396-5480Y1

SPARTAN

DIRECT INJECTION

FORCE EVO APPLICATION SYSTEM INSTALLATION GUIDE

FOR
FINAL INSTALLATION
CALL
866-801-4356

SurePoint Ag Systems

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Introduction

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Safety

A

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.

Precautionary Statements:

Obtain special instructions before use, and read the product label and MSDS.
Do not handle until all safety precautions have been read and understood.
Do not breathe mist, vapors, spray.
In case of inadequate ventilation wear respiratory protection.
If exposed or concerned: Get medical advice/attention.
Specific treatment is urgent (see Section 4 First Aid Measures).
Keep away from heat, sparks, open flames, hot surfaces. No smoking.
Wash hands and face thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves, protective clothing, eye protection.
If swallowed: Immediately call a poison center, doctor or Syngenta. Rinse mouth.
If on skin: Wash with plenty of soap and water.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Immediately call a poison center, doctor or Syngenta.
Call a poison center, doctor or Syngenta if you feel unwell.
Do NOT induce vomiting.
Take off immediately all contaminated clothing and wash it before reuse.
In case of fire: Use dry chemical, foam or CO2 for extinction.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents and container in accordance with local regulations.

Force® Evo

Current EPA - Approved Label

Safety Data Sheet

Recommended Care and Maintenance

A

Cleaning

Under no circumstance should the Spartan pump be cleaned with a pressure washer. The intense pressure generated by pressure washers may penetrate seals of the sensitive electronic components and cause irreversible damage. While wearing proper PPE, clean Force Evo product connectors with **RV antifreeze** using provided spray bottle.

Rinsing and flushing

All rinsing and flushing of the system should be done with **RV Antifreeze** in accordance with the Force Evo product label. **Flushing with water will cause coagulation when mixed with Force Evo product.**

Winterization

SurePoint recommends flushing your fertilizer pump and complete system with adequate amounts of **RV Antifreeze**. At the beginning of the next season, begin with **RV Antifreeze** to verify the system is in working order with no leaks.

Pre-season Service

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

1. Spray product connectors with RV antifreeze to clean and lubricate.
2. Visually check entire system (hoses, fittings, harnesses, etc.) for any signs of wear or trouble.
3. On the display, recheck all setup screens to verify correct setup.
4. Fill system with **RV antifreeze** and run in Manual mode (Section Test or Calibrate PWM Limits) to verify components and system are in working order.
5. 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.
6. 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. Replace o-ring seals as necessary.
7. 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.
8. Remove and clean the strainer. Be sure strainer is tightened securely so it will not suck air.
9. 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.)
10. Run an Auto Check or Nozzle Flow Check to verify that system will lock on to a Target Rate.

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.

Rear Hitch Mounting Kit

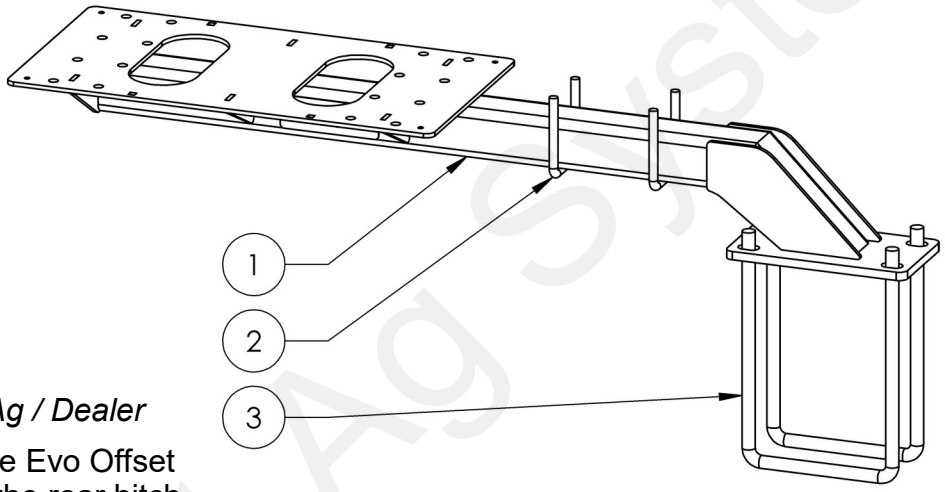
508-05-200100

Force Evo Cabinet Rear Hitch Mounting Kit

B
Cabinet

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	470-5369Y1	Force Evo Offset Hitch Mount - Weldment	1
2	380-1022	1/2" U-bolt Kit - fits 3" x 3" tube - (3" opening) includes flange nuts	2
3a	380-1066	3/4" U-bolt Kit - fits 8" x 12" tube - (8" opening) - includes Flat & Lock washers, Nuts	2
3b	380-1067	3/4" U-bolt Kit - fits 8" x 16" tube (8" opening) includes Flat & Lock washers, Nuts	2

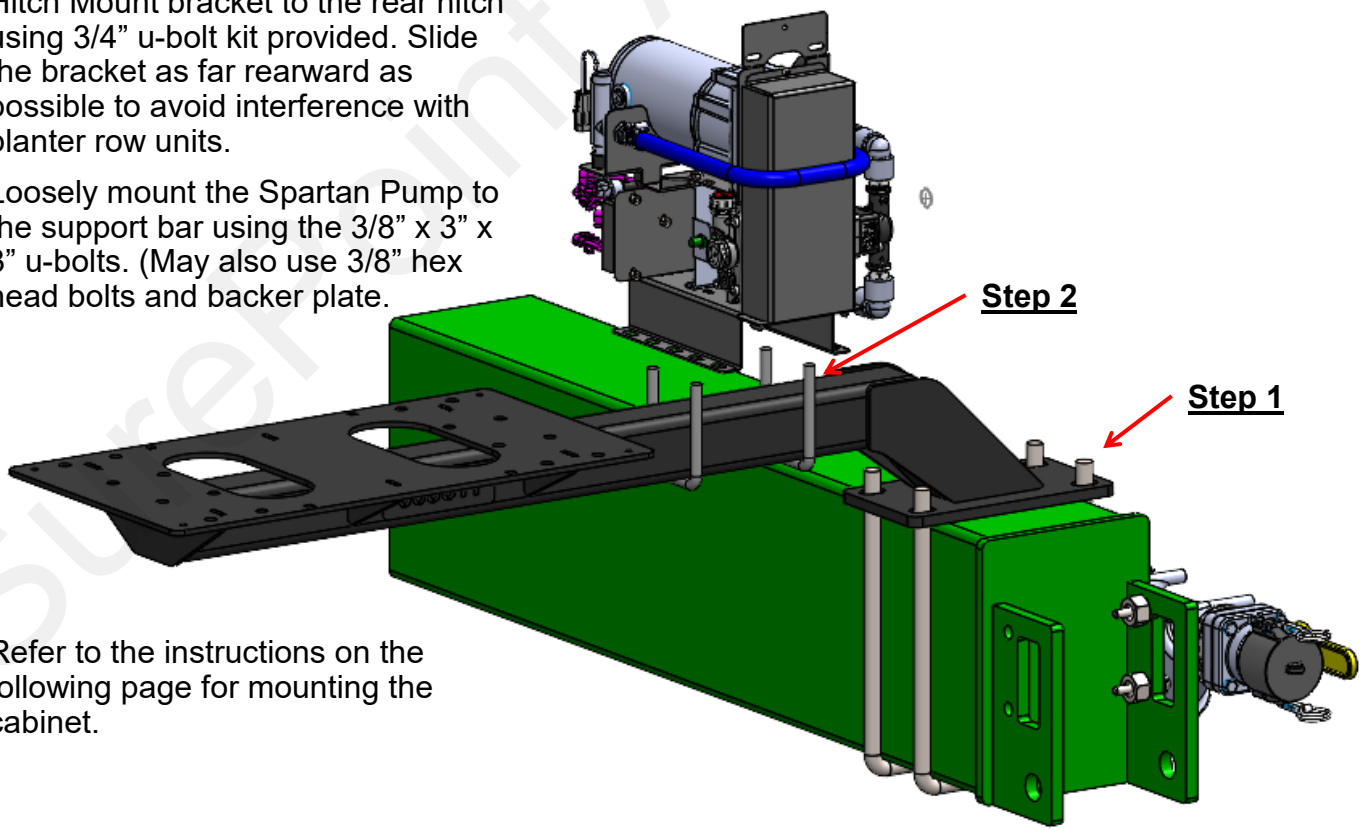
**Cabinet mounting hardware provided with the cabinet, hardware bag is inside the cabinet.*



Installation Instructions:

**Completed by SurePoint Ag / Dealer*

1. Loosely mount the Force Evo Offset Hitch Mount bracket to the rear hitch using 3/4” u-bolt kit provided. Slide the bracket as far rearward as possible to avoid interference with planter row units.
2. Loosely mount the Spartan Pump to the support bar using the 3/8” x 3” x 3” u-bolts. (May also use 3/8” hex head bolts and backer plate.



3. Refer to the instructions on the following page for mounting the cabinet.

Force Evo Cabinet Kit

508-05-100100

B
Cabinet

Spray Bottle, RV Antifreeze and nitrile gloves provided with cabinet kit

Plumbing Components for cabinet interior provided and installed by DCI

Installation Instruction:

1. Mount the cabinet to the mounting bracket using provided hardware bag.

The final install of the inter plumbing system shall be completed by DCI.

