cap	1
33	9910-550040	O-ring	1
34	9910-550030	Oil sight glass	2
36	9910-180101	O-ring	2
41	9910-650660	Diaphragm holder	1
42	9910-650670	Diaphragm	1
43	9910-650690	Clamp	1
44	9910-200391	Retainer ring	1
45	9910-550470	Seal ring	1
46	9910-550070	Spacer ring	1
47	9910-550060	Roller bushing	1
48	9910-550170	Shaft	1
52	9910-200233	Washer	2
53	9910-320621	Washer	5
57	9910-550280	Bearing	2
58	9910-550140	Cylinder	1
64	9910-550160	Spacer	1
66	9910-550491	Seal ring	1
67	9910-650920	O-ring	1
68	2406-0023	Oil drain plug	1
74	9910-1500350	Shield	1
75	9910-550332	Washer	2
76	9910-740290	O-ring	1
77	9910-330173	Plug	1
79	9910-620472	M10 x 20 Bolt	1
87	9910-450120	Threaded adapter	1
88	9910-550870	Ring nut	1

# D115 Diaphragm Pump Parts

# H

Maintenance  
& Parts



REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
1	9910-580013	Pump body with bolts	1
2	9910-580150	Manifold	1
3	9910-550101	DX Right head	2
4	9910-550102	SX Left head	1
5	9910-180152	Nut	3
8	9910-550080	Diaphragm (Buna) Optional	3
8	9910-550085	Diaphragm (Desmopan) Standard	3
9	9910-580110	Sleeve (D115)	3
9	9910-580350	Sleeve (D135)	3
10	9910-500260	Piston ring	3
12	9910-580120	Piston	3
13	9910-380300	Pin	3
14	9910-380080	Pin ring	6
15	9910-580140	Connecting rod	3
16	9910-320030	O-ring	6
17	9910-759051	Complete valve	6
18	9910-540541	Ring nut	1
19	9910-390291	O-ring	7
20	9910-540530	Threaded adapter	1
21	9910-390271	Nut	3
23	9910-580050	Gasket	1
25	9910-580180	Accumulator manifold	1
26	9910-550190	Accumulator diaphragm	1
27	9910-559204	Accumulator head	1
28	9910-550300	Air valve	1
29	9910-650542	O-ring	1
30	9910-550680	M8 x 20 Bolt	4
31	9910-200391	Retainer ring	1
32	9910-550470	Gasket retainer	1
33	9910-550070	Spacer ring	1
34	9910-550060	Roller bearing	1
35	9910-550170	Shaft (D115)	1
36	9910-580470	Connecting rod ring	2

