

RAVEN

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Installation & Operation Manual



Sidekick Pro™

1 to 40 oz./min. & 5 to 200 oz./min.

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CHAPTER

1

Important Safety Information

NOTICE

Read this manual carefully before installing the Raven Sidekick Pro, injection module or any other system components.

- Follow all safety information presented within this manual.
- Keep safety labels in good condition. Replace missing or damaged safety labels as necessary and verify labels are included on replacement parts or new equipment components. Replacement safety labels are available from any local Raven dealer.
- If you require assistance with any portion of the installation or service of Raven equipment, contact a local Raven dealer for support.

When operating the machine after installing the Raven Sidekick Pro, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate any agricultural equipment while under the influence of alcohol or an illegal substance.
- Determine and remain a safe working distance from obstacles or other individuals. The equipment operator is responsible for disabling the system when a safe working distance has diminished.

Review the operation and safety instructions included with the implement and/or controller.

WARNING

Chemical Handling and Safety

Chemicals used in agricultural applications may be harmful to your health or the environment if not used responsibly. Review the safe, effective, and legal use and disposal of agricultural chemicals with a chemical supplier.

- Always follow safety labels and instructions provided by the chemical manufacturer or supplier.
- Store agricultural chemicals in original containers and do not transfer to unmarked containers or containers used for food or drink. Store chemicals in a secure, locked area away from human or livestock food and keep children away from storage areas.
- Avoid inhaling chemical dust or spray particulate and avoid direct contact with agricultural chemicals. Always wear appropriate personal protective equipment as recommended by the chemical and/or equipment manufacturer. Wash hands and face after using agricultural chemicals and before eating, drinking, or using the rest room.
- Seek medical attention immediately if illness occurs during or shortly after the use of chemicals.
- Fill, flush, calibrate, and decontaminate sprayer systems in an area where runoff will not reach ponds, lakes/streams, livestock areas, gardens, or populated areas. Thoroughly flush or rinse equipment used to mix, transfer, and apply chemicals after use.
- Before servicing any component of the system, thoroughly flush or rinse components with water.
- Improper disposal of waste may threaten the environment and ecology. Dispose of empty containers properly. Triple-rinse empty containers and puncture or crush when disposing. Contact a local environmental or recycling center for additional information.

CAUTION

If the system malfunctions or becomes clogged, stop the engine or pump and relieve pressure from the spraying system before servicing.

Do not operate machinery without instruction and keep equipment in proper working condition. Unauthorized modification to equipment may impair machine function and/or safety and may shorten the working life of equipment.

Wear clothing appropriate for the job being performed and avoid loose fitting clothing while working on or near moving components. Keep long hair away from moving components.

Electrical Safety

Do not reverse power leads. Doing so could cause severe damage to the equipment. Always make sure that the power leads are connected to the correct polarity as marked. Ensure that the power cables are the last cables to be connected.

Remove rings and other jewelry to prevent electrical shorts or entanglement in moving parts.

CHAPTER

2

Introduction

System Overview

The Raven Sidekick Pro injection system is designed to provide efficient and accurate application of liquid chemicals applied from an injection module. Using a separate injection module, or tank, eliminates mixing chemicals and reduces chemical waste, and simplifies equipment care and maintenance.

Sidekick Pro provides connectivity to a Raven CANbus system to allow an existing Raven CAN control console to control the rate of the chemical injection system.

After proper installation and calibration of the injection system and Raven controller, including a set target rate for the carrier and injected chemicals, the operator enables the product control system and the control console will automatically maintain the flow regardless of vehicle speed or active boom sections.

Performance of the Raven injection system relies upon proper installation and maintenance of the complete sprayer system. Please review this manual before installing or operating this system to help ensure proper setup and follow instructions provided for proper care and maintenance of the Raven injection system.

Injection System Components

The Raven injection system consists of:

- Raven CAN based control console and appropriate cabling
- Sidekick Pro injection pump
- In-line mixer
- Cabling required to connect injection system components and existing CANbus
- Check valves

The following Raven CAN control consoles may be used with the injection system

- SCS 4000/5000 Series
- Envizio Pro
- Viper Pro

Sidekick Pro Features

Closed Calibration System

Calibrating chemical injection pumps is necessary for accurate chemical injection applications, however, this process can be messy, is potentially hazardous to the operator, and ecologically problematic. The Sidekick Pro closed calibration system allows the operator to perform calibration or system tests without catching or handling dangerous chemicals.

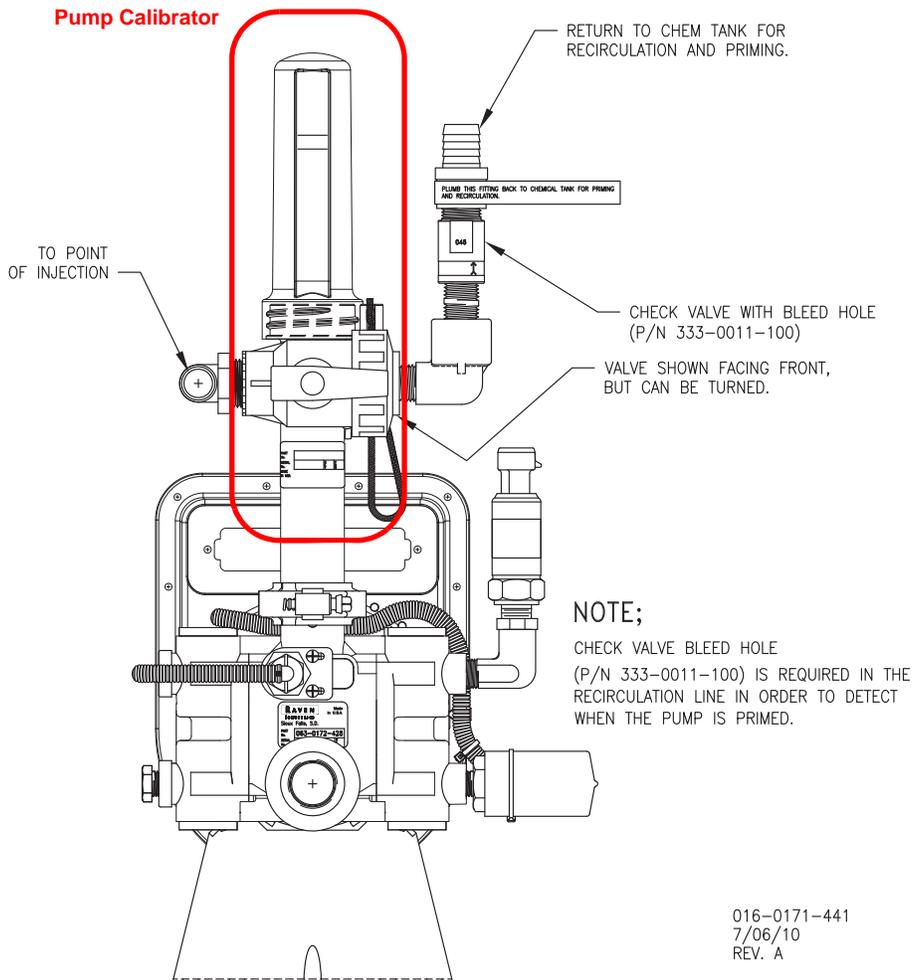
Priming

An automatic priming feature ensures the pump is correctly primed and ready for operation when the operator is ready to apply product.

Pump Calibrator

The pump calibrator provides a quick tool to check pump efficiency and verify that the pump is ready for operation.

FIGURE 1. Pump Calibrator



Integrated Motor Control Node

Sidekick Pro features an integrated motor control node mounted directly on the pump housing for simplified installation and enhanced performance. The control node features status LEDs which provide status and CAN communication information which the operator may be able to use during calibration or system troubleshooting.

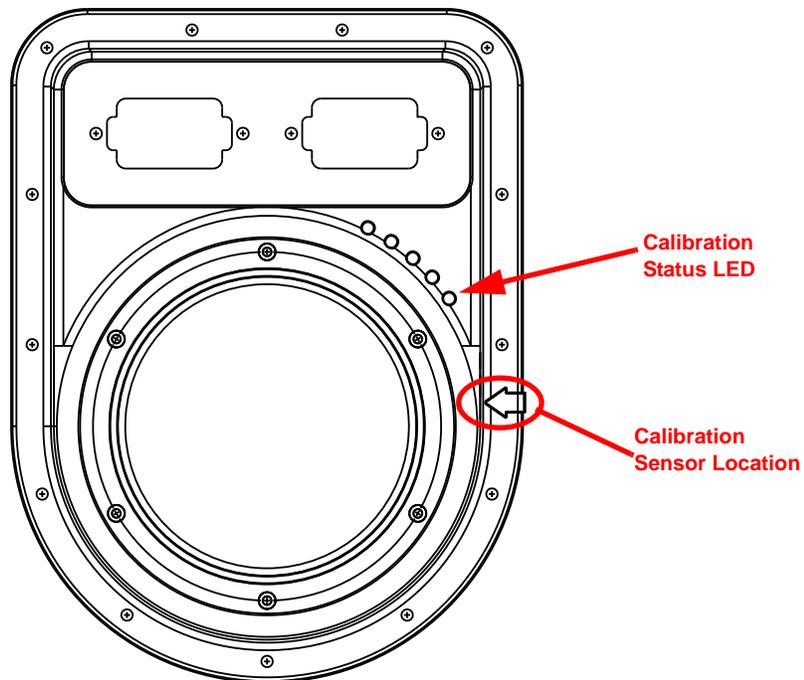
Integrated Calibration Switch

The integrated motor control node also features a sealed calibration switch. The sealed calibration switch allows the operator to begin the pump calibration process by passing a metallic object, such as a screwdriver, across the switch sensor on the Sidekick Pro injection pump. This feature allows the operator to run multiple calibration tests quickly and easily and ensure the system is ready for operation.

Note: Calibration may also be initiated from the control console in the vehicle cab. See the *Calibrate the Injection Pump* section on page 32 for a detailed calibration procedure.

The calibration status LED light will flash when the calibration sensor registers a metallic object by the switch. Pass the metal object past the sensor twice to initiate a pump calibration.

FIGURE 2. Motor Control Node Calibration Sensor



System Diagnostics

Enhanced diagnostic features are monitored by the control console during operation of the Sidekick Pro injection system to help identify potential issues and minimize equipment down time. Refer to Chapter 5, *Setting Application Mode and Injection Diagnostics* for more information on using diagnostics features on a specific console.

Flow Monitoring

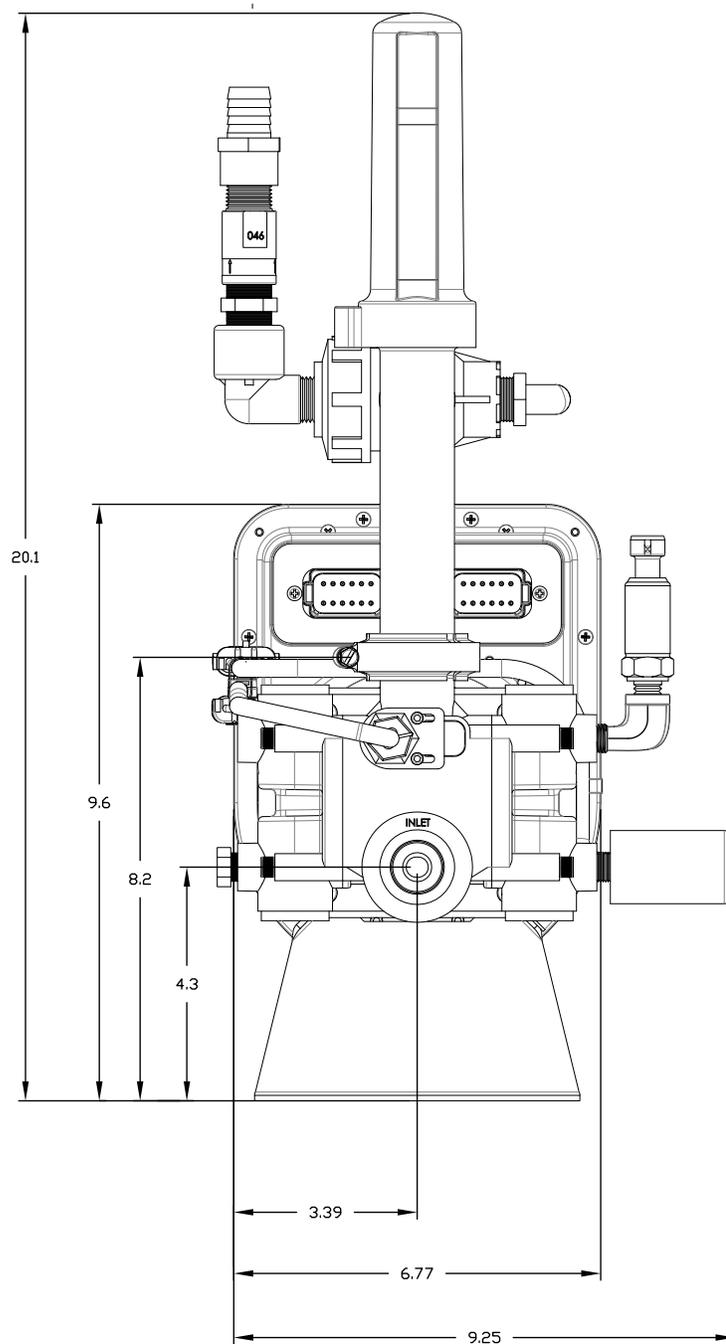
The CAN integrated Sidekick Pro offers enhanced monitoring of pump operation during chemical injection applications to alert the operator to conditions such as an empty chemical supply tank, low injection pressure, incorrect meter calibration, or issues with the injection pump valves.

Sidekick Pro Pump Specifications

The Raven Sidekick Pro injection pump is a positive displacement, variable speed piston pump used for direct chemical injection applications.