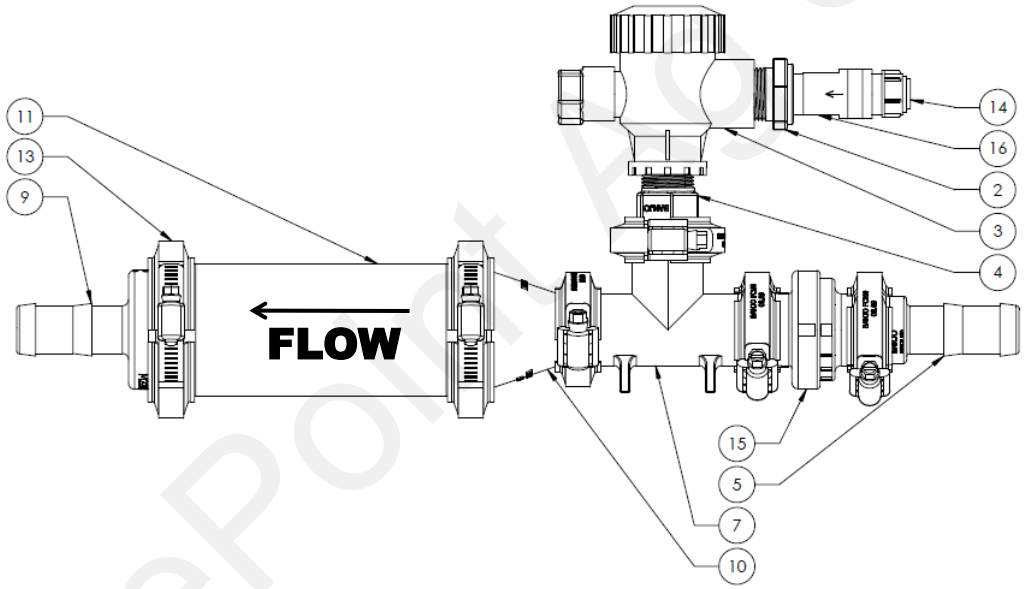
FOR INSTALLATION CALL 866-801-4356

Force Evo Mixing Chamber

520-00-149100 - 1" Mixing Chamber Kit for Force Evo

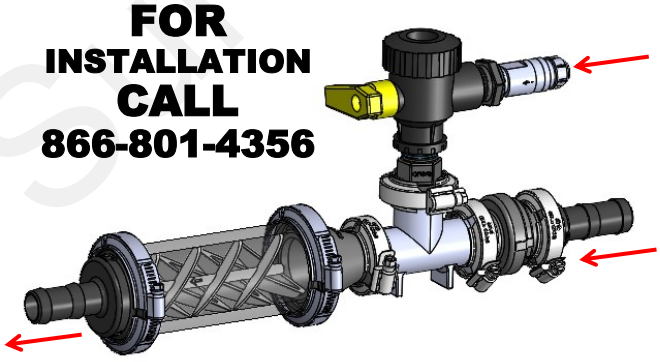
B
Cabinet

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	069-5406Y1-PP	2"O.D. Nylon Mixer for Manifold Spartan Mixing Chamber	1
2	100-075050RB	3/4" MPT x 1/2" FPT Reducer Bushing	1
3	102-075SUBV-3BL-V	3/4" Union Valve 3 Way - Viton	1
4	105-100075MPT	1" Manifold x 3/4" MPT	1
5	105-100BRB	1" Manifold x 1" HB	1
6	105-100G-H	1" EPDM Manifold Gasket	4
7	105-100TEE	1" Manifold Tee	1
8	105-200G-H	2" EPDM Manifold Gasket for 220 Series Manifold Fittings	2
9	105-220100BRB	2" Full Port Manifold x 1" HB	1
10	105-220100CPG	2" Full Port Manifold x 1" Manifold - Reducer Coupling	1
11	105-220CPG6	2" Full Port Manifold Coupling - 6"	1
12	105-FC100	1" Manifold Clamp	4
13	105-FC220	2" Full Port Manifold Clamp	2
14	113-06-038050-P	QC to MPT - 3/8" QC x 1/2" MPT - polypropylene	1
15	136-MCV100	1" Flanged Poly Check Valve	1
16	716-333-0011-102	* 1/2" SS N-Serve Checkvalve - 12 PSI w/ Extreme Viton	1



Final plumbing installation shall be completed by DCI.

FOR INSTALLATION CALL 866-801-4356



Installation Instruction:

1. If not pre-assembled, assemble the plumbing fittings as show. Flow direction arrows are indicated
2. Install the mixing chamber in the main 1" supply hose.
3. Connect the discharge from the Spartan injection port to the inlet of the 3-way valve. *Note: The valve controls the flow from being injected into the main line, or out the top port for calibration / winterization.*

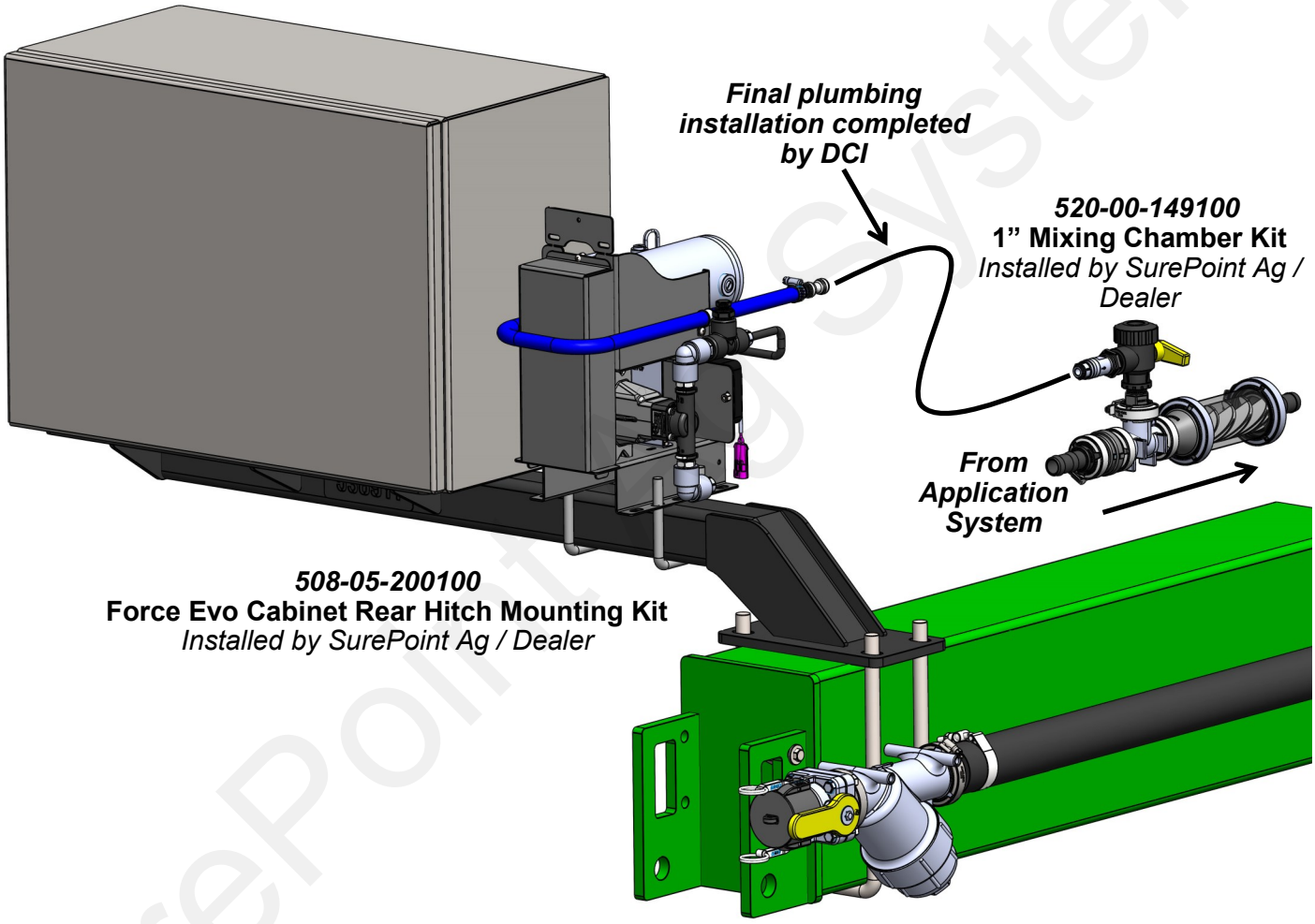
Final plumbing installation shall be completed by DCI.

Use only RV Antifreeze to flush out or pressure test the system!

System / Component Overview

B

508-05-100100
Force Evo Cabinet Kit
Installed by SurePoint Ag / Dealer, Interior plumbing and connection to Spartan Pump made by DCI.



508-05-200100
Force Evo Cabinet Rear Hitch Mounting Kit
Installed by SurePoint Ag / Dealer

Spartan Injection Pump Models 115, 125, 135, and 145

C

ALL SYSTEMS: These flowmeter settings are pulses per ounce, but for some controllers this number will be entered as pulses per gallon. Therefore the controller thinks it is measuring gallons when it is really measuring ounces. This will happen on controllers that only measure gal/acre, and only allow one decimal on the gal/acre rate. Set the Rate using the number of ounces per acre you want. For example, to apply 32 oz/acre, set the rate at 32 gal/acre. The display will read gpa, but it will actually be applying oz/acre.

Operating Caution: Pump will produce up to 290 PSI. Limit operating pressure to 80 PSI. Pressure with water will be less than pressure with a thicker, heavier product.

Specifications

Voltage: 12 VDC Pump Speed: 0-120 RPM Current: 16.3 Amps

Spartan Injection Pump Model #	115	125	135	145
Flow Range (oz/min)	1-10	3-20	6-40	10-80
Flow Cal (pul/oz, but some controllers may use this as pul/gal)	1700	890	450	220
Commander II Flow Cal	3400	1780	900	440

Original John Deere Rate Controller Calibration Settings

PWM Settings-Control Valve Calibration—222 or 322 PWM Low Limit—9 (adjust in field-may need lower)

Use Flow Cal number above and Units—Gal For 32 oz/acre, enter Rate as 32 gal/acre.

NEW John Deere Rate Controller 2000 and Raven RCM Calibration Settings

Control Valve Setup: See also 396-3639Y1 SurePoint Spartan and JDRC 2000.

PWM CLOSE Valve Response—10-15 Control Deadband—2% Coil Frequency—100 High Limit—100

Low Limit—10 PWM Startup—10-15 Flowmeter Cal—See Flow Cal chart above: **Flowmeter Units**: **fl.oz.**

Rate Setup: Set **Decimal Shift** at **2**: **for 32 oz/acre, set rate at 0.25 gpa**

RAVEN RCM - Valve Response = 1. If valve is too aggressive: Advanced Tuning : P = 5, S = 0.9.

Valve Response Rate, Low Limit, and PWM Startup can be adjusted if needed for best operation in the field.

If pump will not get down to the desired rate, lower the PWM Low Limit. If pump oscillates and will not lock on to the rate, decrease the Valve Response Rate. If pump is slow to adjust, increase the Valve Response Rate (on GRC, increase the first Valve Calibration digit). Raven RCM Valve Response may need to be as low as 1 or 2.

To test pump, go to **Diagnostics > Tests > select appropriate Product number > Calibrate PWM Limits.**

This test allows you to run the pump without the controller turning off the pump because it doesn't read flow yet.

Run this test. Observe DC(%) and flow (gal/min) as you speed up the pump. The flow may only be 0.1 or 0.2 gal/min. Be careful not to build more pressure than system will handle.

You can also run a **Nozzle Flow Check** with a Test Speed and Test Rate.

On the Run screen, SurePoint recommends putting **DC% (PWM Duty Cycle)** as one of the Display Settings that you can monitor for this product.

Settings for SurePoint Spartan injection pump

Typical settings. Adjust as needed for best performance on your system in the field.