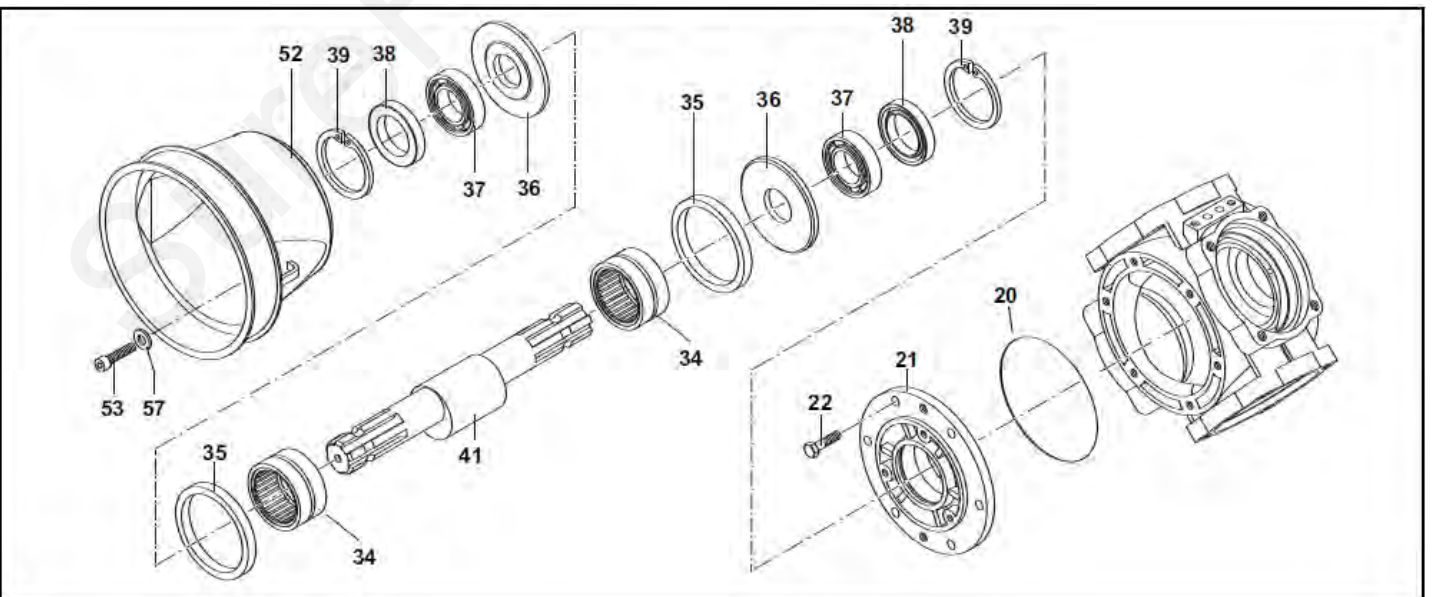
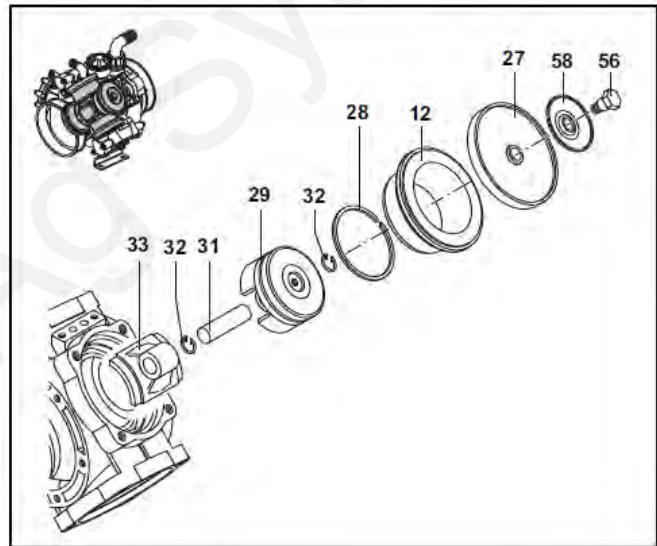
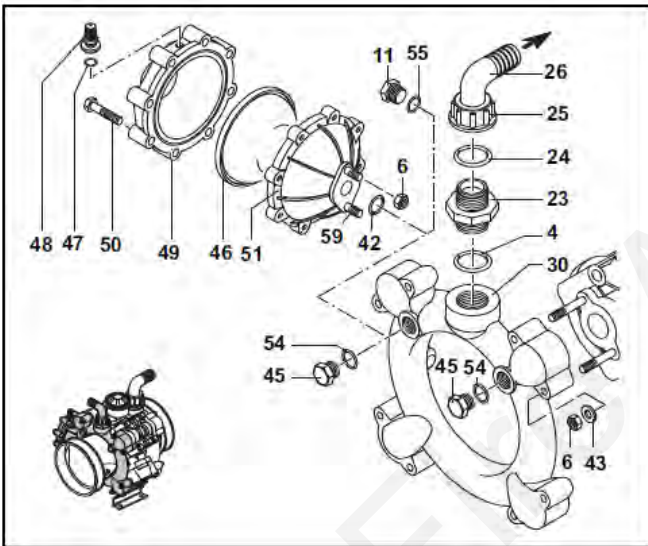
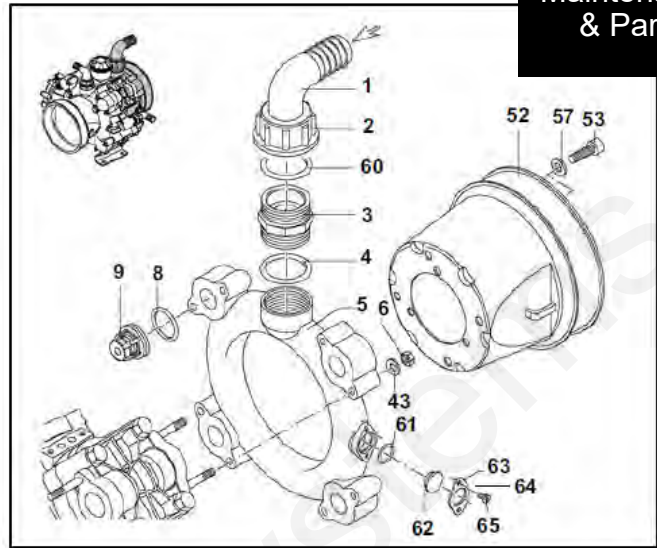
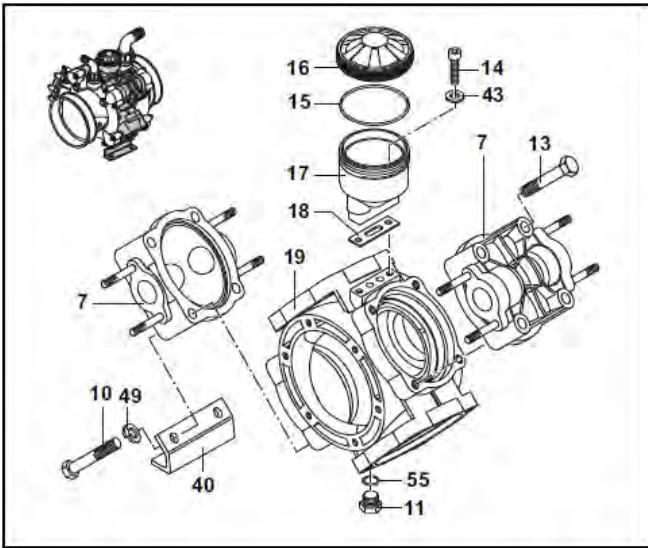
REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
37	9910-551040	M10 x 55 Bolt	12
38	9910-550310	Roller bushing	1
46	9910-550340	Threaded adapter	1
47	9910-550350	O-ring	1
48	9910-550242	Ring nut	1
49	9910-550370	Elbow 1"	1
50	9910-540550	Elbow 1-1/2"	1
52	9910-250310	O-ring	1
53	9910-550491	Seal ring	1
54	9910-650920	O-ring	1
55	2406-0023	Oil drain plug	1
56	9910-330173	Plug	1
57	9910-589200	DX Right valve retainer w/plug/o-ring	2
58	9910-580072	SX Left valve retainer	1
59	9910-1500350	Shield	1
60	9910-550332	Washer	2
61	9910-320621	Washer	5
62	9910-740290	O-ring	1
63	9910-580330	Shaft (D135)	1
64	9910-580370	Plate	3
65	9910-580360	Diaphragm bolt	3
66	9910-250310	O-ring	1
69	9910-200233	Washer	2
77	9910-180101	O-ring	1
78	9910-850851	M6 x 30 Bolt	2
79	9910-620472	M10 x 20 Bolt	3
81	9910-390180	O-ring	1
82	9910-1040310	Oil sight glass	1
83	9910-650920	O-ring	1
84	9910-1040322	Black oil tank cap	1