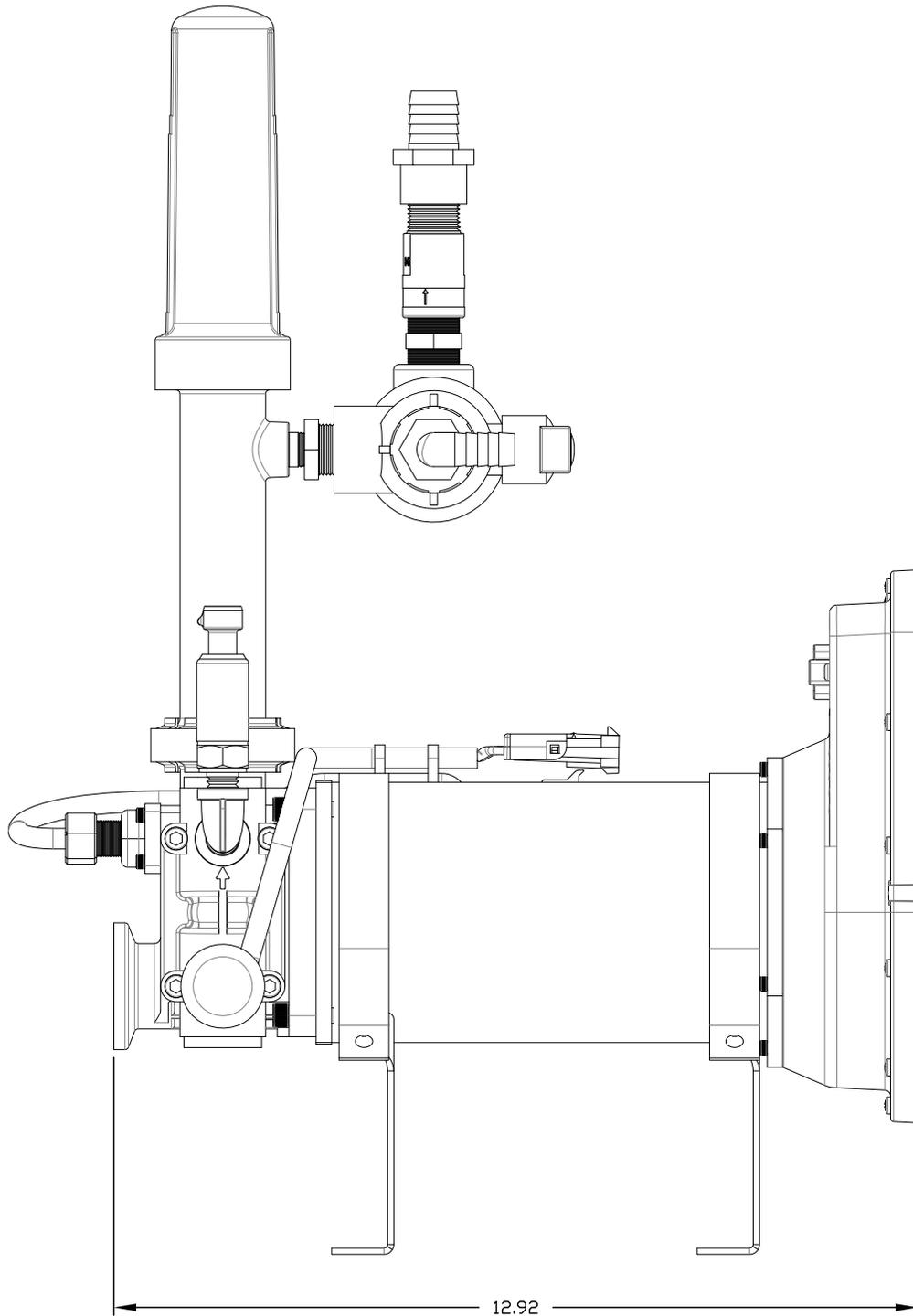
Dimensions	(See Figure 3 on page 7 or Figure 4 on page 8)	
Pistons	1 @ 0.750" Dia.	
Maximum Stroke Length	0.390"	
Flow Output Range	P/N 063-0173-081 5-200 oz./min. [1.5-59 dl/min.]	P/N 063-0173-103 1-40 oz./min. [0.3-11.8 dl/min.]
Maximum Operating Pressure	150 psi	
Maximum Power Required	1/4 HP	
Maximum Recommended Suction Lift	2 ft.	
Inlet and Outlet Plumbing	Mates with Banjo M100 Flange and 3/4" Female NPT	
Wetted Parts	Polypropylene Stainless Steel	
Body Material	Polypropylene	
Wetted Seals/O-Rings	V965-80 Viton and Graphite Filled Teflon	

FIGURE 3. Sidekick Pro Injection Pump Dimensions



Note: 5-200 oz./min. pump shown. Basic dimensions are the same for 1-40 oz./min. pump.

FIGURE 4. Sidekick Pro Injection Pump Dimensions (Cont.)



Note: 5-200 oz./min. pump shown. Overall length of 1-40 oz./min. pump is 13.25 inches [33.66 cm].

CHAPTER

3

Installation

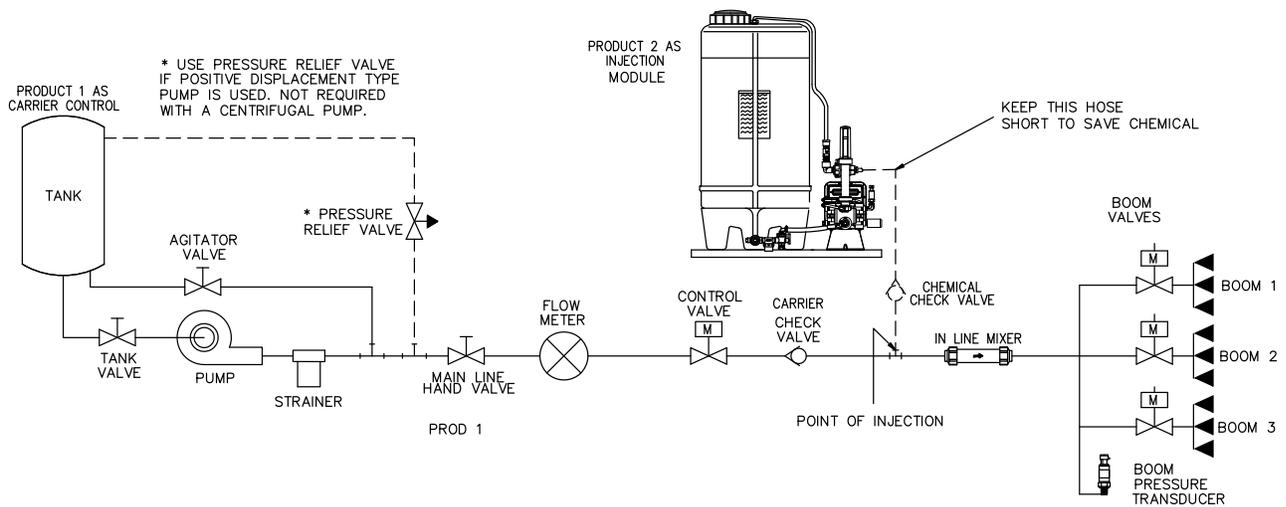
Overview

The following steps must be completed to install a Raven Sidekick Pro injection system:

1. Select and plumb the point of injection. See page 10.
 - a. Install carrier and chemical injection check valves.
 - b. Install in-line mixer.
2. Mount the Sidekick Pro injection module or tank. See page 12.
3. Mount the Sidekick Pro injection pump. See page 13.
4. Plumb the Sidekick Pro pump and injection lines into the main carrier line at point of injection. See page 15.
5. Install the closed calibration system. See page 15.
6. Plumb the recommended rinse system. See page 16.
7. Connect the Sidekick Pro injection pump to CANbus. See page 18.
8. Connect the Sidekick Pro pump to source of electrical power. See page 18.

The following sections provide detailed information and procedure to assist with completing the above steps. Contact a local Raven dealer for assistance or questions during the installation procedure.

FIGURE 1. Example Sidekick Pro Injection System

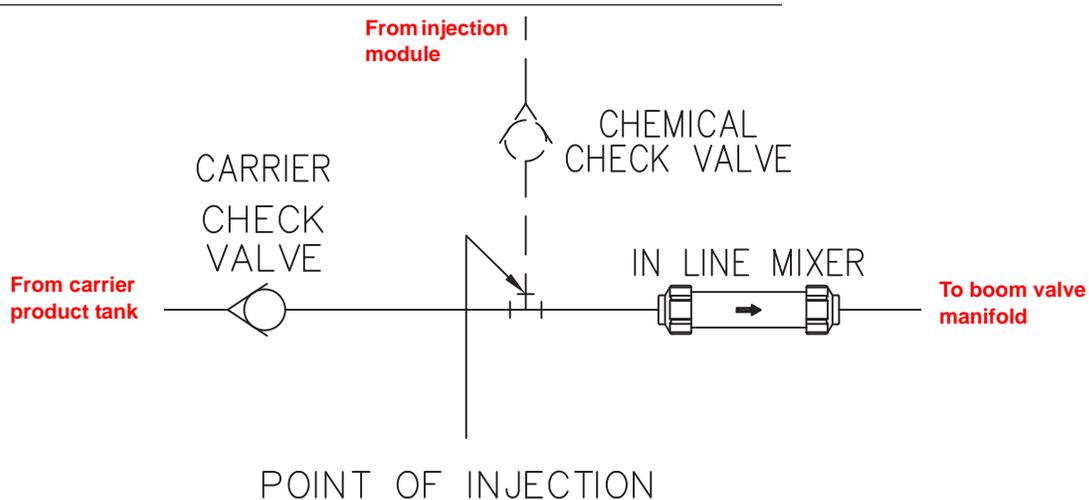


Initial Plumbing and Point of Injection

The Raven Sidekick Pro injection system pumps chemical into the main carrier line at the point of injection. This point must be on the pressure side of the carrier product pump and should be as close to the boom section valves as possible.

Note: *It is not necessary for injected products or chemicals to be measured by the flow meter. Depending upon the type of applications or chemical mixtures the injection system will normally be used with, it may be more desirable to place the injection point after the flow meter. This configuration will minimize the exposure of the flow meter to corrosive chemicals and may extend the life of the flow meter.*

FIGURE 2. Point of Injection Detail

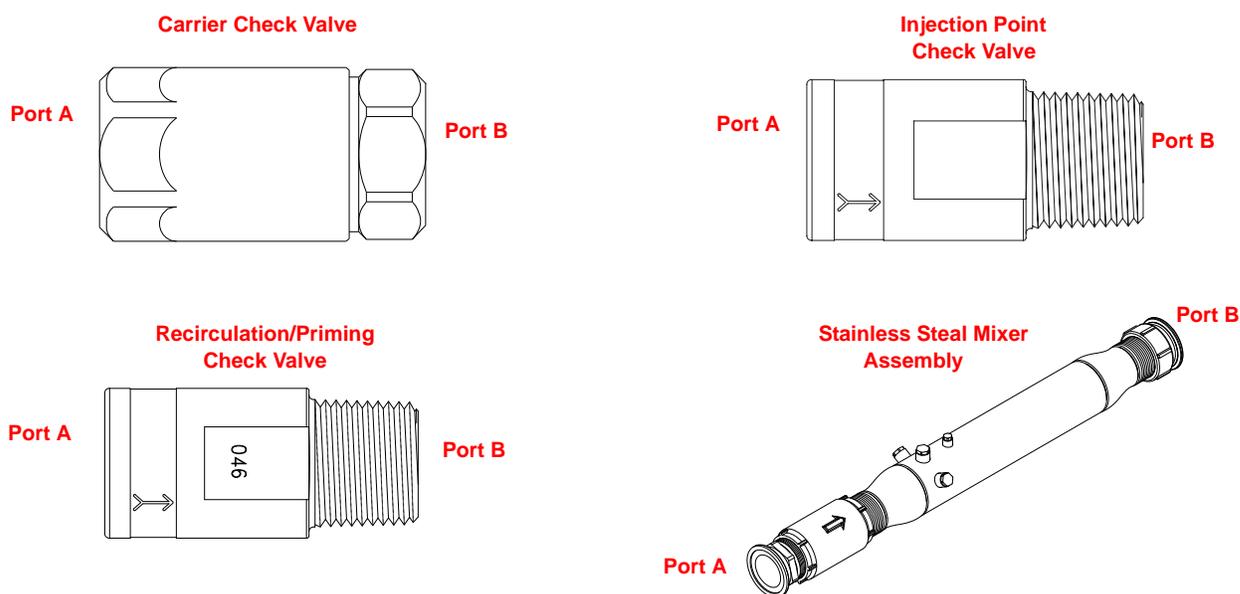


Check valves are used in both the carrier and injection lines to prevent back flow and contamination of carrier and chemical reservoirs. An in-line mixer should be installed after the point of injection to ensure even mixing of the injected product.

Once a point of injection has been selected:

1. Install a carrier check valve in the main product line to prevent back flow to the carrier reservoir. Use Table 1, "Check Valve Sizing and Selection Chart," on page 11 to determine proper sizing of the carrier check valve.
2. Install a tee type fitting suitable for chemical applications after the carrier check valve.
3. Install an in-line mixer to the through port of the tee fitting and connect to the existing carrier product line or boom valve manifold. Use Table 2, "In-line Mixer Sizing and Selection Chart," on page 11 to determine proper sizing of the in-line mixer.
4. Install a chemical injection check valve to the injection line in front of the point of injection to prevent back flow to the chemical reservoir. Use Table 1, "Check Valve Sizing and Selection Chart," on page 11 to determine proper sizing of the carrier check valve.

FIGURE 3. Check Valve Thread



Note: Be sure to install the check valves with the flow direction indicator pointing in the direction of chemical flow.