C

SurePoint SENTINEL

Control Speed 100 PWM Minimum 5

Flow Cal—see chart above For 32 oz/acre, enter Rate as 32

SurePoint Commander II

Valve Control Speed (CAL-Control Speed)— (-3) PWM Minimum (Special CAL 3--Area)—5

Flow Cal—see chart above For 32 oz/acre, enter Rate as 32

Trimble Field-IQ Module for FmX

Allowable Error 2% Lower PWM Limit and Minimum Response 5%

Drive Calibration Proportional --5 All other gains 0 (Newer software uses Proportional instead of Integral)

Ag Leader Control

Checkmark in Close Flow Control valve when rate off PWM Gain 311

Zero Flow Offset and PWM Standby 5 Allowable Error 2%

Pro 700 AccuControl

AccuControl Valve Calibration > Advanced Calibration > Integral Gain—0.2 Breakout—2%

Dead Zone—2% Advanced PWM > PWM Minimum—5

ADJUSTMENTS

Valve Control Speed (Gain) , PWM Low Limit (Minimum), and PWM Startup can be adjusted if needed for best operation in the field.

If pump will not get down to the desired rate, lower the PWM Low Limit. At low output, the pump may run at 5% PWM Duty Cycle or less. At higher outputs, the PWM Low Limit can be raised.

If pump oscillates and will not lock on to the rate, decrease the Valve Control Speed (Gain). If pump is slow to adjust, increase the Valve Control Speed (Gain).

Closely monitor the gallons applied and the acres worked for correct flowmeter adjustment. Adjust the flow cal as needed for best accuracy in the field. (If you need to apply more, increase the flow cal. If you need to apply less, decrease the flow cal.)

IMPORTANT - RINSE AND FLUSH

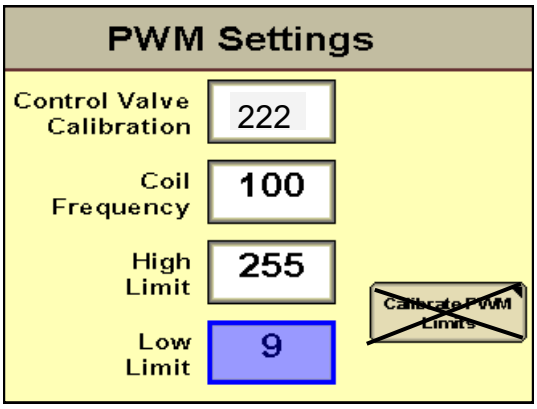
If using a suspension liquid, use constant agitation and FLUSH when you will be stopped for an hour or more. If it is a product that might set up, it can ruin the pump. Install a rinse tank if needed. Only use RV Antifreeze with Force Evo product.

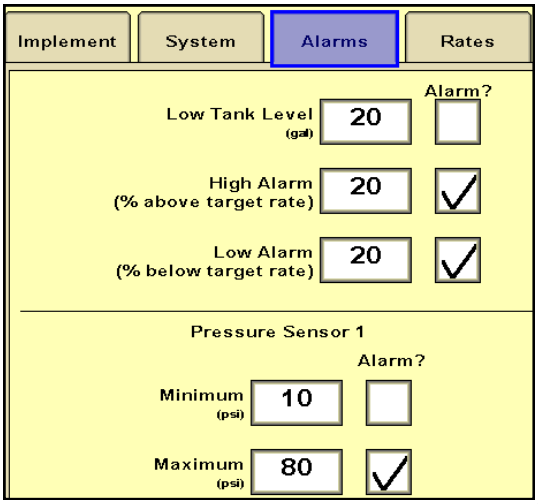
OIL

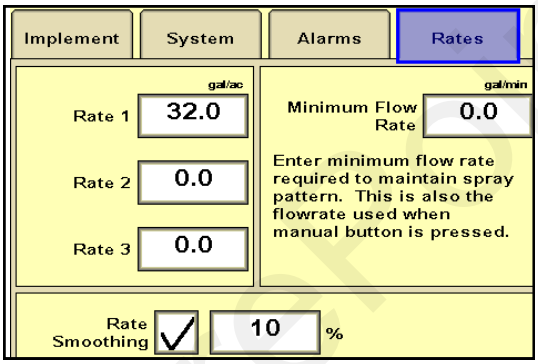
SurePoint uses and recommends Mobil Super 5000 5W-30 oil for the Spartan.

RPM SENSOR, FLOW SWITCH, SIGNAL CONDITIONER

See page 4 for important information on these components of the flow-measuring system. Flow is measured indirectly by using the pump RPM. The positive displacement pump outputs a known amount for each pump revolution. A floating flow switch verifies that liquid is flowing. If the pump is turning, but the float is down, the display will show NO FLOW.







Control Valve Calibration **222 or 322**

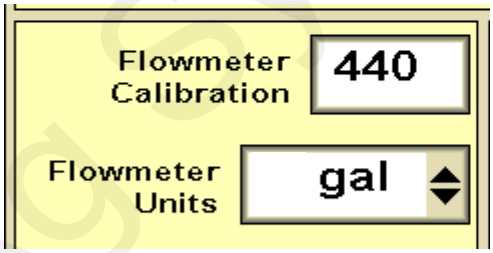
If the system is slow getting to the Target Rate, increase the first digit of the Control Valve Calibration. If the system overshoots above and below the Target Rate, decrease the first digit.

Low Limit **9 (Decrease if pump needs to run slower)**

This must be set here to "jump-start" the pump. If the pump stalls and won't get to rate on start-up, increase this setting 1 digit at a time.

PWM High Limit could be set lower to prevent the pump from running at a high speed. (Most systems will be below 160 on the PWM Duty Cycle.)

*Also on System screen, enter the **flow cal** for the pump you are using. **See the first page of this document for flow cal numbers.** Use the number in the chart, set flowmeter units as Gal. This will cause the controller to measure the output in ounces, even though the screen will say gallons.*



These are suggested settings for **Alarms.**

If using a Pressure Sensor, set the Alarms as shown.

The SurePoint Injector Pump is capable of achieving 290 PSI. Operating pressure should be kept at 80 PSI or less.

Operating pressure with water will typically be less than the pressure that will be experienced with thicker, heavier products.

Rates

Set the desired Rate in **oz/acre** (ignore the gal/ac label on the screen). With the settings shown on this sheet, the flow will be measured and reported in **ounces** (oz/acre, oz/min, etc.).

After the system is plumbed, and the settings shown above have been entered, SurePoint recommends:

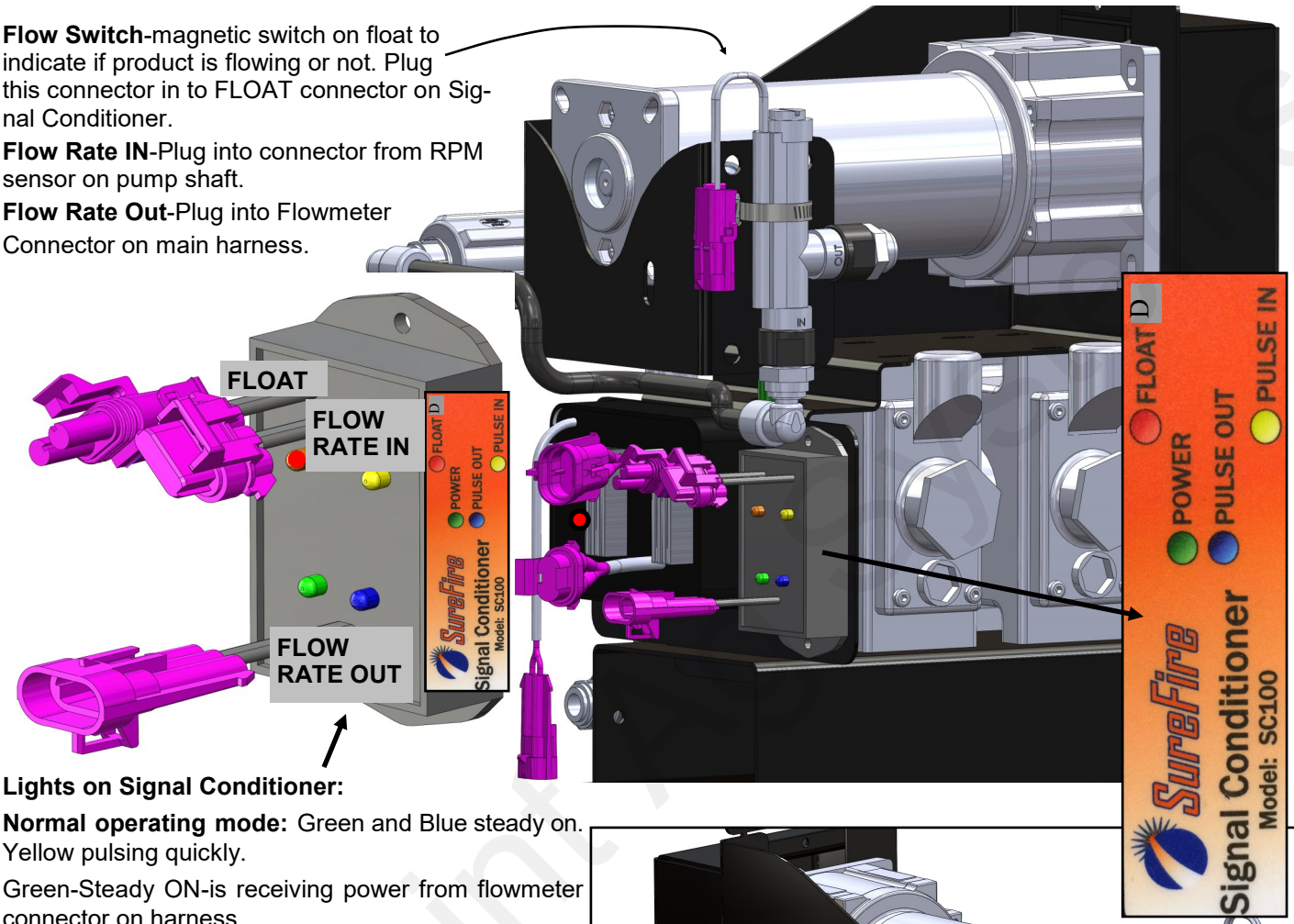
1. Run a **Section Test**. **Diagnostics—Tests—Section Test.** This will verify that you can start the pump and speed it up and slow it down. **Keep the pressure at 80 PSI or less during the Section Test.**
2. Run a **Nozzle Flow Check** with typical operating Rate and Speed to verify that the controller will lock on to the Target Rate. (Enter the Rate in **oz/acre)** You can change the speed to check out various possible operating speeds.
3. Do a **Catch Test** to verify the Flowmeter Calibration. Catch the output from the pump and compare that to what the flowmeter calculated. Adjust the Flowmeter Calibration number as needed. Increase the flow cal if you need to pump more. Decrease the flow cal if you need less.

The flowmeter on the Spartan is a pump RPM sensor that is calibrated to convert the pump RPM to flow measured in oz/min. To be certain that liquid is actually flowing, a flow switch with a floating magnetic switch is in the flow line. If the tank is empty, the float will go down, telling the controller that there is no flow. If the flow switch malfunctions and tells the controller there is no flow when there is flow, you can run the system without the flow switch by unplugging the flow switch and plugging in the jumper connector to the Float connection on the Signal Conditioner.