# D160 Diaphragm Pump Parts

# H

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& Parts



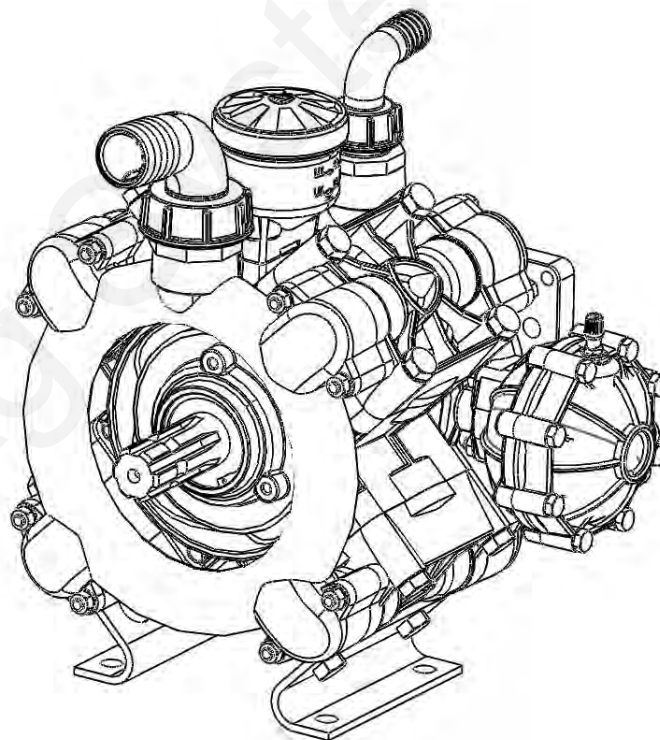
# D160 Diaphragm Pump Parts

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& Parts

REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
1	9910-760020	Elbow 2"	1
2	9910-760040	Ring nut	1
3	9910-760030	Threaded adapter	1
4	9910-250310	O-ring	1
5	9910-760220	Suction manifold	1
6	9910-380242	Nut	18
7	9910-750100	Head	4
8	9910-680070	O-ring	8
9	9910-759051	Complete valve	8
10	9910-750071	Bolt	4
11	2406-0023	Oil drain plug	2
12	9910-750110	Sleeve	4
13	9910-750061	M12 x 65 Bolt	12
14	9910-680350	M8 x 35 Bolt	2
15	9910-1040060	O-ring	1
16	9910-750057	Black oil tank cap	1
17	9910-750030	Oil sight glass	1
18	9910-750040	Gasket	1
19	9910-760010	Pump body	1
20	9910-851360	O-ring	1
21	9910-680020	Bearing support housing	1
22	9910-160672	M10 x 25 Bolt	6
23	9910-540530	Threaded adapter	1
24	9910-250310	O-ring	1
25	9910-540540	Ring nut	1
26	9910-540550	Elbow 1-1/2"	1
27	9910-550085	Diaphragm (Desmopan) Standard	4
27a	9910-550080	Diaphragm (Buna) Optional	4
28	9910-500260	Piston ring	4
29	9910-750122	Piston	4
30	9910-760070	Manifold	1
31	9910-160700	Pin	4
32	9910-160691	Pin ring	8
33	9910-760140	Connecting rod	4
34	9910-750090	Roller bearing	2
35	9910-750130	Connecting rod ring	2
36	9910-540040	Spacer washer	2
37	9910-230350	Bearing	2
38	9910-160740	Seal ring	2
39	9910-200390	Retainer ring	2
40	9910-760201	Base	2
41	9910-750170	Crankshaft	1
42	9910-390290	O-ring	1
43	9910-380243	Washer	18
44	9910-250143	Washer	4
45	9910-330173	Plug	2
46	9910-550190	Accumulator diaphragm	1
47	9910-650542	O-ring	1
48	9910-180020	Air valve	1
49	9910-620232	Accumulator head	1
50	9910-621781	M8 x 40 Bolt	8
51	9910-680180	Accumulator body	1
52	9910-1500350	Shield	2
53	9910-850251	M8 x 12 Bolt	6
54	9910-180101	O-ring	2
55	9910-740290	O-ring	2
56	9910-580360	Diaphragm bolt	4
57	9910-390314	Washer	6
58	9910-580370	Retaining washer	4
59	9910-390670	Accumulator stud	1