TABLE 1. Check Valve Sizing and Selection Chart

	Raven Part No.	“A” NPT	“B” NPT
Recirculation and Priming Check Valve ^a	333-0011-100	1/2” (F)	1/2” (M)
Injection Point Check valve 12 PSI [82.74 kPa]	333-0011-098	1/2” (F)	1/2” (M)
Carrier Check Valve	333-0011-090	1”	1”
	333-0011-091	1-1/4”	1-1/4”
	333-0011-093	2”	2”
	333-0011-094	3”	3”
	333-0011-095	4”	4”

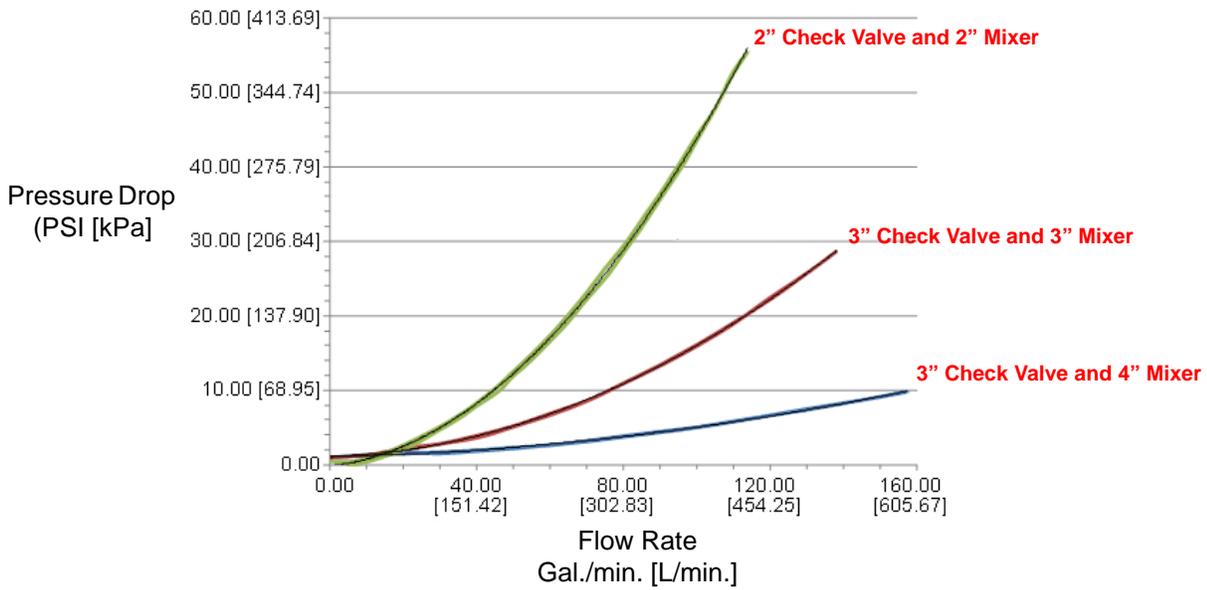
a. Has 0.046” Bleed Hole.

TABLE 2. In-line Mixer Sizing and Selection Chart

	Raven Part No.	“A” NPT	“B” NPT
Polypropylene	063-0171-303	1”	1”
	063-0159-632	1-1/4”	1-1/4”
	063-0171-300	2”	2”
Stainless Steel	333-9000-010	3”	3”
Cast Iron	063-0171-784	1”	1”
Stainless Steel Mixer Assembly ^a	063-0173-264	4”	4”

a. 3” Check Valve and 3” Banjo Flange included in assembly.

FIGURE 4. Pressure Drop vs. Flow Rate



Mount the Sidekick Pro Pump and Chemical Tank

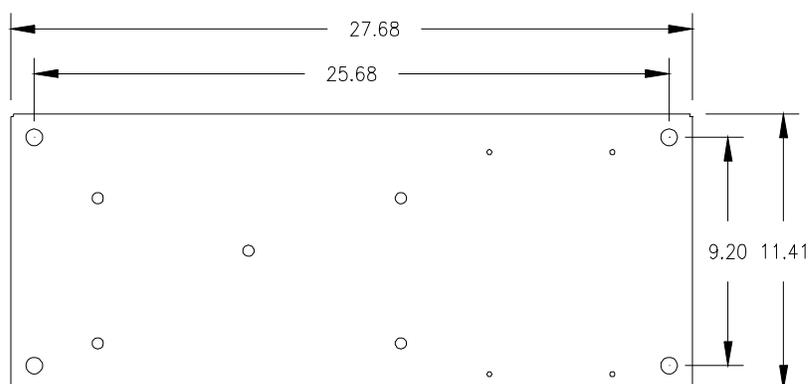
Installation and mounting of the Sidekick Pro injection pump and injection module, or chemical tank, will vary between implements. Use the following sections to help select an appropriate mounting location on the implement.

Mount the Injection Module

The Raven Sidekick Pro injection module provides a platform for mounting the chemical supply tank and Sidekick Pro injection pump in the optimal configuration for pump operation.

Note: *The Raven Sidekick Pro injection module may be ordered with a 24 gallon chemical supply tank or without a chemical tank to connect the injection system with an existing tank on the vehicle or purchased separately.*

FIGURE 5. Injection Module Platform Dimensions



- Mount the injection module platform in an area close to the boom valve manifold. This minimizes the volume of chemical in the injection line between the pump and point of injection and allows for more accurate control of the injected chemical.
- Verify that the hand valves and drain are accessible in the selected mounting location.
- Verify that the injection pump is accessible to perform periodic maintenance.

Mount the Chemical Tank

Note: *If a Raven injection module is used, the supplied platform provides an ideal mounting configuration for the Sidekick Pro injection pump and chemical tank.*

- Mount the chemical tank or injection module as close as possible to the injection pump. Minimize the length of the product line between the chemical tank and injection pump. Avoid any product lines longer than 5 ft. [1.5 m] between the chemical tank and injection pump inlet port.

Note: *Long product lines between the chemical tank and injection pump may cause high vacuum pressures on the pump inlet, long pump priming times or difficulty priming the pump, and larger amounts of chemical waist during rinsing.*

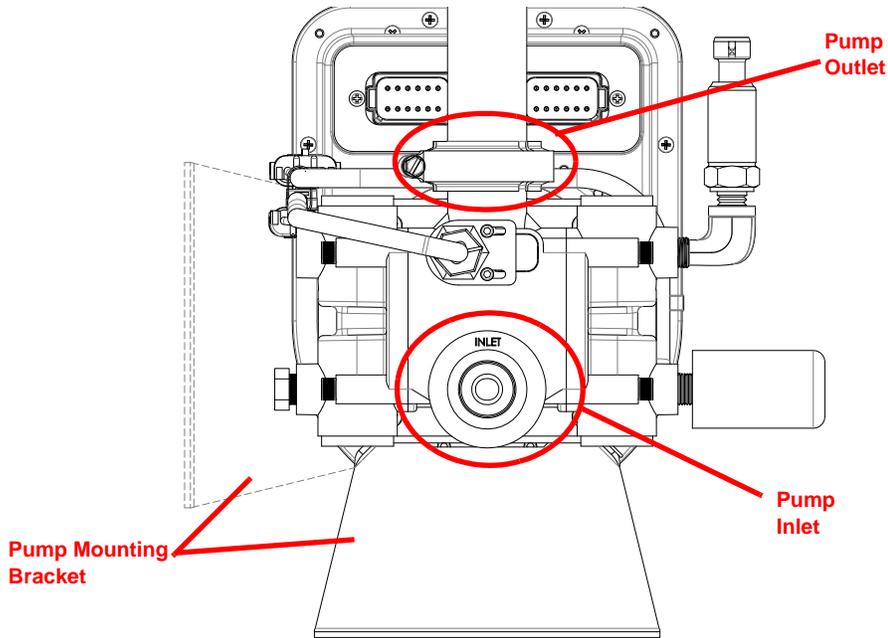
If vacuum errors are encountered during pump operation, one or both of the following corrective measures may be necessary to reduce inlet pressure:

- Reduce the inlet plumbing length
- Increase the tubing size
- Mount the Sidekick Pro pump so that the line between the injection pump and chemical supply tank is near level with a slight incline to help relieve air bubbles. The line connected to the pump inlet must not raise chemical above 2 ft. [0.6 m] from the chemical supply tank outlet. See Figure 8 on page 17.

Mount the Sidekick Pro Pump

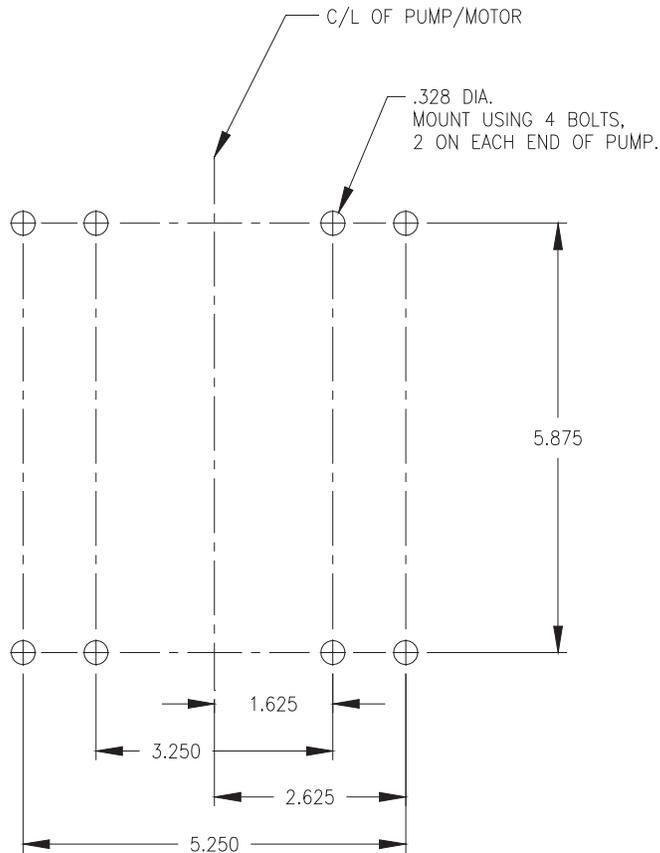
- Mount the Sidekick Pro pump as close as possible to the selected point of injection.
- Mount the Sidekick Pro pump so that the outlet port is pointing up. The pump will not meter product application correctly if the pump is mounted in any other orientation.
- The Sidekick Pro should be mounted in a location which provides access to the pump and control node to simplify calibration and troubleshooting.

FIGURE 6. Sidekick Pro Pump Mounting and Bracket Orientation



Note: The pump mounting bracket may be rotated to accommodate mounting to a vertical surface, however, the injection pump must be mounted level with the outlet port perpendicular to the ground.

FIGURE 7. Sidekick Pro Pump Mounting Bracket Bolt Pattern



Sidekick Pro Injection System Plumbing

Plumb the Sidekick Pro Pump

Pump Inlet

Use 3/4" chemically resistant hose between the chemical tank and injection pump inlet. Do not use hose or tubing that may collapse when a vacuum is applied during pump operation.

The product line should be as straight as possible. Avoid low spots in plumbing to ease pump priming and avoid chemical waist.

Strainer

A strainer with a #20 mesh screen must be installed on the inlet side of the injection pump.

Pump Outlet

Connect the pump outlet to the injection check valve at the point of injection. Use the following hose sizes depending upon the capacity of the injection pump used with the system.

Pump Capacity	Tubing Size
1-40 oz./min.	3/8"
5-200 oz./min.	1/2"



 **CAUTION**

Hoses used on the outlet of the injection pump must be re-enforced, chemically resistant hose rated for at least 150 PSI at 100° F [1034 kPa at 66° C].

Avoid product lines longer than 15 ft. [4.5 m] between the pump outlet and the point of injection. Long runs can cause increased pressure in the pump heads which cause the pump to pull more electrical current and may raise the temperature of the injection pump motor and integrated motor control node. See the *Setting Application Mode and Injection Diagnostics* section on page 35 for details on injection system diagnostics and to monitor pump pressure and node temperature.

Plumb the Sidekick Pro Closed Calibration System

The Sidekick Pro closed calibration system provides an environmentally effective method of calibrating the injection pump without exposing the operator to dangerous or hazardous chemicals.

Pump Calibrator

To provide accurate calibration of the injection pump, the pump calibrator (P/N 063-0172-822) must be installed directly onto the outlet of the pump. This configuration prevents air from getting trapped between the injection pump and the calibration plunger. Trapped air will cause the plunger to feel "spongy" when pressed and will cause the pump calibrator to work improperly.

3-Way Valve

A 3-way valve must be plumbed after the closed calibration system to allow chemical to be directed either back to the chemical tank or to the point of injection.

Hoses

Use chemically resistant hose compatible with the chemicals which will be used with the injection system. Follow the same hose specifications as described in the *Pump Outlet* section on page 15 with the closed calibration system.

Recirculation Check Valve

A recirculation and priming check valve (P/N 333-0011-100) must be plumbed into the recirculation line between the 3-way valve on the outlet side of the injection pump and the chemical tank. This check valve is required to allow air to bleed off during priming of the injection pump. The recirculation and priming check valve is also necessary to allow the system to detect if the pump is primed. See Figure 1 on page 9.