Flow Switch-magnetic switch on float to indicate if product is flowing or not. Plug this connector in to FLOAT connector on Signal Conditioner.

Flow Rate IN-Plug into connector from RPM sensor on pump shaft.

Flow Rate Out-Plug into Flowmeter Connector on main harness.



Lights on Signal Conditioner:

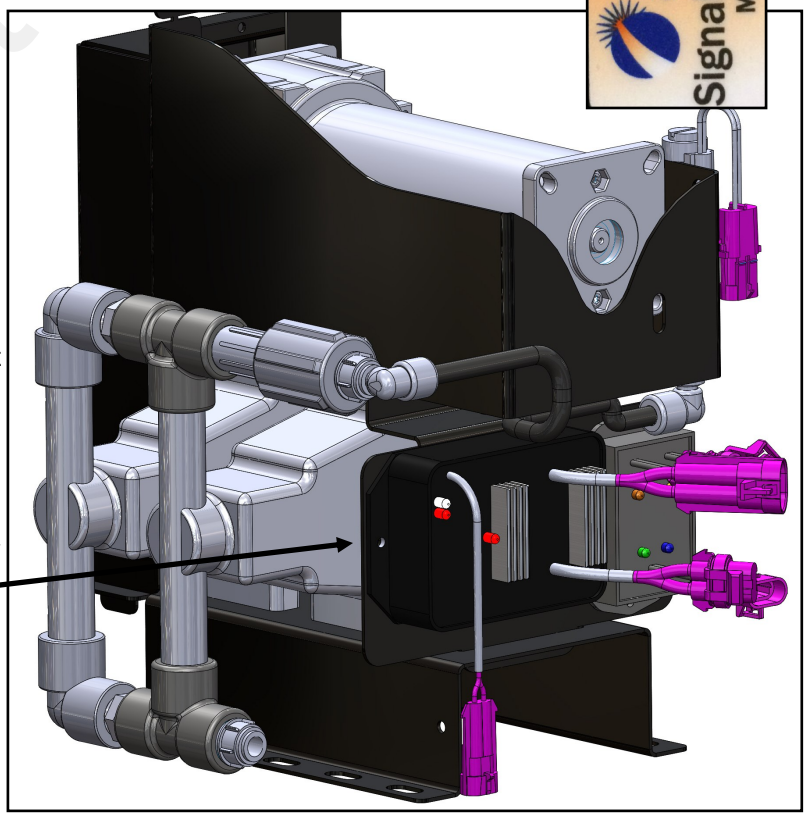
Normal operating mode: Green and Blue steady on. Yellow pulsing quickly.

Green-Steady ON-is receiving power from flowmeter connector on harness.

Blue– should be ON when system is running. Indicates Signal Conditioner is sending out pulses to controller.

Yellow—Quick pulses while system is running indicates it is receiving pulses from the RPM sensor on the pump shaft.

Red-should be OFF. Red light ON indicates that float is down or is malfunctioning if fluid is flowing. Red light ON means no pulses are being sent to the controller. (When Red light first comes ON, pulses will be sent for about 10 seconds). To bypass the float (Flow Switch) unplug Flow Switch connector from Float connector on Signal Conditioner, and plug jumper into Float connector. Red light should go out.



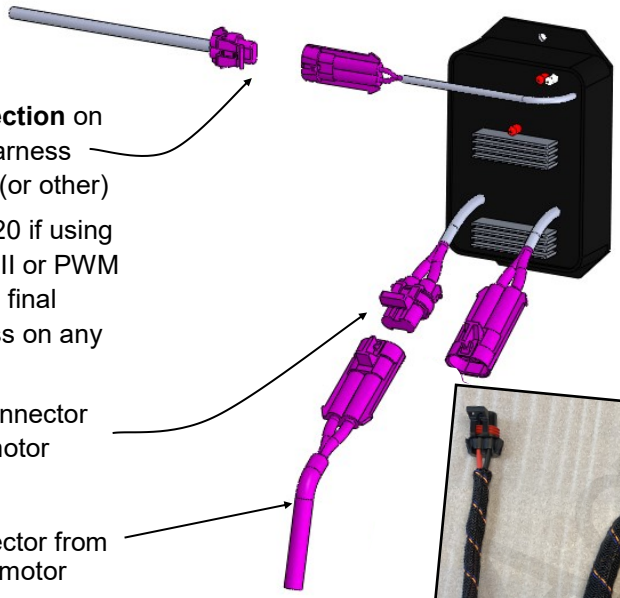
Lights on EPD module:

Red light by fins-steady blink (once per second) indicates power from battery. When system is running, this light goes steady red, and red light in corner turns on (maybe not as bright) indicating PWM signal.

40 Amp PWM EPD
(Pulse Width Modulated Electric Pump Driver)
Item Number: 205-18385 (replaces 205-18007 and -18120)

C

The Electric Pump Driver powers the electric pump by providing a pulse width modulated signal to control pump speed. It needs to have a power connection and wiring capable of carrying up to 40 amps of current. **It must be connected directly to the tractor battery.** SurePoint recommends 10 gauge wire (or heavier) if extending harnesses in the field.



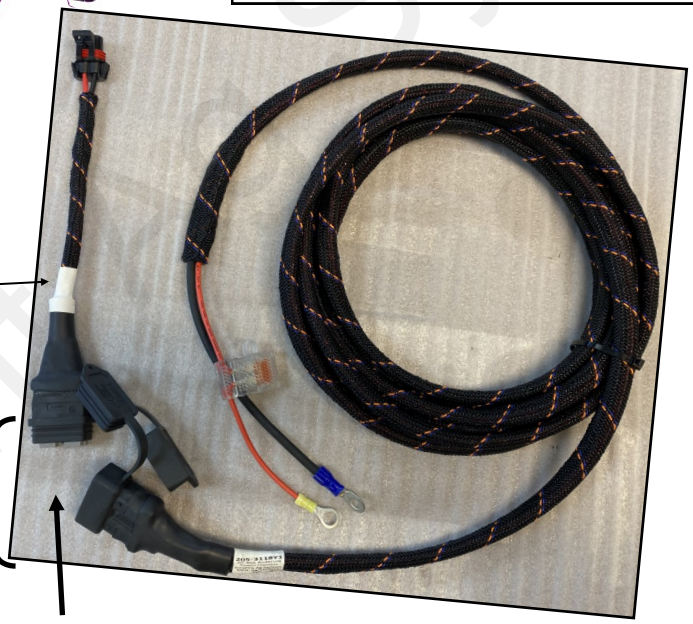
PWM Connection on pump final harness 207-3461Y2 (or other)

(200-03-18220 if using Commander II or PWM connector on final pump harness on any controller)

Plugs into connector from pump motor

Connector from pump motor

Troubleshooting Tip:
The LED in the center above the fins should have a slow steady blink (once per second) when the EPD is receiving power from the battery. When the pump is turned on, this light should go steady red, and there should be a red light (PWM signal) in the corner.
The center light will go off after 5 minutes of inactivity.



Adapter 201-3130Y1

There may be an extension from the hitch to the pump

Troubleshooting Tip:
If the pump won't run, connect the power and pump connector directly together to give pump full 12 volts directly from battery. This will tell you if the pump is the problem or if something else is wrong. The pump will be running at full speed, so don't leave them connected this way for long. Disconnect pump outlet hose so high pressure does not cause damage.

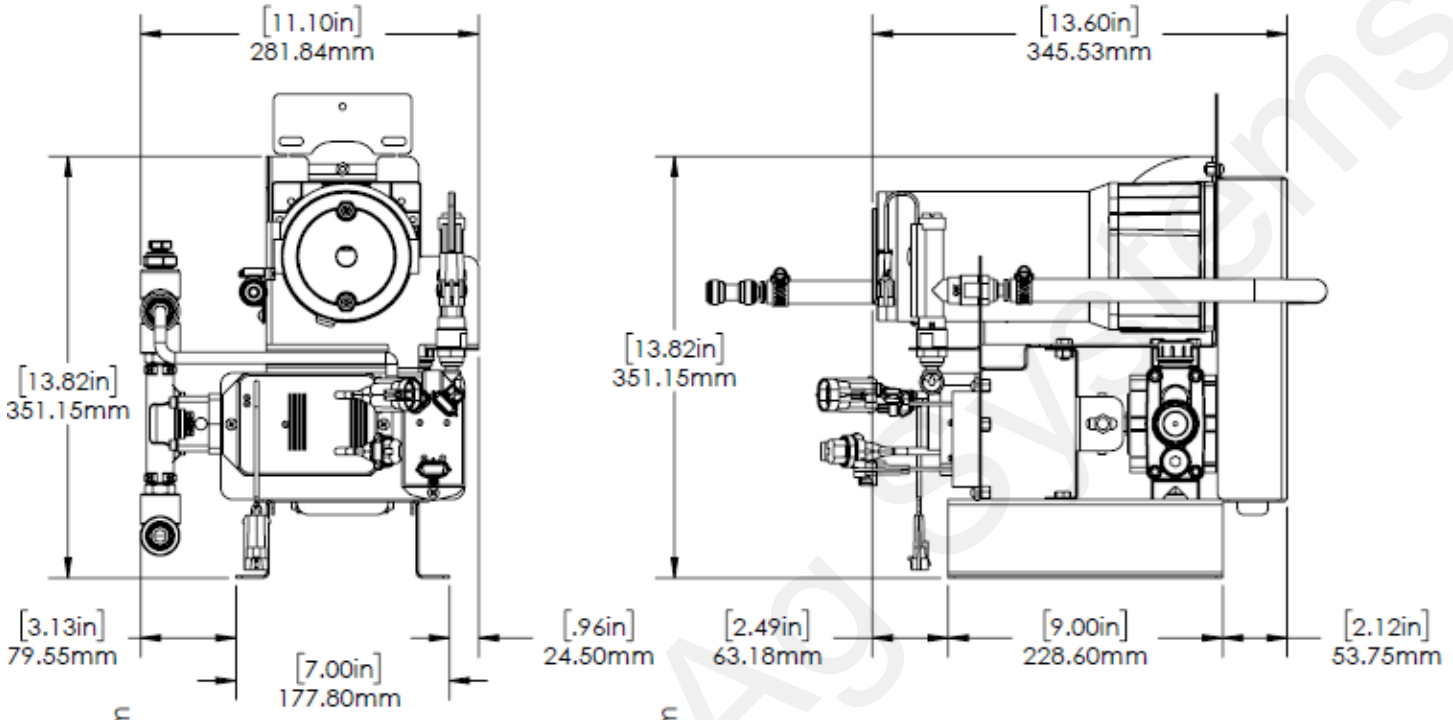
Use EPD **Power Harness Extensions** as needed