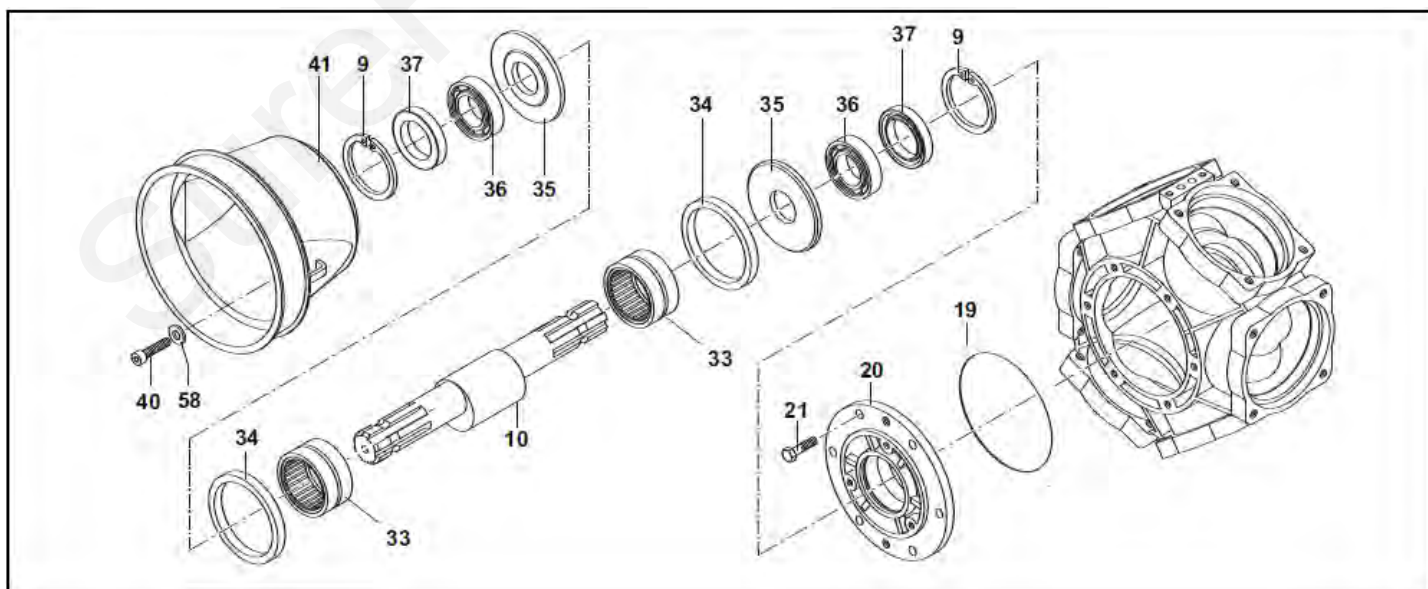
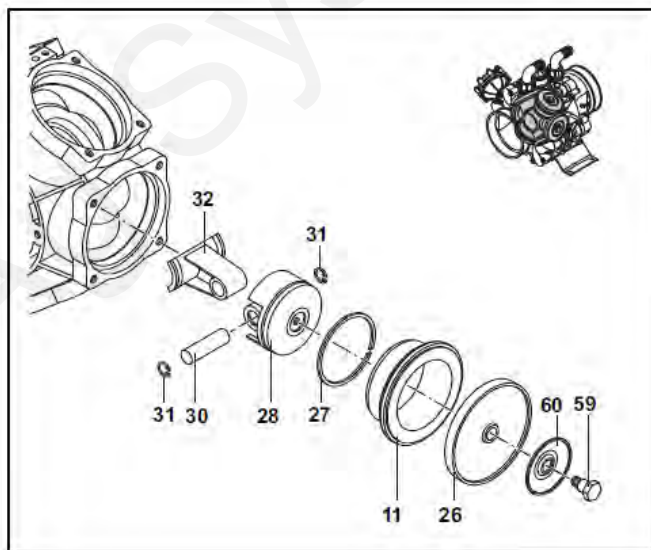
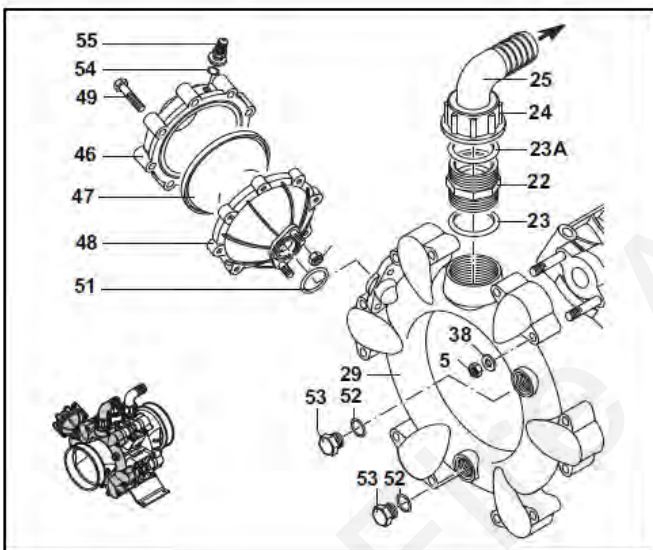
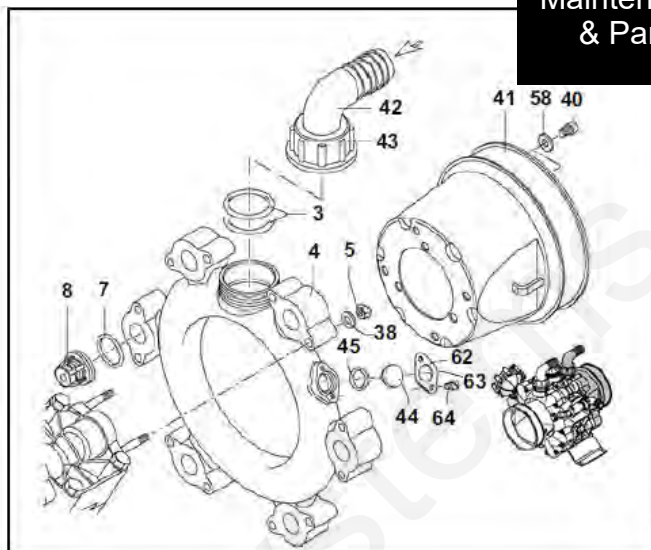
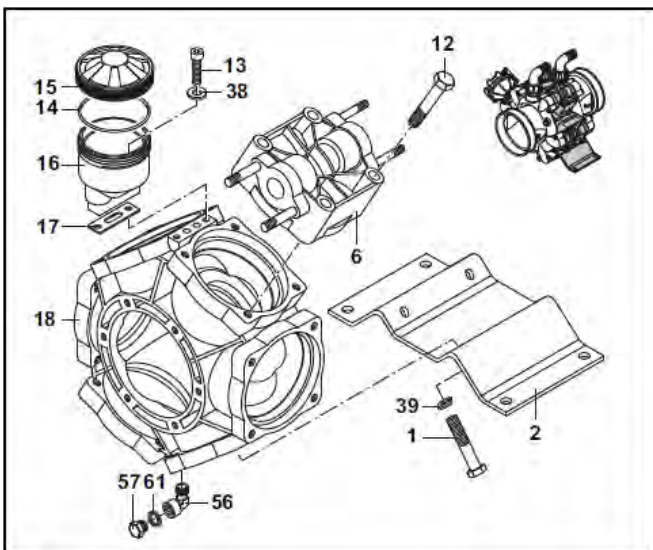
REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
60	9910-620210	O-ring	1
61	9910-480440	O-ring	1
62	9910-2420120	Flange Plug	1
63	9910-2420110	Flange	1
64	9910-2420290	Washer	2
65	9910-2420280	Bolt	2