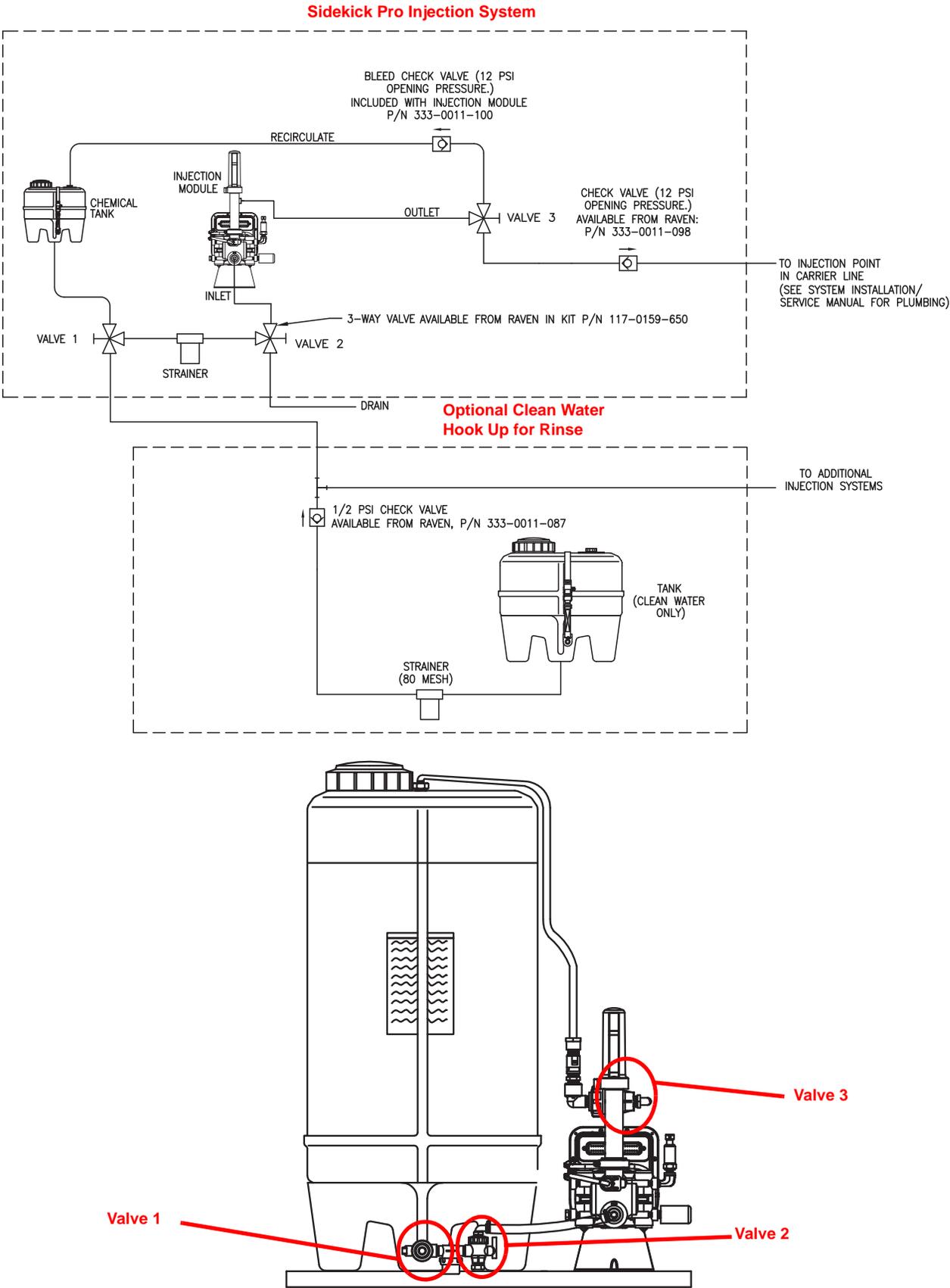
Plumb the Recommended Pump Rinse System

An injection pump rinse system is recommended to enhance the performance of the Sidekick Pro injection pump and provide a clean method for changing between chemicals. The rinse system flushes chemical build up or residues which may collect in the injection pump.

Note: *Some components of the recommended rinse system may not be available from Raven. The following components may be purchased separately and plumbed as shown in Figure 8 on page 17.*

- Clean water supply tank
- Strainer (80 Mesh)
- 1/2 PSI check valve (P/N 333-0011-087)
- Appropriate hose or tubing
- Miscellaneous fittings

FIGURE 8. Recommended Injection System Plumbing with Optional Pump Rinse Tank



CANbus and Power Connections

The Raven Sidekick Pro connects to a Raven CANbus system via a CAN motor control cable and requires both a clean logic power and a high current power connection.

Note: *Refer to the installation manual for the specific CAN control console for detailed information about installing and powering a CAN system.*

The logic and high current power connections must be routed through a properly sized relay and connected directly to battery. This configuration protects the injection system's electrical components and prevents the implement battery from discharging if left alone for long periods of time.

Best Installation Practices

The information below illustrates proper methods for wiring a CANbus system. The main points of CAN installation are summarized below.

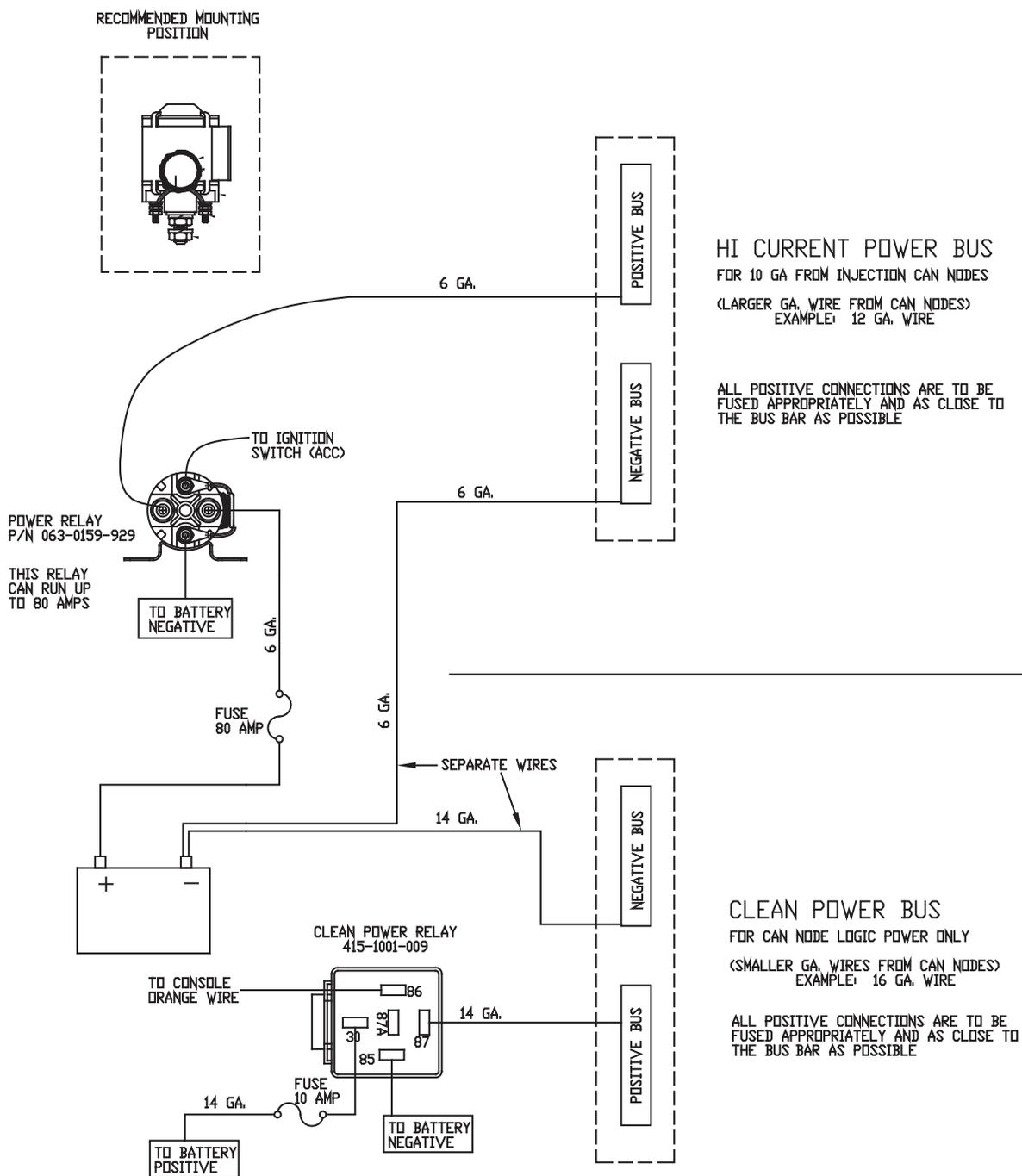
Note: *Following these recommendations will result in the most robust system possible while greatly reducing CAN communication problems.*

1. Always use sealed connectors with dielectric grease. Avoid unsealed, crimped connections (i.e. butt connectors).
In addition to using dielectric grease, mount all CAN terminators (P/N 063-0172-369) with the connector pointing down to avoid collecting water and/or chemical. Liquids collecting within the terminator can corrode pins and may cause CAN communication issues.
2. Connect the power directly to a controlled clean power source.
3. Connect the ground directly to the vehicle's battery.
4. Node logic power should be connected to a clean power bus relay.
5. Use dedicated bus bars to connect the console and all nodes to the same source for both power and ground. See Figure 9 on page 19.
6. Provide relays to switch power on and off to avoid draining the battery. Raven recommends connecting the console to a clean power source (at relay) and using the console 'orange' wire to activate the relay. This makes the console the master power switch and allows engine shutdown without turning off the console. See Figure 9 on page 19.

CAN Terminators

Two CAN terminators (P/N 063-0172-369) are required to provide optimal signal integrity through the CANbus. These terminators should be installed at each end of the CANbus. A CAN power adapter tee cable (P/N 115-0171-368) should be placed toward the front of the bus with one end terminated. CAN power, obtained from a switched power source, runs throughout the bus to act as a shield.

FIGURE 9. CAN Node Wiring Diagram



Sidekick Pro CANbus Connection

Review the following diagrams for assistance with installation and connection of the injection pump to the CANbus system.

Note: *The high current power and ground lead wires are larger gauge wire than the logic power and ground leads.*

FIGURE 10. CAN Motor Control and Pump Connection

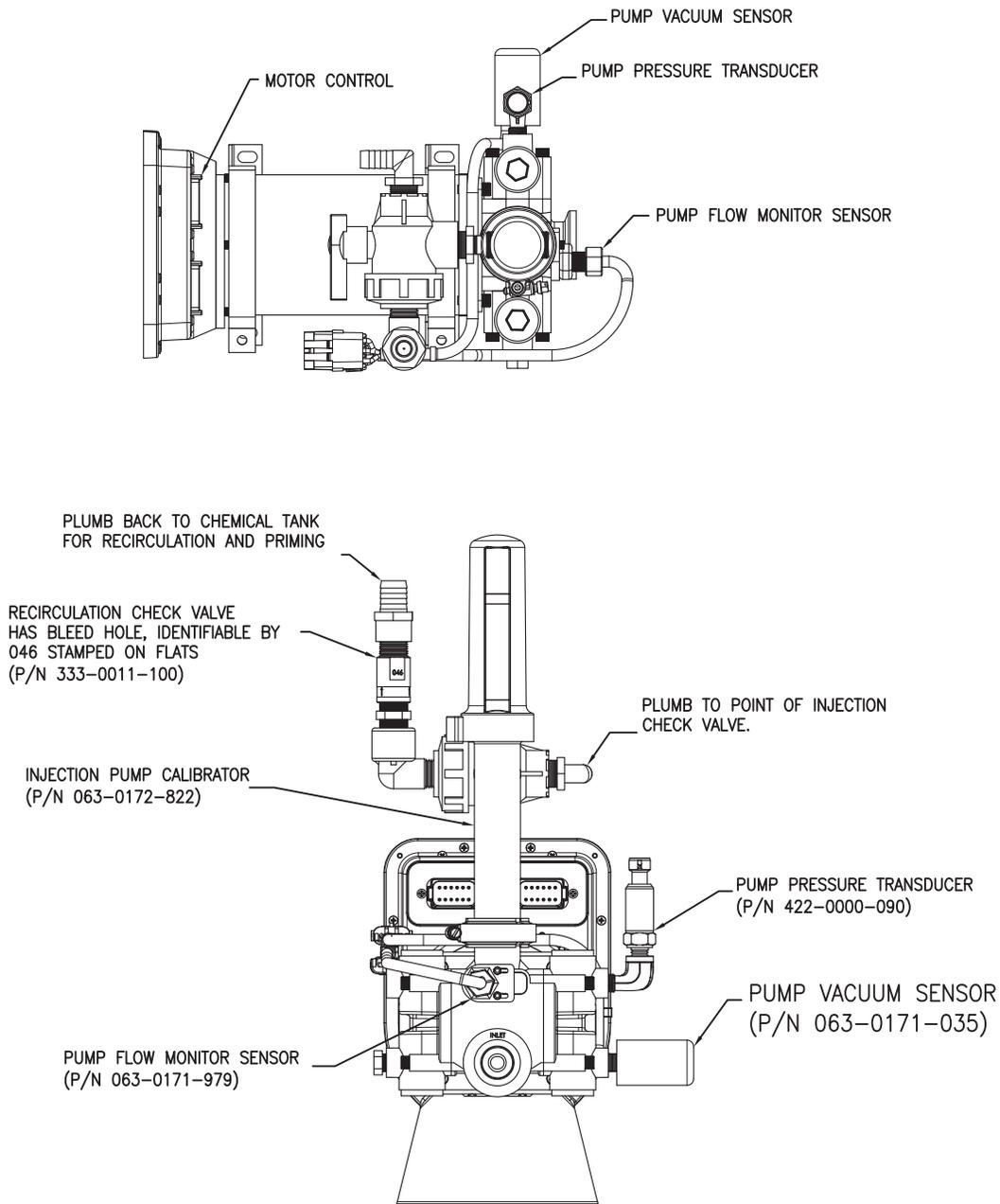


FIGURE 11. 35' CAN Motor Control Cable with Agitator Connection (P/N 115-0171-943)

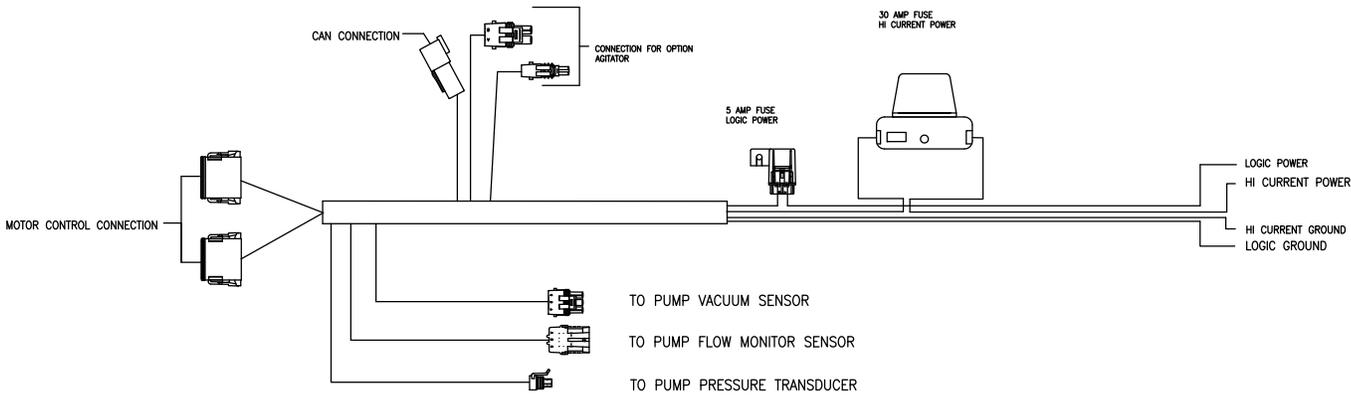


FIGURE 12. CAN Motor Control Cable (P/N 115-0171-944)