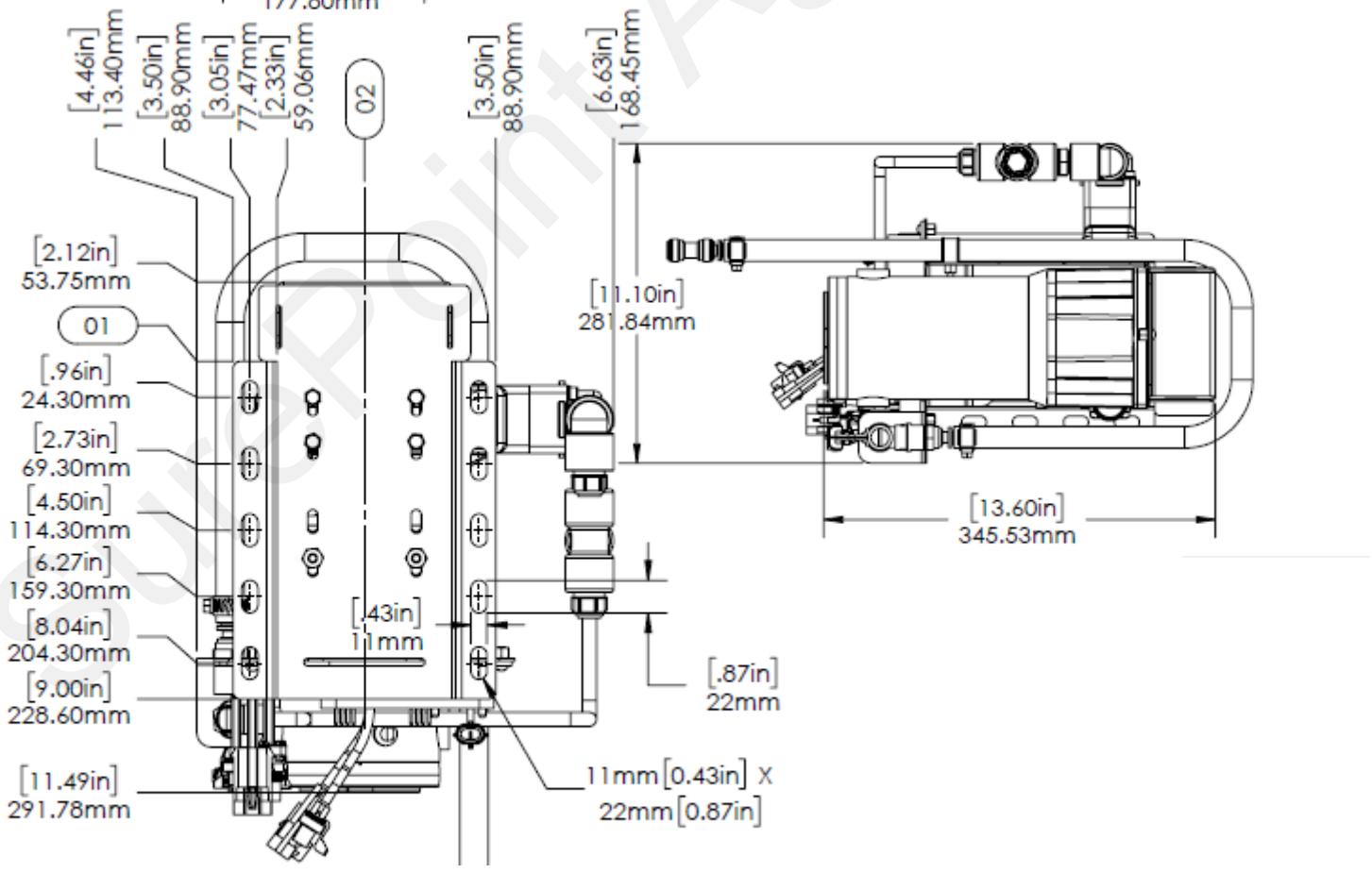
(These have Anderson Connectors)		Wire Size
206-02-3120Y1	1' Extension	10 gauge
206-02-3121Y1	5' Extension	10 gauge
206-02-3122Y1	10' Extension	8 gauge
206-02-3123Y1	20' Extension	8 gauge
206-02-3124Y1	30' Extension	30' and longer—6 gauge
206-02-3125Y1	40' Extension	
206-02-3126Y1	50' Extension	
206-02-3127Y1	60' Extension	
206-02-3128Y1	2' Anderson Ext w/ Power Switch-8 AWG	

SurePoint recommends a single long extension harness as multiple connectors will reduce voltage, increase current and hurt performance of your electric pump system.