# D250 Diaphragm Pump Parts

# H

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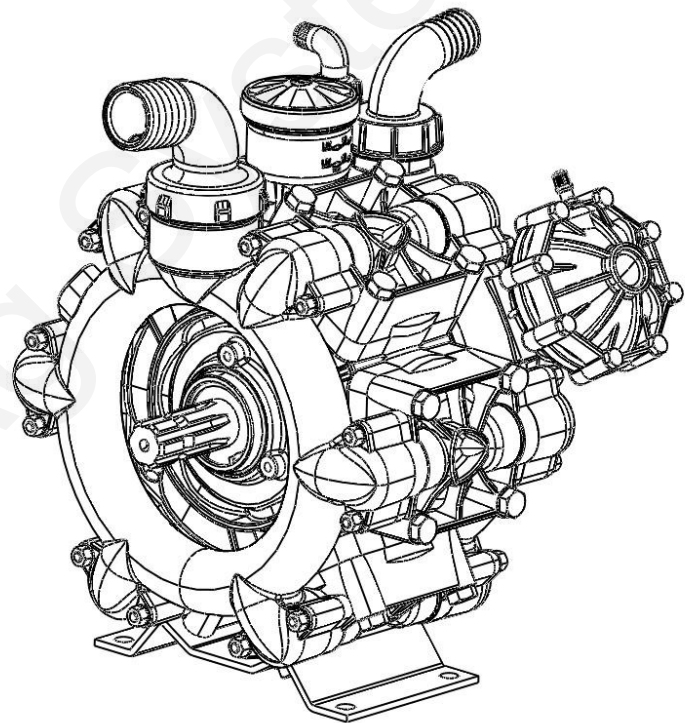
# D250 Diaphragm Pump Parts

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REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
1	9910-750071	Bolt	4
2	9910-750200	Base	1
3	9910-750740	O-ring	2
4	9910-KIT2486	Suction Manifold Kit (Includes Ref. 3, 42, 43, 44, 45 and 62)	1
5	9910-380242	Nut	26
6	9910-750100	Head	6
7	9910-680070	O-ring	12
8	9910-759051	Complete valve	12
9	9910-200390	Retainer ring	2
10	9910-750170	Crankshaft	1
11	9910-750110	Sleeve	6
12	9910-750061	M12 x 65 Bolt	20
13	9910-680350	M8 x 35 Bolt	2
14	9910-1040060	O-ring	1
15	9910-750057	Black oil tank cap	1
16	9910-750030	Oil sight glass	1
17	9910-750040	Gasket	1
18	9910-750010	Pump body	1
19	9910-851360	O-ring	1
20	9910-680020	Shaft support	1
21	9910-160672	M10 x 25 Bolt	6
22	9910-751130	Threaded adapter	1
23	9910-751140	O-ring	1
23A	9910-390290	O-ring	1
24	9910-750670	Ring nut	1
25	FNE-112112	Elbow 1-1/2"	1
26	9910-550085	Diaphragm (Desmopan) Standard	6
26A	9910-550080	Diaphragm (Buna) Optional	6
27	9910-500260	Piston ring	6
28	9910-750122	Piston	6
29	9910-751080	Manifold	1
30	9910-160700	Pin	6
31	9910-160691	Pin ring	2
32	9910-750140	Connecting rod	6
33	9910-750090	Roller bearing	2
34	9910-750130	Connecting rod ring	2
35	9910-540040	Spacer washer	2
36	9910-230350	Bearing	2
37	9910-160740	Seal ring	2
38	9910-380243	Washer	26
39	9910-250143	Washer	4
40	9910-850251	M8 x 12 Bolt	6
41	9910-1500350	Shield	2
42	9910-750850	Elbow 2"	1
43	9910-750710	Ring nut	1
44	9910-2420120	Plug	1
45	9910-480440	O-ring	1
46	9910-620232	Accumulator head	1
47	9910-550190	Accumulator diaphragm	1
48	9910-680180	Accumulator body	1
49	9910-621781	M8 x 40 Bolt	8
51	9910-390290	O-ring	1
52	9910-180101	O-ring	2
53	9910-330173	Plug	2
54	9910-650542	Gasket	1
55	9910-180020	Air valve	1
56	9910-750370	Elbow	1
57	9910-880581	Oil drain plug	1
58	9910-390314	Washer	6
59	9910-580360	Diaphragm bolt	6