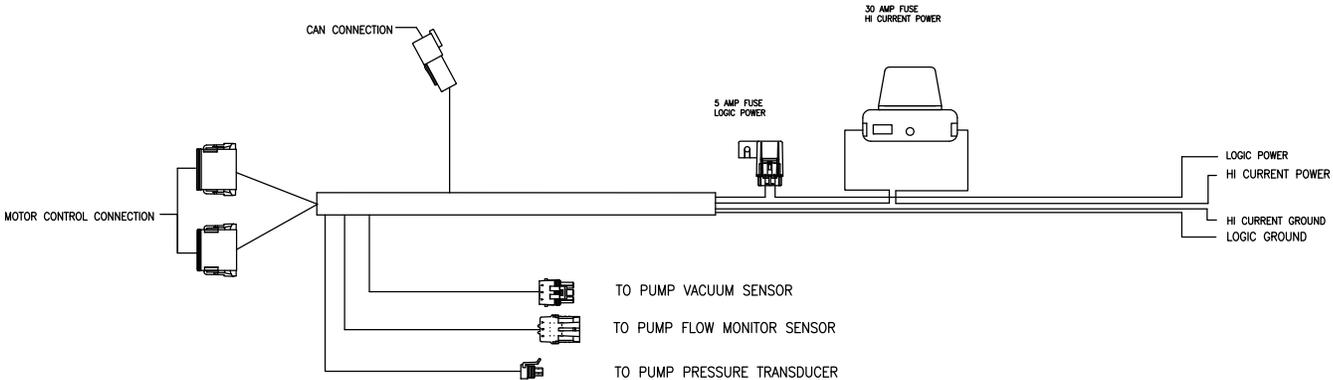
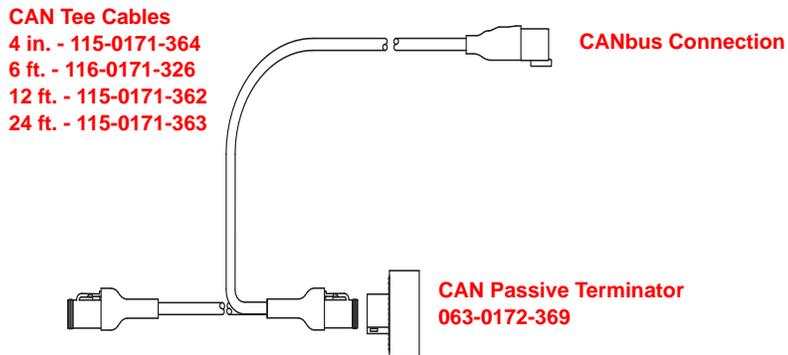


FIGURE 13. CAN Extension Cables with Tee and Passive Terminator



Detecting and Addressing the Motor Control Node

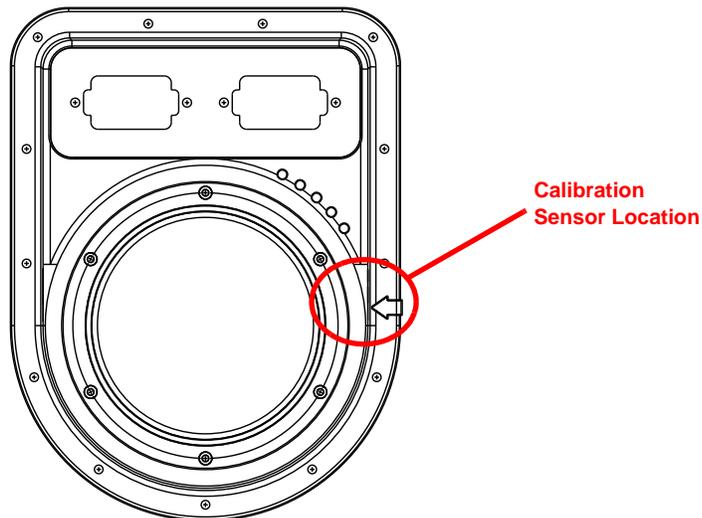
Review the CAN setup section of the Raven control console manual for detailed CANbus system information.

Alternate Method to Readdress the Injection Motor Control Node

The Sidekick Pro motor control node may be readdressed using either the process described in the CAN control console manual, or by the following procedure:

1. Begin readdressing nodes as described in the Raven control console manual.
2. When prompted to readdress the product number for the injected product, pass a metal object across the calibration sensor located at the point of the white arrow on the side of the node housing.

FIGURE 14. Motor Control Node Calibration Sensor



3. Complete the procedure to readdress nodes as described in the Raven control console manual.

Verifying Installation of the Sidekick Pro

Note: Before filling the tank with chemical for the first time, thoroughly vacuum the chemical supply tank and clean any plastic or metal particles that may be left from the manufacturing or installation process. If these particles get stuck within the injection pump, they may cause a significant reduction in pump accuracy. Turn the hand valve(s) to allow the tank to drain without running through the pump or injection plumbing and thoroughly rinse tank prior to testing or running the injection system for the first time.

Perform the procedures outlined in the *Normal Application Mode* section on page 29 to verify that the system is installed properly.

Fill the chemical supply tank with clean water when checking the installation. Check for any leaks on all plumbing connections before applying chemicals with the injection system. It is recommended to check the system periodically and replace worn or damaged connections, valves, or hoses.

CHAPTER

4

Calibration and Operation

Control Console Calibration

Once installation of the injection system has been verified, and the motor control node is recognized by the CAN control console, the Sidekick Pro and console must be calibrated to provide accurate control of the injected product.

Note: *The Sidekick Pro motor control node is only capable of operating in a liquid chemical application mode.*

Regardless of which control console is used to control the Sidekick Pro, the following settings must be calibrated or programmed to ensure proper control and operation of the pump:

- Meter Cal
- Valve Type and Valve Cal
- Rate Cal
- PVD or FER Error Cal
- Pressure Transducer Cal

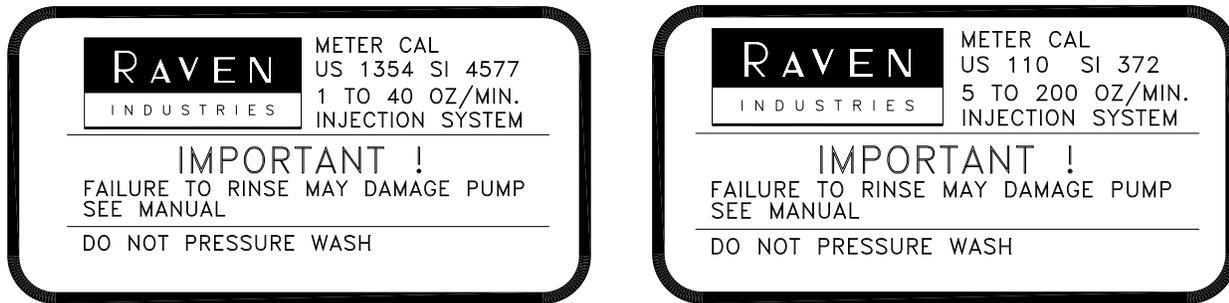
Note: *These settings must be programmed for each injection product or pump which will be used to control product during an application. Refer to the specific control console manual for instructions on programming these settings or other calibration information on the console.*

Meter Cal

The meter cal value for the Sidekick Pro injection pump may be found on the label located on the pump motor. Enter this value as the initial meter cal in the control console.

Note: *The meter cal may be adjusted to refine calibration of the chemical injection pump. Refer to the Calibrate the Injection Pump section on page 32 to check or refine the meter cal.*

FIGURE 1. Sidekick Pro Pump Motor Label with Meter Cal



Valve Type and Valve Cal

The initial valve cal value for any injection pump is 123. When controlled via a CANbus connection, the Sidekick Pro pump should be set up as a “Standard Valve” on the control console to ensure proper control of the injection pump.

Note: *The initial valve cal may be adjusted to refine Sidekick Pro system response for various application needs. Refer to the specific control console manual for more information.*

Rate Cal

Enter the desired rate of injected chemical in ounces per acre [deciliters/hectare].

Verifying Flow Rate Limits

Before beginning to apply product, use the following formula to verify that Sidekick Pro is capable of applying at the target application rate and speeds:

$$Volume/Minute = \frac{Rate \times Speed \times Width}{5940[60,000]}$$

Be sure that the calculated volume per minute is within operating tolerance of the injection pump installed on the implement.

Flow Output Range	P/N 063-0173-081 5-200 oz./min. [1.5-59 dl/min.]	P/N 063-0173-103 1-40 oz./min. [0.3-11.8 dl/min.]
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For Example:

U.S. Units. Given a target rate of 75 oz./acre, a target application speed of 11.0 MPH, and a boom width of 85 ft. (1020 in.):

$$\text{Volume/Minute} = \frac{75 \times 11.0 \times 1020}{5940} = 141.67 \text{ oz./min}$$

Thus, the desired rate of 75 oz./acre is within the capacity of the 5 - 200 oz./min. pump, but will not be acceptable for the 1 - 40 oz./min. pump.

Metric Units. Given a target rate of 50 dl/ha, a target application speed of 17.0 km/h, and a boom width of 25 m (2500 cm):

$$\text{Volume/Minute} = \frac{50 \times 17.0 \times 2500}{60000} = 35.42 \text{ dl/min}$$

Thus, the desired rate of 50 dl/ha is within the capacity of the 1.5 - 59 dl/min. pump, but will not be acceptable for the 0.3 - 11.8 oz./min. pump.

PVD Error Cal (Viper Pro and Envizio Pro only)

The PVD (Pump Valve Diagnostic) error cal value is used to set the flow error tolerance of chemical injection applications. Increase the PVD error cal value to set a tighter tolerance. Set the PVD error cal to zero to turn off all flow monitor alarms for the injected chemical.

Note: The range for the PVD error cal is 0 through 9. The default value for any Sidekick Pro injection pump is 6.

FER Cal (SCS 4000/5000 Series only)

The FER (Flow to Encoder Ratio) error cal value is used to set the flow error tolerance of chemical injection applications. Increase the FER error cal value to set a tighter tolerance. Set the FER error cal to zero to turn off all flow monitor alarms for the injected chemical.

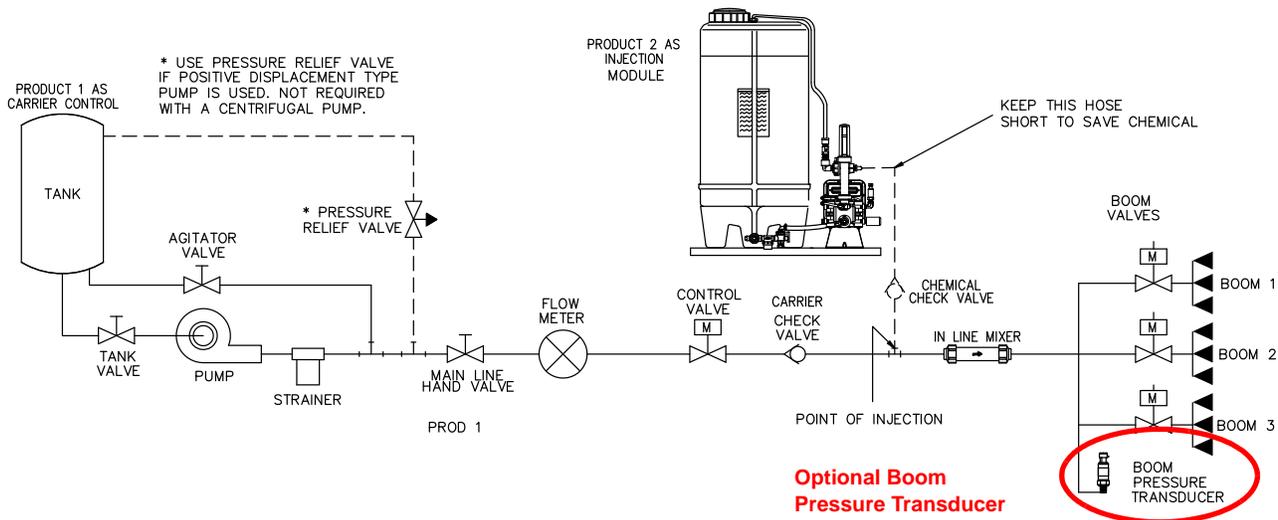
Note: The range for the FER error cal is 0 through 9. The default value for any Sidekick Pro injection pump is 6.

Pressure Transducer Calibration

Before operating the Sidekick Pro system, calibrate the pressure transducers which monitor both the injected chemical and carrier product pressures.

Pressure of the injected product is monitored by a pressure transducer connected to the Sidekick Pro pump. Pressure of the carrier product is monitored by an optional boom or carrier product line pressure transducer.

FIGURE 2. Optional Boom Pressure Transducer Location



Note: The boom or carrier pressure transducer may be installed either as shown in the figure above or upstream of the point of injection.

Sidekick Pro uses these pressure transducers to verify injection status and for error detection. If an optional carrier or boom pressure transducer is not installed, the Sidekick Pro will not provide low pressure alarms during chemical injection applications.

Calibrating the Pump Transducer

Note: The following process offers a general overview of calibrating or resetting the Sidekick Pro pump pressure transducer. Refer to the operation manual for the specific control console for detailed navigation and calibration of the pressure transducer or pressure display.

1. Turn off the injection pump and product control system and ensure
1. Select or display the set up screens for the correct product.
2. Turn off the injection pump and product control system and ensure no product pressure in the injection lines.
3. Enter a value of zero for the pressure calibration value.

Control Features and Application Modes

The following sections outline control features and application modes which may be used with an injection system.

Application Modes

The following modes are available for rate control of injected chemicals:

- Normal Application Mode
- Ratio Rate Mode

Normal Application Mode

Operation of the Sidekick Pro injection pump and control of injected chemicals in normal mode is the same as controlling standard products on a Raven CANbus and will utilize the same operator input. Review the control console manual for specific operation instructions.

Note: *The ratio rate option must be disabled to control injected chemical application in normal mode. The default setting for the ratio rate feature is disabled.*

The following procedure outlines the general operation of Sidekick Pro and controlling an injected chemical.