Spartan 115
Overall Dimensions

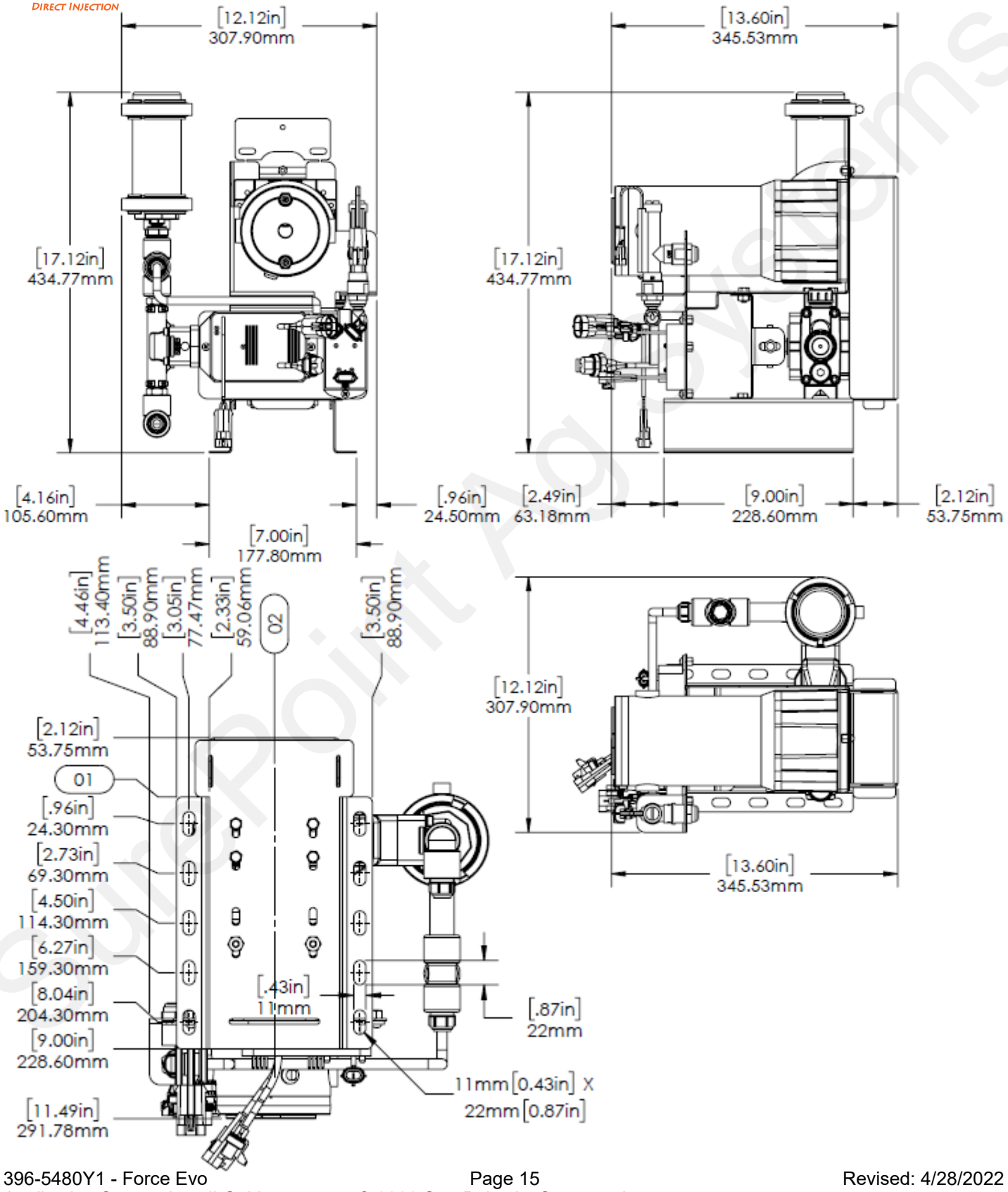
D





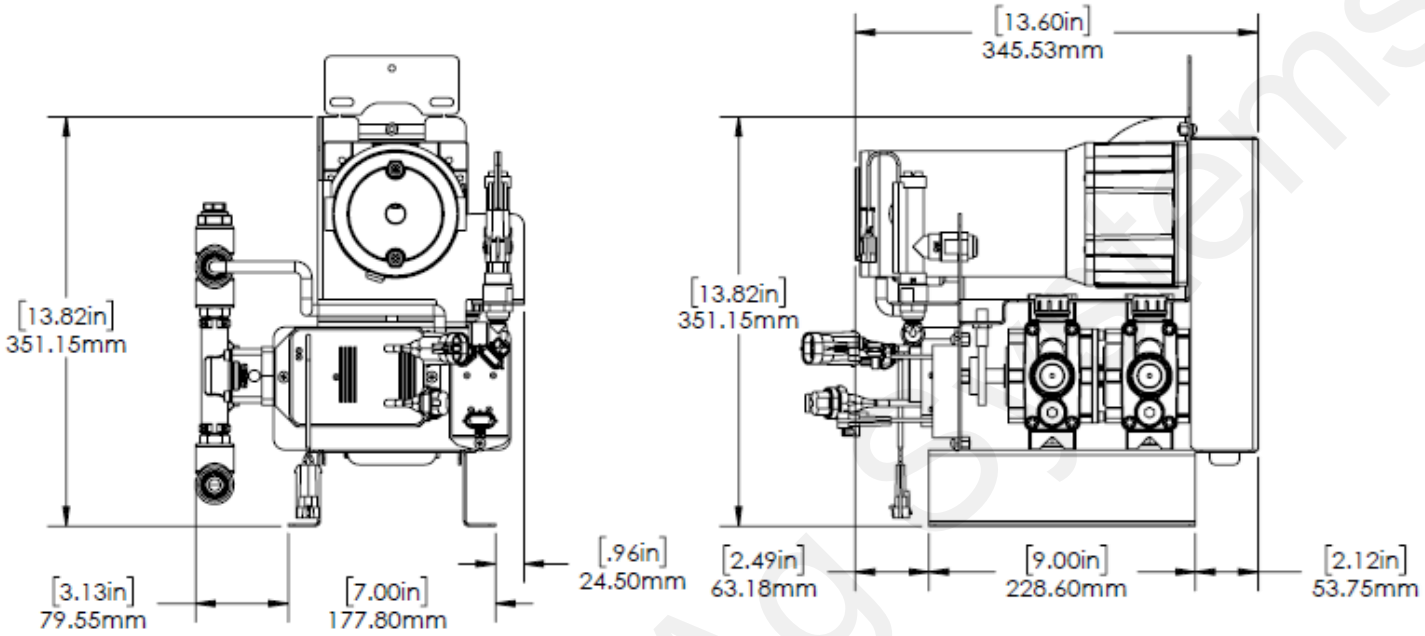
Spartan 125 & 135
Overall Dimensions

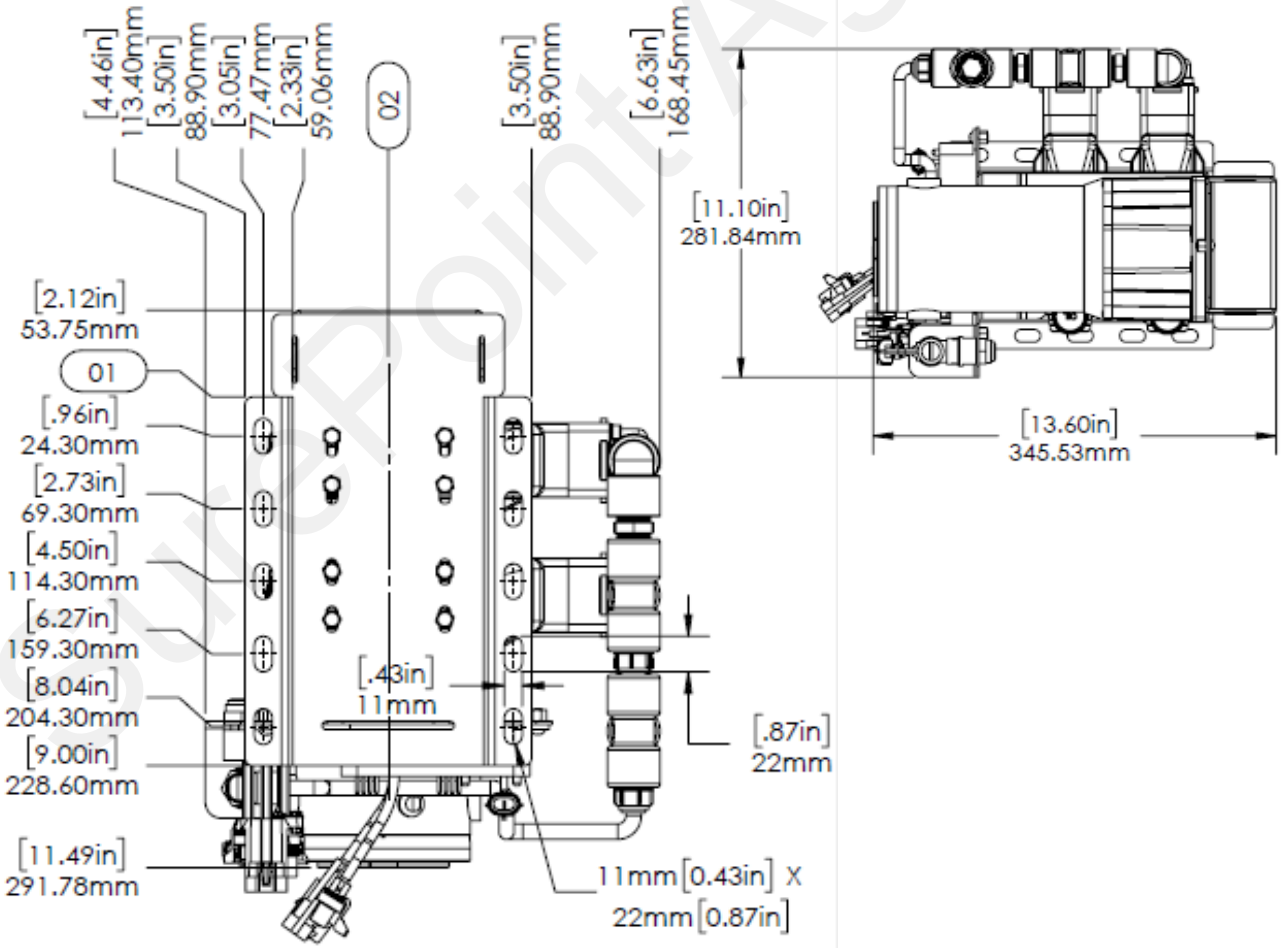
D



Spartan 145
Overall Dimensions

D





Spartan 115
Assembly and Parts Breakdown

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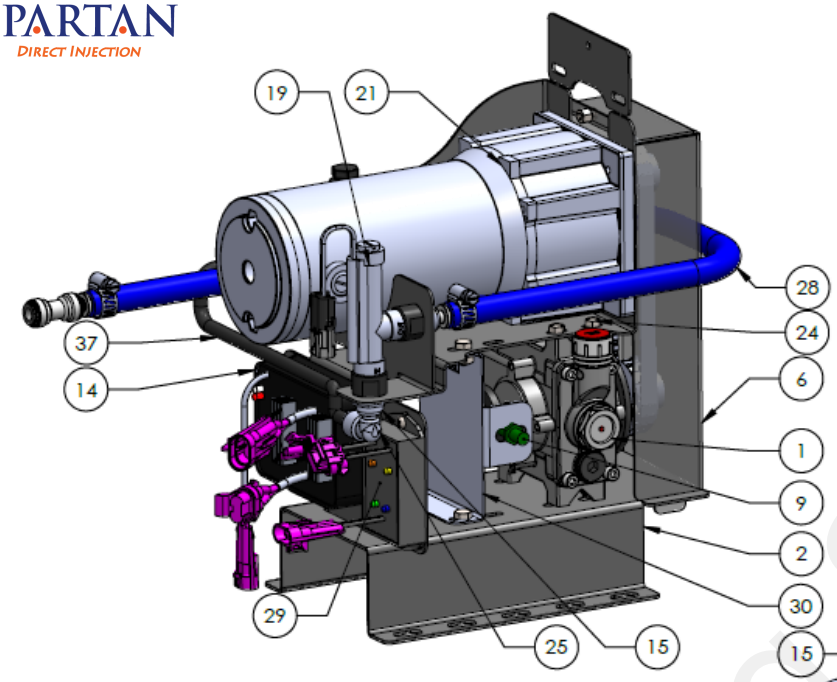