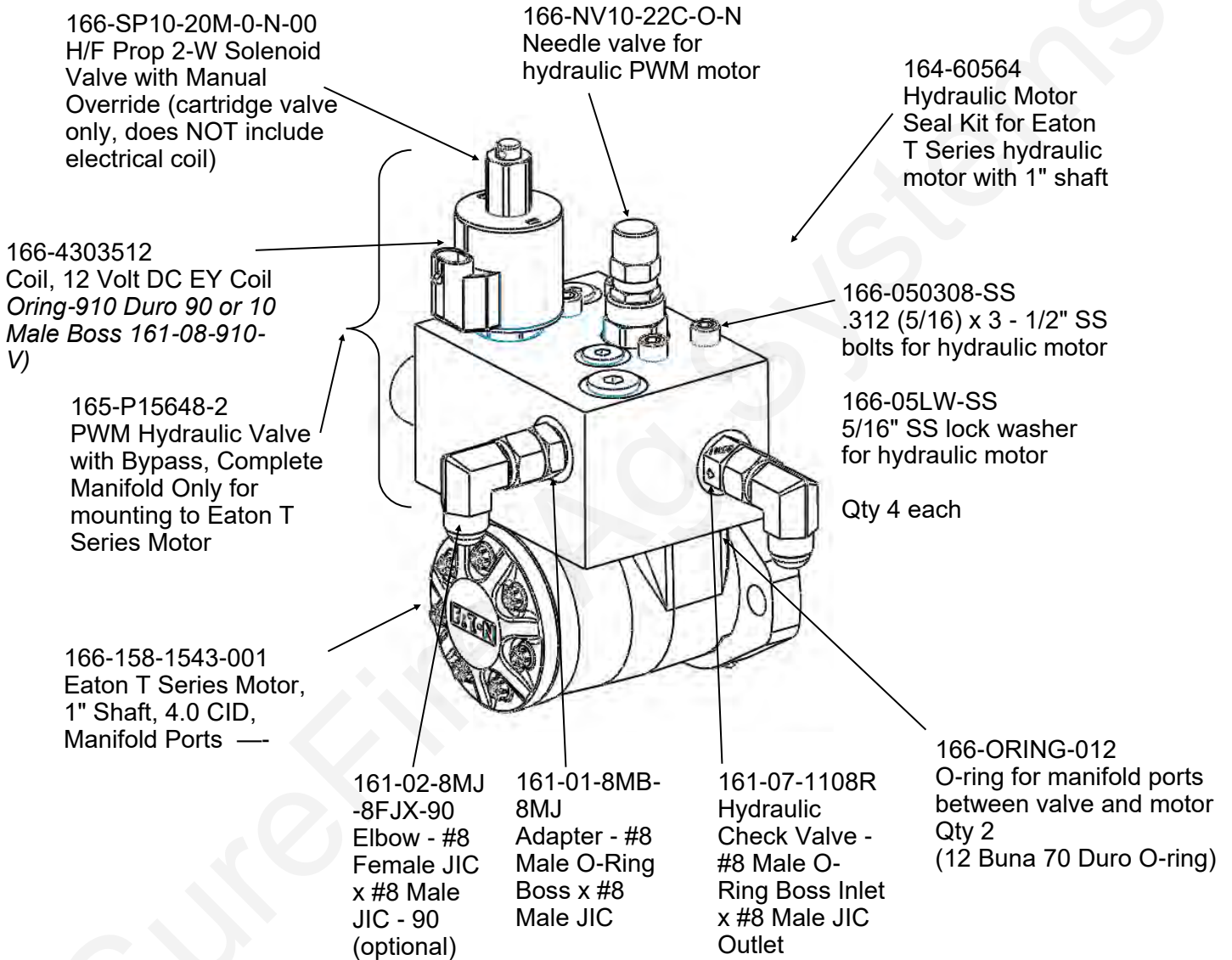
REF. NO.	PART NUMBER	DESCRIPTION	QTY. REQ'D
60	9910-580370	Retainer washer	6
61	9910-880820	Washer	1
62	9910-2420110	Flange	1
63	9910-2420290	Washer	2
64	9910-2420280	Bolt	2



# 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



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