Note: *Perform pump priming and calibration checks before beginning to apply an injected chemical. Be sure to verify console calibration settings for each injection pump before operating the Sidekick Pro pump(s).*

1. Check injection system hand valves and ensure that product will be routed to the point of injection and boom valves.
2. Toggle the master boom switch to the off position.
3. Turn product control on for each of the injected chemical(s) on the control console.
4. Select manual or automatic mode of product control for each Sidekick Pro pump. In automatic control mode, the control node will automatically adjust rate control based on speed and active boom sections. In manual mode, the machine operator manually controls the rate of chemical injection.
5. Accelerate to at least 0.7 MPH [1.1 km/h] and toggle the master boom switch to the on position. The Sidekick Pro injection pump will begin injecting product into the main product line at the injection point.

Note: *A self test speed may also be entered on the control console to simulate a vehicle speed for testing purposes.*

If the pump does not turn on or an error is displayed, verify calibration values in the control console, make sure the system has a rate cal, speed, and an active boom section, and verify that the pump is primed. See Chapter 7, Troubleshooting, if the pump still does not respond.

6. To shut the injection pump off:
 - a. Toggle the master boom switch to the off position.
 - b. Toggle the selected injection product(s) off.
 - c. Slow the vehicle speed to below 0.7 MPH [1.1 km/h].

Ratio Rate Application Mode

The ratio rate application mode allows the operator to apply an injected chemical at a rate proportional to the carrier product flow rate. The ratio rate application mode must be enabled via the control console and a ratio rate cal value must be entered for each product controlled in ratio to the carrier.

Note: *The carrier product must be programmed as product 1. If a carrier product is not set as product 1, the low pressure alarm will not function.*

If the off rate alarm is triggered frequently during injection applications in ratio rate mode, access the volume per minute display on the control console and verify that the target flow rate is within the application range for the pump.

The ratio rate calibration value is entered as the ratio of injected chemical to carrier in ounces per gallon [deciliters per liter].

For Example:

If the desired ratio of injected chemical concentration is 2 ounces per gallon [0.59 deciliters per liter], enter a value of 2 [0.59] for the ratio rate cal value. Once the operation conditions in the *Normal Application Mode* section on page 29 are set, the system will automatically adjust the rate of injected product in proportion with the carrier product flow rate.

Flow Monitor Features

The injection node is capable of detecting the following flow error conditions:

- Maximum vacuum (plugged strainer, chemical too thick)
- Plugged pump valve or injection line
- Empty tank
- Severe leak on the inlet or outlet hose
- Hand valves in the wrong position

Each of these flow errors are isolated to provide minimal troubleshooting and to reduce machine down time. For assistance troubleshooting the injection system, refer to Chapter 7, *Troubleshooting*. Refer to the console manual for information on disabling audible alarms for these error conditions.

Agitator

An optional tank agitator may be used to mix chemical suspensions and help ensure uniform application. If an agitator is installed with the injection system, enable the agitator feature to power the agitator motor. Refer to the console specific section in Chapter 5, *Setting Application Mode and Injection Diagnostics*, for information on enabling the agitator feature.

Sidekick Pro Priming and Calibration

Before starting application of injected products, perform the following procedures to ensure the system is properly calibrated and ready for chemical application:

1. Verify control console setup
2. Prime the injection pump
3. Calibrate the injection pump

Verify Control Console Settings

Review the *Control Console Calibration* section on page 25 and verify that the correct settings for the chemical injection product are programmed for the correct product node or product number. See Chapter 5, *Setting Application Mode and Injection Diagnostics* and the controller operation manual for instructions on programming the settings required for the injection system.

Prime the Injection Pump

1. Open the hand valve(s) between the supply tank and injection pump.
2. If installed, set the hand valve on the injection pump outlet to recirculate product back to the supply tank.
3. Lift the plunger handle on the pump calibrator to the top of the calibration cylinder.
4. Verify the following conditions are present:
 - a. Boom pressure less than 12 PSI [83 kPa]
 - b. Console speed must be less than 0.7 MPH [1.1 km/h]
 - c. Vacuum pressure for the injected product must be less than 5.5 PSI [37.92 kPa]
 - d. Product 1 must be toggled off on the control console
 - e. Injection product must be toggled “Off” on the control console
 - f. Toggle the master switch and at least one boom section switch “On”
5. On the control console, navigate to the Injection Diagnostics display and begin the pump priming procedure. Refer to Chapter 5, *Setting Application Mode and Injection Diagnostics* and the console specific section for details and to locate the Injection Diagnostics display.
6. Begin the priming procedure and allow the pump to prime. The priming procedure will run until the controller detects the pump has primed. If the pump is unable to prime, the console will end the priming procedure after two minutes and display a “prime time-out” message.

Note: *If the console displays an error message during the priming process, verify that the conditions listed in step 4 are present. If the problem continues, see Chapter 7, *Troubleshooting*, to resolve issues during the pump priming process.*

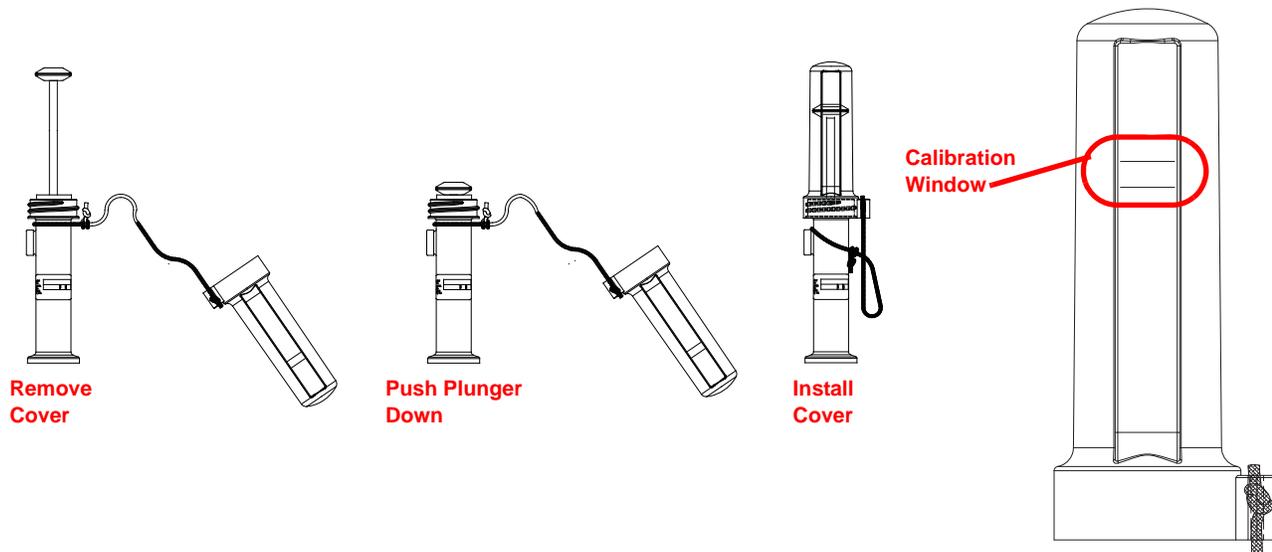
*Press the “End Prime” button to stop the priming procedure at any time. If the pump fails to prime successfully after the first attempt, restart the priming procedure. If the pump is still unable to prime successfully, refer to Chapter 7, *Troubleshooting*, for assistance diagnosing issues with the injection system.*

Calibrate the Injection Pump

Prior to starting a chemical injection application, verify that the pump is properly calibrated and operational by performing a pump calibration.

1. Ensure the pump is primed as described in the *Prime the Injection Pump* section on page 31 before proceeding with the calibration process.
2. Remove the cover from the injection pump calibrator.
3. Press the calibrator all the way down and replace the calibrator cover.

FIGURE 3. Sidekick Pro Pump Calibrator



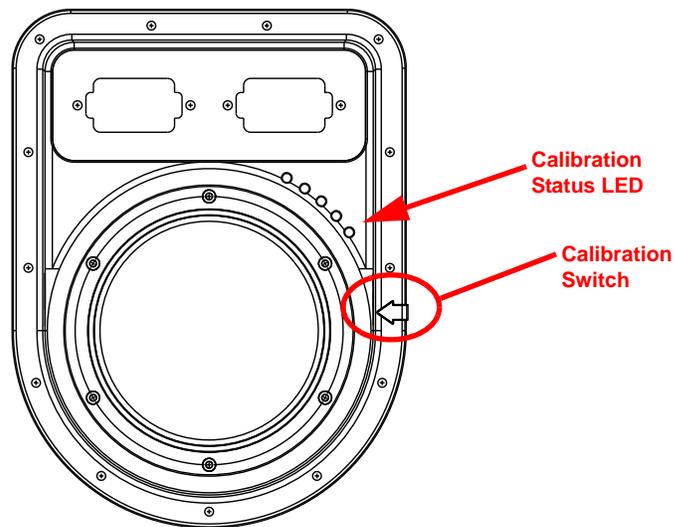
4. Verify the following conditions are present:
 - a. Boom pressure less than 12 PSI [83 kPa]
 - b. Console speed must be less than 0.7 MPH [1.1 km/h]
 - c. Product 1 must be toggled off on the control console
 - d. Vacuum pressure for the injected product must be less than 5.5 PSI [37.92 kPa]
 - e. Injection product must be toggled off on the control console
 - f. Toggle the master switch and at least one boom section on
5. On the control console, navigate to the Injection Diagnostics display and begin the pump calibration. Refer to Chapter 5, *Setting Application Mode and Injection Diagnostics* and the console specific section details to locate the Injection Diagnostics display.
6. Begin the calibration process on the control console. The pump will proceed to run until the console detects 1 oz. [0.3 dL] of chemical has been passed through the pump and the console displays a “CAL complete” message.

Note: To stop calibration while in progress, at any time pass the metal object past the calibration sensor.

If the console displays an error message during the priming process, verify that the conditions listed in step 4 are present. If the problem continues, see Chapter 7, *Troubleshooting*, to resolve issues during the pump calibration process.

After the initial calibration has been completed, the injection pump calibration process may be re-initiated by passing a metal object past the integrated calibration sensor twice. Use an object such as a screw driver or spare bolt.

FIGURE 4. Calibration Sensor



7. Check the calibrator plunger on the injection pump.

The black ring on the plunger should stop within the “window” markings on the calibrator cover if the pump calibration is successful. If the black ring stops slightly outside of the calibration window, the meter cal value may be adjusted to compensate:

- If the plunger stops below the calibration window, increase the meter cal.
- If the plunger stops above the calibration window, decrease the meter cal.

The initial meter cal should be adjusted in increments of 1% from the default meter cal. If the meter cal must be increased or decreased by more than 5% from the value printed on the pump housing, perform pump maintenance procedures outlined in Chapter 6, *System Maintenance*. If the problem persists, see Chapter 7, *Troubleshooting*, for possible solutions to issues with the injection pump.

CHAPTER

5

Setting Application Mode and Injection Diagnostics

Review the specific section for the control console for details on locating and using the injection diagnostics screens with the injection pump.

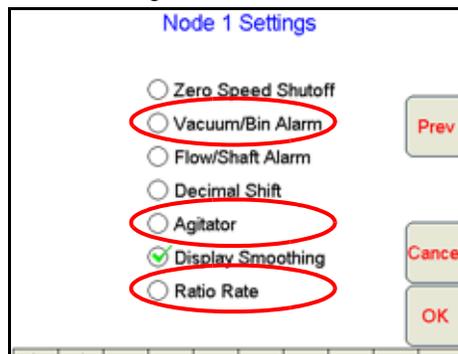
Viper Pro

Note: Raven Sidekick Pro injection pumps (P/N 063-0173-081 or 063-0173-103) are equipped with diagnostic and flow monitoring features for CANbus control consoles. To access complete diagnostic capabilities for the Sidekick Pro injection system, the Viper Pro must have software version 3.3.0.0 or newer. Software updates for the control console may be downloaded from the Raven Applied Technology Division web site:

<http://www.ravenprecision.com/Support/Software/index2.jsp>

Application Mode Setup

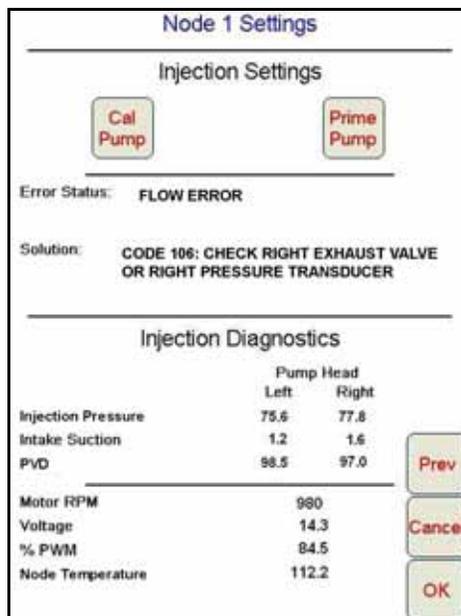
1. Touch within the product control area at the bottom of the main screen.
2. Select the product node corresponding to the injected product and touch within data box 1.
3. Touch the Next button to display the following screen.



4. The Vacuum/Bin Alarm is enabled by default when a motor control node is detected on the CANbus. Deselect this option to disable the audible alarm for injected products.
5. When enabled, the Agitator option will send power to an agitator motor via the CAN motor control cable. See Figure 11 on page 21.

Injection Diagnostics Display

1. Touch within the product control area on the main screen.
2. Select the product node corresponding to the injected product and touch within data box 2 to display the first Node Settings screen.
3. Press the Next button until the Injection Settings screen displays.



Cal Pump

Touch the “Cal Pump” button to start the injection pump calibration process.

Note: *The injection pump should be primed before starting a pump calibration.*

Prime Pump

Touch the “Prime Pump” button to prime the injection pump. The Viper Pro will stop the pump when the system detects the pump has been primed.

Error Status and Solution

If any error conditions are encountered during an injected chemical application, the error type will be displayed on the Injection Settings screen. Refer to Chapter 7, *Troubleshooting*, for detailed troubleshooting information and solutions.

A brief description of the error code and solution is displayed in the solution area. Refer to Chapter 7, *Troubleshooting*, for detailed troubleshooting information.

Injection Diagnostics

The following diagnostic information is displayed on the Viper Pro Injection Settings screen:

Note: *The units for injection system pressure displays may be set to PSI or kPa. Refer to the control console operation manual for information on selecting display units.*

Injection Pressure. These values are the pressure observed during the pressure stroke of the left and right pump heads.

Intake Suction. These values are currently not used and will display a value of zero.