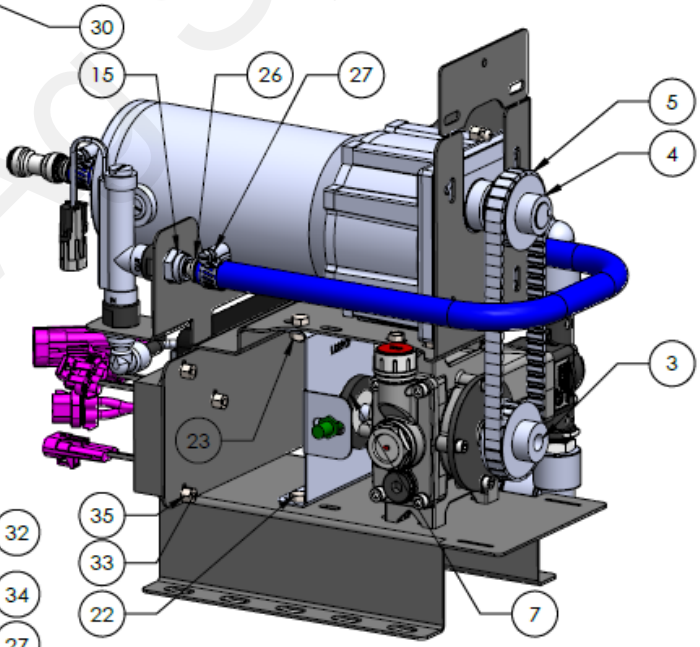

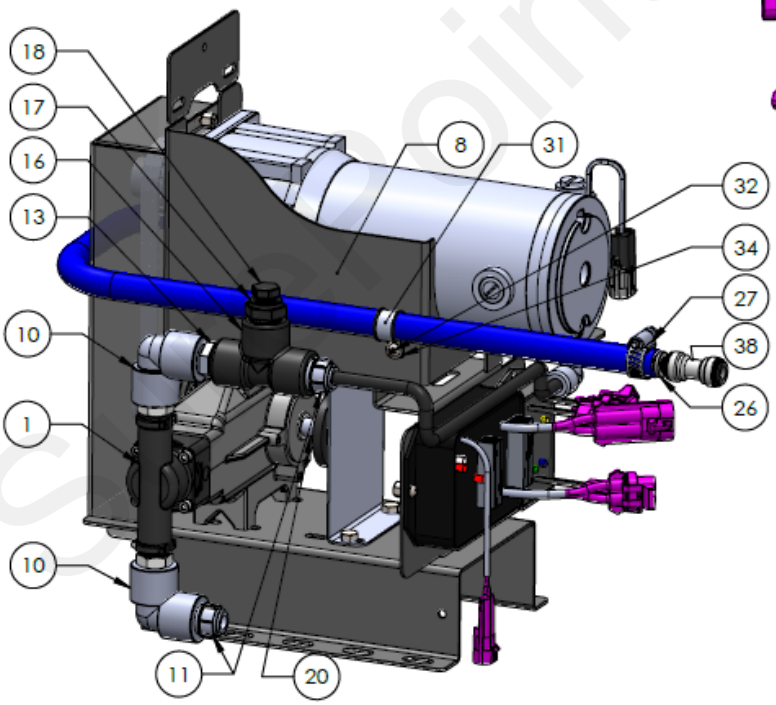

Spartan 115
Assembly and Parts Breakdown

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	290-10-52.0000.20	Plunger Metering Pump	1
2	470-2065A1	Base Sheet Metal	1
3	367-A 6Z 4M16DF12512	12mm ID Timing Pulley 16 Teeth	1
4	367-A 6Z 4-16DF050020	5/8" ID Timing Pulley 16 Teeth	1
5	367-187L050	187L050 18.5" Timing Belt	1
6	470-2067A1	Belt Sheild Sheet Metal	1
7	204-04-P32B25R32	P32B25R32 Modified with 12mm ID, 32 pulse Target	1
8	470-2066A1	Motor Mount Sheet Metal	1
9	203-01-13096	Hall-effect Flow Sensor Cable 5'	1
10	100-050EL-90	1/2" Pipe Elbow	2
11	113-06-0038050-P	QC to MPT - 3/8" QC x 1/2" MPT	2
12	201-2119Y1	Injection Pump Flow Wiring Harness	1
13	100-050NIP-SH	1/2" Short Nipple	1
14	205-18385	PWM EPD with MP480 Connectors	1
15	113-06-038025-P	QC to MPT - 3/8" QC x 1/4" MPT	2
16	100-050TEE	1/2" TEE	1
17	100-050025RB	1/2" MPT x 1/4" FPT Reducer Bushing	1
18	100-025PLUG	1/4" Pipe Plug	1
19	204-06-3381Y1	Spartan Flow Switch (2-80 oz/min)	1
20	383-1439K411-ONE Pump	Keyway Target Shaft - 12mm	1
21	756-7930-7513	Gear Motor 5/8" Shaft - 76.2 in/lb - 12 VDC - 16.24 Amps	1
22	300-040008-5	1/4" x 1/2" Hex Head Bolt-G5	4
23	323-04	1/4" Flange Nut	4
24	300-M610MM-SS	M6 x 10MM Hex Head Bolt - SS	8
25	113-12-038038-P	Stem Elbow - 3/8" Stem x 3/8" QC	1
26	113-01-038050-P	Stem to HB - 3/8" Stem x 1/2" HB - Polypropylene	2
27	350-0605	SS Hose Clamp - Size 6 - 7/8" Diameter	2
28	284-050-A4086-48in	1/2" Blue Chem Hose - 300PSI - 48"	1
29	204-01-4208Y1	Assembled Signal Conditioner - 16 pulse avg (2 PIN WP Tower - Compac Flow Switch)	1
30	470-4168Y1	RPM Sensor Bracket	1
31	352-11EPDM	EPDM Clamp	1
32	340-100012	Machine Screw - Size 10 x 3/4"	1
33	340-100008-24	Machine Screw - Size 10 x 1/2" - 24 Thread Count	5
34	330-1024	Size 10 Flat Washer	1
35	321-1024	Size 10 Nylock Nut 24 Threads	6
36	470-3359Y1-SS	Cam - 2.1375mm (3-20 oz/min)	1
37	281-038-Spartan115	3/8" Tubing x 12" Long	1
38	113-14-038038	QC to QC - 3/8" QC x 3/8" QC	1

Spartan 125 & 135
Assembly and Parts Breakdown

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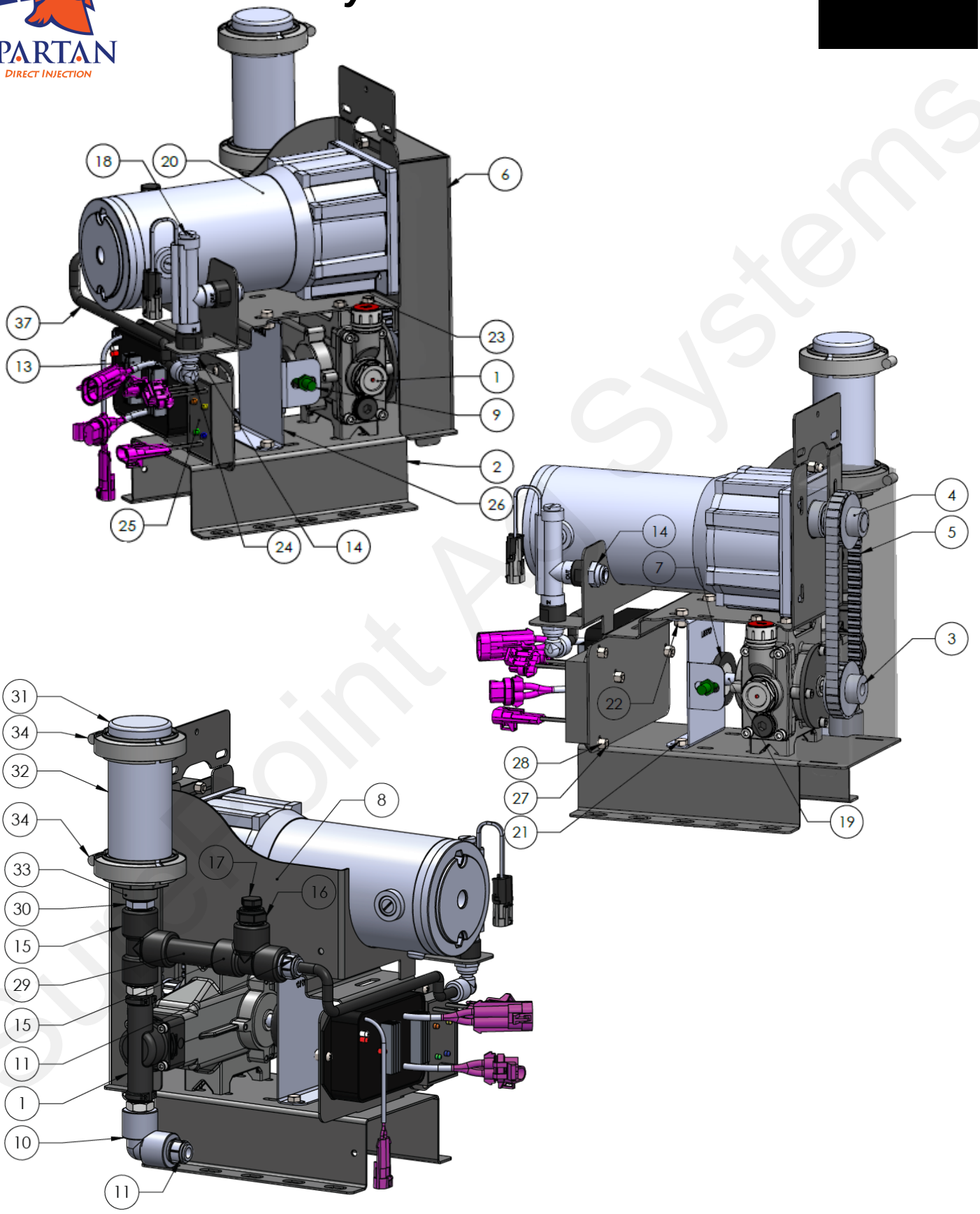

Spartan 125 & 135
Assembly and Parts Breakdown

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	290-10-52.0000.20	Plunger Metering Pump	1
2	470-2065A1	Base Sheet Metal	1
3	367-A 6Z 4M16DF12512	12mm ID Timing Pulley 16 Teeth	1
4	367-A 6Z 4-16DF050020	5/8" ID Timing Pulley 16 Teeth	1
5	367-187L050	187L050 18.5" Timing Belt	1
6	470-2067A1	Belt Sheild Sheet Metal	1
7	204-04-P32B25R32	P32B25R32 Modified with 12mm ID, 32 pulse Target	1
8	470-2066A1	Motor Mount Sheet Metal	1
9	203-01-13096	Hall-effect Flow Sensor Cable 5'	1
10	100-050EL-90	1/2" Pipe Elbow	1
11	113-06-0038050-P	QC to MPT - 3/8" QC x 1/2" MPT	2
12	201-2119Y1	Injection Pump Flow Wiring Harness	1
13	205-18385	PWM EPD with MP480 Connectors	1
14	113-06-038025-P	QC to MPT - 3/8" QC x 1/4" MPT	2
15	100-050TEE	1/2" TEE	2
16	100-050025RB	1/2" MPT x 1/4" FPT Reducer Bushing	1
17	100-025PLUG	1/4" Pipe Plug	1
18	204-06-3381Y1	Spartan Flow Switch (2-80 oz/min)	1
19	383-1439K411-ONE Pump	Keyway Target Shaft - 12mm	1
20	756-7930-7513	Gear Motor 5/8" Shaft - 76.2 in/lb - 12 VDC - 16.24 Amps	1
21	300-040008-5	1/4" x 1/2" Hex Head Bolt-G5	4
22	323-04	1/4" Flange Nut	4
23	300-M610MM-SS	M6 x 10MM Hex Head Bolt - SS	8
24	113-12-038038-P	Stem Elbow - 3/8" Stem x 3/8" QC	1
25	204-01-4208Y1	Assembled Signal Conditioner - 16 pulse avg (2 PIN WP Tower - Compac Flow Switch)	1
26	470-4168Y1	RPM Sensor Bracket	1
27	340-100008-24	Machine Screw - Size 10 x 1/2" - 24 Thread Count	5
28	321-1024	Size 10 Nylock Nut 24 Threads	5
29	100-050NIP-3	1/2"X3" Nipple	1
30	100-050NIP-SH	1/2" Short Nipple	1
31	105-200PLG	2" Manifold Plug	1
32	105-200CPG	2" X 2" STANDARD PORT FLANGE	1
33	105-200PLG050	2" Manifold Plug x 1/2" FPT	1
34	105-FC200	2" Manifold Clamp	2
35	105-150G-V	1 1/2" EPDM Gasket - Viton	2
36	470-2266Y1	Spartan 125 Cam - 4.275mm	1
37	281-038-Spartan125-135	3/8" Tubing x 12" Long	1

Spartan 145
Assembly and Parts Breakdown

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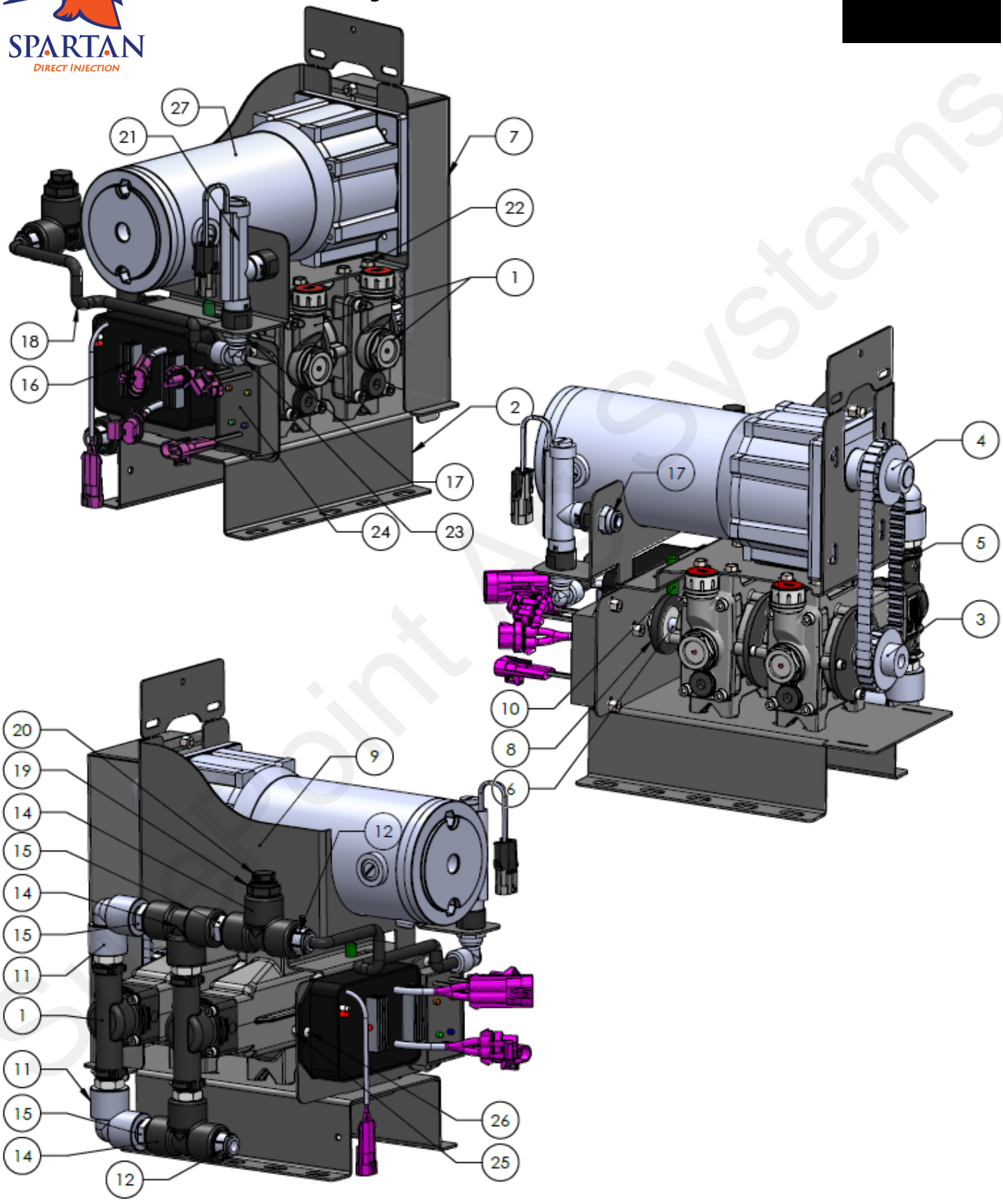