PVD. The PVD (pump valve diagnostics) value is a tool used in conjunction with the PVD Error Cal to identify the relative efficiency of the pump. This area displays a value between 0 and 100.

Note: *This number is an indicator of pump health and cannot be used to meter flow from the pump.*

Motor RPM. The current RPM of the injection pump motor is displayed in the lower portion of the Injection Settings screen.

Voltage. The high current voltage detected by the CAN motor control node is displayed in this area.

% PWM. The percent PWM value may be used to determine how hard the pump is being driven. A value of 100 indicates the pump is being driven at the maximum.

Node Temperature. The temperature of the motor control node is displayed in this area. This value, in conjunction with the motor RPM, may be useful to help determine how hard the pump is being driven.

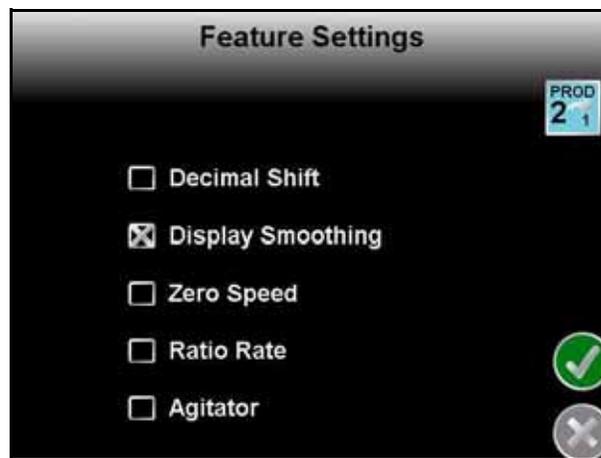
Envizio Pro

Note: Raven Sidekick Pro injection pumps (P/N 063-0173-081 or 063-0173-103) are equipped with diagnostic and flow monitoring features for CANbus control consoles. To access complete diagnostic capabilities for the Sidekick Pro injection system, the Envizio Pro must have software version 2.3.0.3 or newer. Software updates for the control console may be downloaded from the Raven Applied Technology Division web site:

<http://www.ravenprecision.com/Support/Software/index2.jsp>

Application Mode Setup

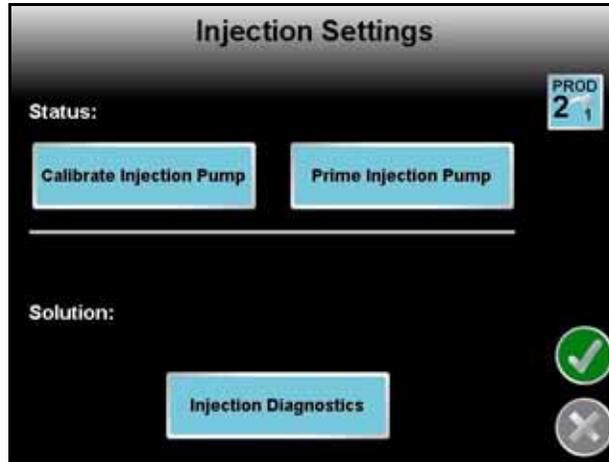
1. Touch the “Tools Menu” icon on the Envizio Pro Home screen.
2. Select the “Product Control” icon within the System menu and touch the “Feature Settings” button to display the following screen.



3. The Vacuum/Bin Alarm is enabled by default when a motor control node is detected on the CANbus. Deselect this option to disable the audible alarm for injected products.
4. When enabled, the Agitator option will send power to an agitator motor via the CAN motor control cable. See Figure 11 on page 21.

Injection Diagnostics Display

1. Touch the Tools Menu icon on the Home screen and select the Product Control icon within the System menu.
2. Touch the “Injection Settings” button to display the Injection Settings screen.



Calibrate Injection Pump

Touch the “Calibrate Injection Pump” button to start the injection pump calibration process.

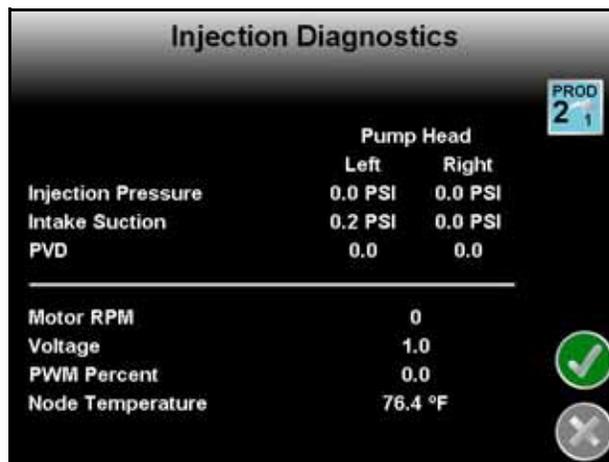
Note: *The injection pump should be primed before starting a pump calibration.*

Prime Injection Pump

Touch the “Prime Injection Pump” button to prime the injection pump. The Envizio Pro will stop the pump when the system detects the pump has been primed.

Injection Diagnostics

Touch the “Injection Diagnostics” button to view diagnostic information for the selected injection pump.



Injection Pressure. These values are the pressure observed during the pressure stroke of the left and right pump heads.

Intake Suction. These values are currently not used and will display a value of zero.

PVD. The PVD (pump valve diagnostics) value is a tool used in conjunction with the PVD Error Cal to identify the relative efficiency of the pump. This area displays a value between 0 and 100.

Note: *This number is an indicator of pump health and cannot be used to meter flow from the pump.*

Motor RPM. The current RPM of the injection pump motor is displayed in the lower portion of the Injection Settings screen.

Voltage. The high current voltage detected by the CAN motor control node is displayed in this area.

% PWM. The percent PWM value may be used to determine how hard the pump is being driven. A value of 100 indicates the pump is being driven at the maximum.

Node Temperature. The temperature of the motor control node is displayed in this area. This value, in conjunction with the motor RPM, may be useful to help determine how hard the pump is being driven.

SCS 4000/5000 Series

Note: *Raven Sidekick Pro injection pumps (P/N 063-0173-081 or 063-0173-103) are equipped with diagnostic and flow monitoring features for CANbus control consoles. To access complete diagnostic capabilities for the Sidekick Pro injection system, the SCS controller must have software version 1.90 or newer. Software updates for the control console may be downloaded from the Raven Applied Technology Division web site:*

<http://www.ravenprecision.com/Support/Software/index2.jsp>

SCS 4000/5000 Series consoles with software versions older than 1.90 will still operate with Sidekick Pro, however, the diagnostic capabilities of the console will not be available.

Application Mode Setup

1. Press the DATA MENU button until the page 2 of the Product submenu is displayed on the screen.
2. Enable the Vacuum or Bin Level Alarm to receive an audible alarm if the system detects an error condition with the injection system.
3. When enabled, the Agitator option will send power to an agitator motor via the CAN motor control cable. See Figure 11 on page 21.
4. To enable the ratio rate application mode, press the DATA MENU button until the Console submenu is displayed on the screen and select the ratio rate option.

Injection Diagnostics Display

1. Press the DATA MENU key until the Run Time Diagnostics screen is displayed.

PROD NODE 2-INJECTION RUN TIME INFO	
FLOW ERROR CODE #	
PUMP-PRESS	12.0
FER	99.5
MOTOR RPM	107
TEMP	99.3
VOLTAGE	14.2
% PWM	87.5
HOURS	23.6
KEY 1 - START CAL	
KEY 2 - START PRIMING	

Press - PSI. These values are the pressure observed during the pressure stroke of the left and right pump heads.

Vacuum - PSI. These values are the pressure observed during the vacuum stroke of the left and right pump heads.

FER. The FER (flow to encoder ratio) value is a tool used in conjunction with the FER Error Cal to identify the relative efficiency of the pump. This area displays a value between 0 and 100.

Note: *This number is an indicator of pump health and cannot be used to meter flow from the pump.*

Motor RPM. The current RPM of the injection pump motor is displayed in this area.

Temperature. The temperature of the motor control node is displayed in this area. This value, in conjunction with the motor RPM, may be useful to help determine how hard the pump is being driven.

Voltage. The high current voltage detected by the CAN motor control node is displayed in this area.

% PWM. The percent PWM value may be used to determine how hard the pump is being driven. A value of 100 indicates the pump is being driven at the maximum.

Hours. This value represents the number of hours which the injection node has been engaged for operation.

CHAPTER

6

System Maintenance

Proper injection pump maintenance is critical to maintain system performance and extend the lifetime of the injection pump. Perform these maintenance procedures periodically over a season and be sure to store the pump properly when not being used.

	⚠ WARNING Always use caution when performing maintenance or servicing an injection pump or system which has been previously pressurized. Wear appropriate protective equipment to prevent contact with hazardous chemicals and rinse the chemical system as instructed by the chemical manufacturer prior to performing maintenance.
--	--

Maintenance and Cleaning

	⚠ WARNING Hazardous chemicals may be under pressure even if the pump has not been in service recently. Before replacing any components on the injection pump, thoroughly rinse the injection pump with clean water to remove excess chemical residue.
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Depending upon the type of chemicals used with the Raven injection system, periodic maintenance may be required to ensure proper operation of the injection pump.

Note: *Some chemicals may require daily maintenance of the injection pump. Review best practices with a chemical supplier to ensure the proper frequency of pump maintenance.*

Check Valve O-Rings

	<div style="background-color: yellow; text-align: center; padding: 5px;">⚠ CAUTION</div> <p>Valve assembly contains small parts and springs under compression. Wear safety glasses when maintaining or cleaning valve assemblies.</p> <p>Chemical residue and build up may be present on internal pump components. Wear gloves when servicing internal pump assemblies.</p>
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Small particles of rust, sand, or grit may build up around the check valve seals. Over time, this may cause a noticeable decrease in the accuracy of injected product application rates. Clean or replace the o-ring seals periodically to ensure accuracy of the injection system.

1. Empty and rinse product from the chemical supply tank and flush the injection pump with water.
2. Carefully remove the intake and discharge valve cartridges from the injection pump using a 9/16" allen wrench.

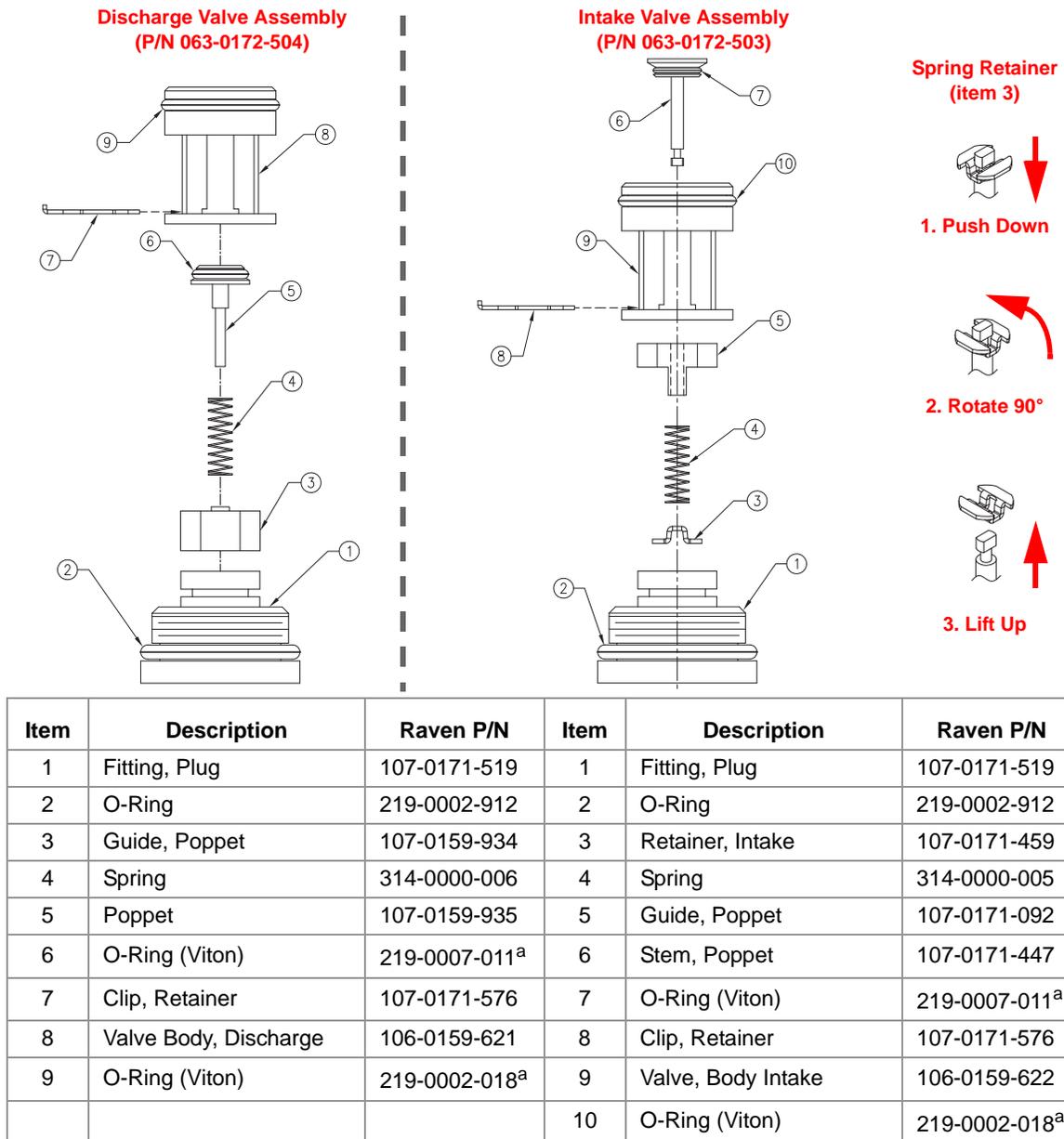
Note: *The intake and discharge valve assemblies contain parts which are not interchangeable. To ensure proper re-assembly, it is recommended that the intake and discharge valve assemblies are cleaned and inspected separately.*

3. Examine the valve assembly o-ring and replace if cut or nicked. These o-rings are made of a chemical resistant compound and should only be replaced with o-rings supplied by a local Raven dealer.
4. Disassemble the check valve assemblies as shown in Figure 1 below.