Spartan 145
Assembly and Parts Breakdown

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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	290-10-52.0000.20	Plunger Metering Pump	2
2	470-2065A1	Base Sheet Metal	1
3	367-A 6Z 4M16DF12512	12mm ID Timing Pulley 16 Teeth	1
4	367-A 6Z 4-16DF050020	5/8" ID Timing Pulley 16 Teeth	1
5	367-187L050	187L050 18.5" Timing Belt	1
6	383-1439K411	Keyway Target Shaft - 12mm	1
7	470-2067A1	Belt Sheild Sheet Metal	1
8	204-04-P32B25R32	P32B25R32 Modified with 12mm ID, 32 pulse Target	1
9	470-2066A1	Motor Mount Sheet Metal	1
10	203-01-13096	Hall-effect Flow Sensor Cable 5'	1
11	100-050EL-90	1/2" Pipe Elbow	2
12	113-06-0038050-P	QC to MPT - 3/8" QC x 1/2" MPT	2
13	201-2119Y1	Injection Pump Flow Wiring Harness	1
14	100-050TEE	1/2" TEE	3
15	100-050NIP-SH	1/2" Short Nipple	3
16	205-18385	PWM EPD with MP480 Connectors	1
17	113-06-038025-P	QC to MPT - 3/8" QC x 1/4" MPT	2
18	281-038-Spartan	3/8" Tubing x 12" Long	1
19	100-050025RB	1/2" MPT x 1/4" FPT Reducer Bushing	1
20	100-025PLUG	1/4" Pipe Plug	1
21	204-06-3381Y1	Spartan Flow Switch (2-80 oz/min)	1
22	300-M610MM-SS	M6 X 10MM Hex Head Bolt - SS	16
23	113-12-038038-P	Stem Elbow - 3/8" Stem x 3/8" QC	1
24	204-01-4208Y1	Assembled Signal Conditioner - 16 pulse avg (2 PIN WP Tower - Compac Flow Switch)	1
25	321-1024	Size 10 Nylock Nut	5
26	340-100008-24	Machine Screw - Size 10 x 1/2" - 24 Thread Count	5
27	756-7930-7513	Gear Motor 5/8" Shaft - 76.2 in/lb - 12 VDC - 16.24 Amps	1

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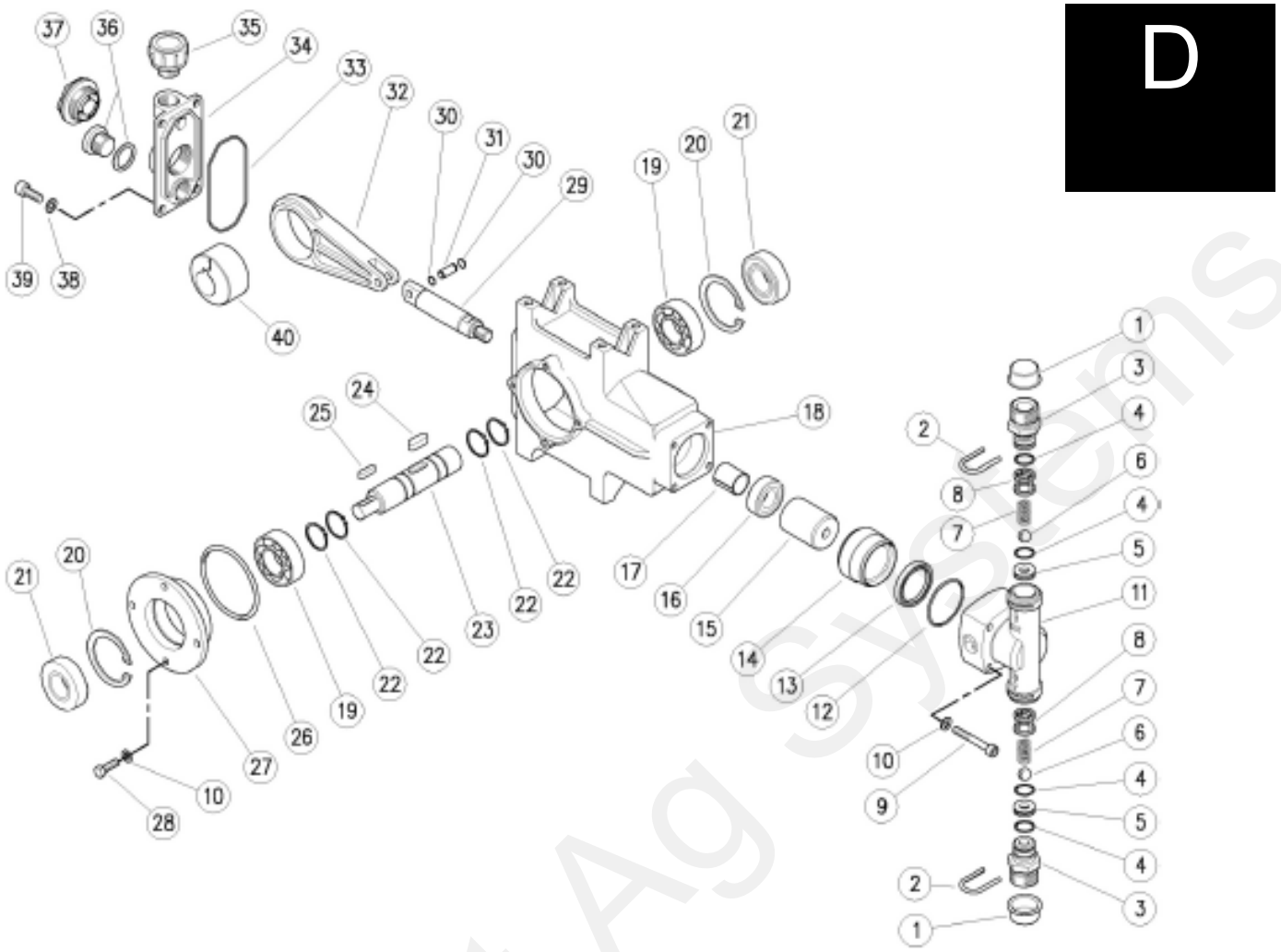

Pos.	P/N	Description	Q.ty	K1	K2	K3	K4	
1	15.3700.00	Plug, 20,5 mm pvc	2					10
2	29.0087.51	U-bolt, Sst.	2					10
3	52.0016.51	Valve coupl., 1/2M Bsp Sst.	2					1
4	10.3060.18	O-ring, 1,78x12,42 mm EPDM	4	•				5
5	52.0012.51	Seat, 7x15,9x4,5 mm Sst.	2		•			1
6	14.7443.25	Ball, 11/32" Sst. Aisi 316	2		•			5
7	52.0010.51	Spring, 0,3x7,1x7,5 mm Sst.	2		•			1
8	25.1337.84	Ball cage	2		•			1
9	16.1869.35	Screw, DIN912 M5x35 mm z.pl.	4					5
10	14.3560.61	Washer, 5,3x10x1 mm	8					10
11	52.0015.84	Pump head, PA black	1					1
12	10.3079.10	O-ring, 1,78x34,65 mm EPDM	1	•				10
13	10.2028.00	Stem seal, 28x34,2x4,2 mm	1	•				4
14	52.0011.81	Bushing, 28mm POM	1					1
15	52.0008.51	Plunger, 28 mm	1					1
16	10.2016.30	Seal ring, 16x30x7 mm	1	•				3
17	10.4216.18	Bushing, DU 16x18x20 mm	1					5
18	52.0014.44	Pump housing, alum.	1					1
19	11.4320.42	Ball-bearing, 20x42x12 mm	2					2
20	10.1042.00	Snap ring, I 42	2					5
21	10.2020.42	Seal ring, 20x42x7 mm	2	•				3

Pos.	P/N	Description	Q.ty	K1	K2	K3	K4	
22	10.1020.00	Snap ring, E 20	4					5
23	52.0005.61	Pump shaft	1					1
24	12.3006.18	Feather, 6x6 mm	1					5
25	12.3004.16	Feather, 4x4 mm	1					5
26	10.3080.00	O-ring, 1,78x56,87 mm	1	•				5
27	52.0002.41	Case flange, alum.	1					1
28	16.1871.14	Screw, DIN933 M8x14 mm z.pl.	4					10
29	52.0007.61	Plunger shaft	1					1
30	10.0956.00	Snap ring, E 6	2					5
31	52.0006.61	Plug, 6x20mm	1					1
32	52.0003.34	Pump connecting rod, alum.	1					1
33	10.3081.63	O-ring, 1,78x63,22 mm	1	•				10
34	52.0001.44	Coperchio alum. per carter	1					1
35	15.3725.00	Oil plug 3/8" Bsp+seal	1					5
36	15.3738.10	Oil plug 3/8" Bsp+seal	1					5
37	15.3734.00	See-through oil plug 3/4" Bsp+seal	1					5
38	14.3568.00	Washer, 6,4x11x1 mm	4					10
39	16.1888.00	Screw, DIN912 M6X16 mm z.pl.	4					10
40	52.0004.61	Cam ring	1					1
40	52.0004.61	Cam ring (1)	1					1

Kit	P/N	Description	
K1	52.0018.24	Pump Seals-Kit, 28mm 7x1pcs.	1
K2	52.0021.24	Spares-kit, suct.+deliv. valves,4x1pcs.	1

(1) 52.0000.02