Note: *Valve assembly contains tension springs and small parts. To prevent the loss of parts, place the valve assembly inside a clear plastic bag while disassembling.*

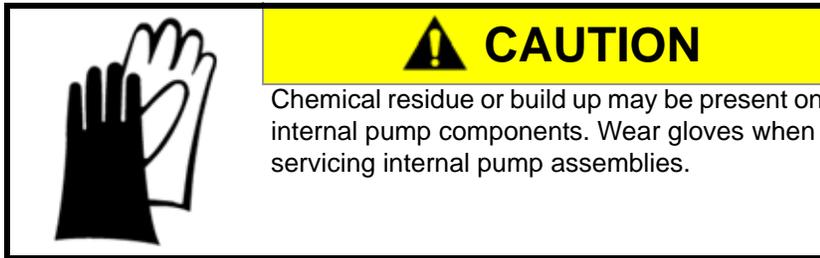
5. Examine the guide, spring, poppet and poppet o-ring for wear, pitting, swelling or foreign matter. Clean or replace if necessary. O-rings inside valve assembly are made of a chemical resistant compound and should only be replaced with o-rings supplied by a local Raven dealer.
6. Reassemble the intake and discharge plugs as shown in Figure 1 on page 45.
7. Apply petroleum jelly to valve body o-rings and replace valve assemblies into the pump head and tighten valve plug.

FIGURE 1. Check Valve Assemblies



a. O-Rings included in Pump Seal Kit (P/N 117-0159-987)

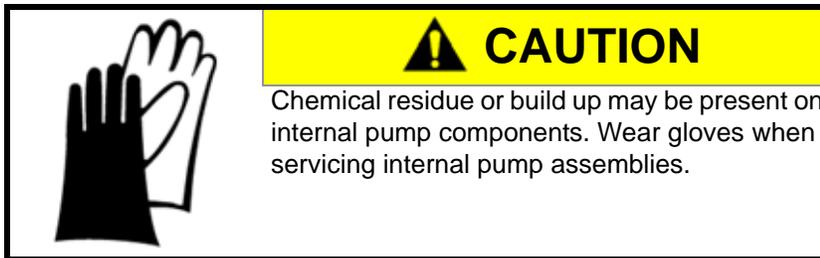
Pump Cam and Bearing



Chemicals may seep into the bearing cavity. The pump cam and bearing housing should be cleaned and inspected periodically to prevent maintenance issues.

1. Loosen the four socket head screws holding the pump head to the motor assembly.
2. Remove pump from motor and clean surfaces of cam and bearing.
3. Examine the sealed bearing. If the bearing does not turn freely or smoothly, replace the bearing.
4. Apply a heavy coating of automotive grease to the area where the piston engages the cam bearing and reassemble pump to motor.

Piston Seal Replacement



The piston seals within the injection pump motor housing should be replaced periodically to keep chemical from seeping into the pump housing. The piston seals should be serviced or replaced if chemical begins leaking from the weep hole on the underside of the pump housing.

Note: *New piston seals are supplied in the Pump Seal Kit (P/N 117-0159-987) available through a local Raven dealer.*

FIGURE 2. Pump Head and Motor Separation

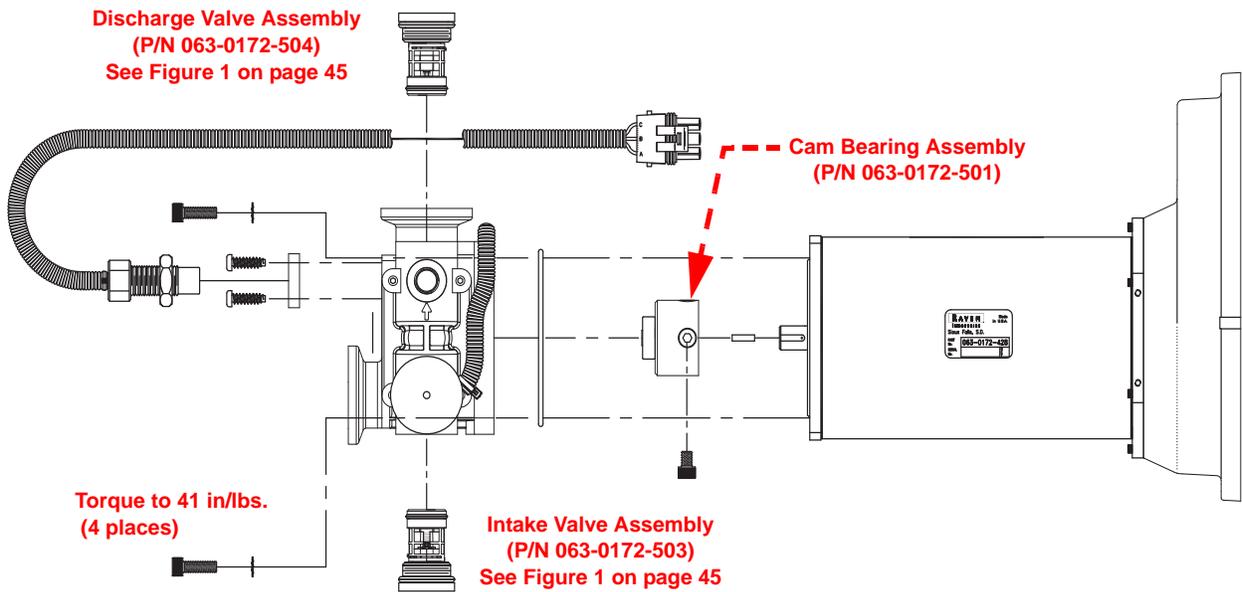
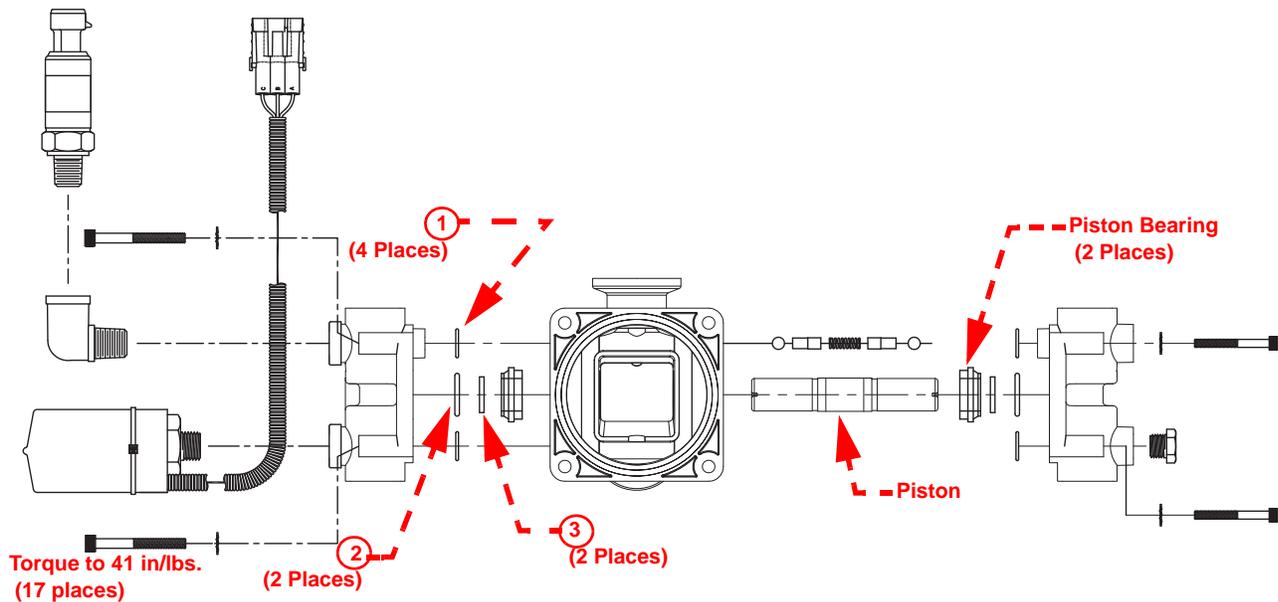


FIGURE 3. Pump Head Parts and Seal Installation



Item	Description	Raven P/N	Qt.
1	O-Ring, Viton	219-0002-015	4
2	O-Ring, Compound 117965-80	219-0007-117	2
3	Seal, 3/4" Slipper	219-0000-125	2

1. Empty product from the chemical supply tank and flush the injection pump with water.
2. Disconnect the injection pump plumbing and cabling. Remove the injection pump from the implement and take to a suitable work area to perform maintenance.
3. Separate the pump from the motor by removing the four socket head screws.
4. Loosen the four socket head screws securing each pump head to the crank case.



- Carefully remove the pump heads. While removing the pump heads, take care not to damage the exposed finish on the piston during disassembly.
- Remove the slipper seals and o-rings from the pump.

Note: *During removal of the piston, the slipper seal and o-rings may stick within the pump housing. Be sure to remove and inspect both of the two slipper seals and two o-rings used with the piston.*

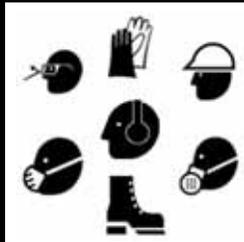
The seals and o-rings are made of a chemical resistant compound and should only be replaced with o-rings supplied by a local Raven dealer.

- Inspect the piston for scratches. If the finish is scratched or damaged, replace the piston.
- Inspect the piston bearing for wear and replace if necessary.
- Replace the seals and o-rings into the pump housing:

Note: *Complete one side of the piston and head assembly before starting on the other side.*

- Install the slipper seal onto the piston.
 - Using general purpose grease, lubricate the o-ring and seat over the slipper seal.
 - Replace pump head o-rings into pump heads. If the o-rings tend to slip before the head is installed, use a small amount of additional grease on the o-ring to help hold it in place.
 - Install the pump head to the pump assembly.
 - Repeat the above steps to install the remaining pump head.
- Tighten socket head screws to the torque specified in Figure 3 on page 47.

Seasonal Maintenance and Storage

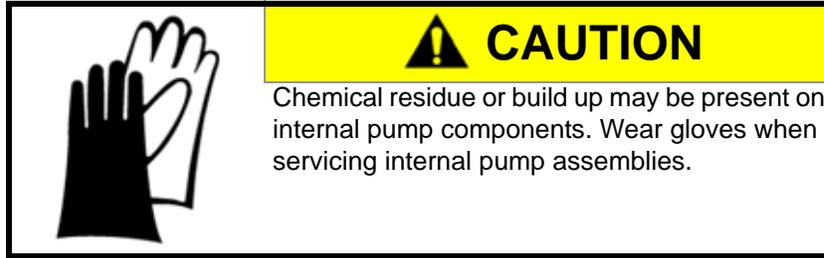
	<p>WARNING</p> <p>Always use caution when performing maintenance or servicing an injection pump or system which has been previously pressurized. Wear appropriate protective equipment to prevent contact with hazardous chemicals and rinse the chemical system as instructed by the chemical manufacturer prior to performing maintenance.</p>
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Perform the following procedure before storing the injection pump for long periods:

Note: *Failure to perform seasonal maintenance may result in damage to injection system or reduce the working life of the injection pump.*

- Empty product from the chemical supply tank and flush the injection pump with water.
- Remove hardened chemical residues or build up by flushing the injection system with:
 - kerosene or fuel oil if the last product through the pump was petroleum based.
 - soap and water if the last product through the pump was water based.

3. Remove the intake and discharge valve assemblies from the pump.



4. Remove the pressure transducer and clean the cavity and transducer body of excess build up.
5. Clean and inspect each assembly as instructed in the *Check Valve O-Rings* section on page 44.

Note: Be sure to reinstall the intake and discharge valves into the correct ports on the injection pump.

6. Perform the procedure described in the *Pump Cam and Bearing* section on page 46 to service the cam and bearing.
7. Recirculate a 50% water and automotive antifreeze mixture through the injection pump to check pump operation after reassembly as well as prevent freezing of pump components.

CHAPTER

7

Troubleshooting

Motor Control Node LED Status Indicators

The Sidekick Pro integrated motor control node displays the status of the injection pump with the following node status indicators.

FIGURE 1. LED Status Indicators

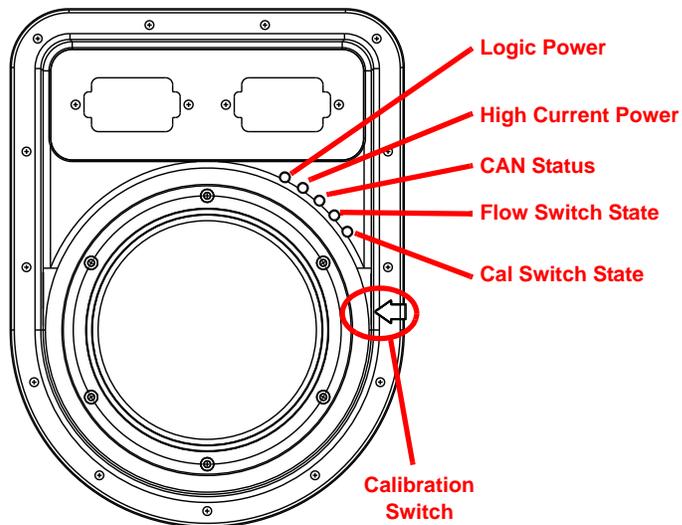


TABLE 1. LED Status Indicators

LED	Status Display
Logic Power	If logic power is present at the motor control node, the logic power indicator will be on.
High Current Power	If high current power is present at the motor control node, the high current power indicator will be on.
CAN Status	The CAN status indicator will flash once per second if the motor control node is communicating on the CANbus. If the motor control node cannot communicate via the CANbus, the CAN status indicator will flash four times per second.
Flow Switch State	The flow switch indicator will flash once per revolution of the injection pump shaft.
Calibration Switch State	The calibration switch indicator will flash when a metal object is passed by the calibration switch sensor.

Error Codes

TABLE 2. Sidekick Pro Error Codes for Viper Pro and Envizio Pro

Error Code	Possible Cause	Solution
Code 101	<ul style="list-style-type: none"> • Left transducer out of calibration • Faulty left transducer 	<ul style="list-style-type: none"> • Recalibrate pressure transducers. • Replace left pressure transducer.
Code 102	<ul style="list-style-type: none"> • Right transducer out of calibration • Faulty right transducer 	<ul style="list-style-type: none"> • Recalibrate pressure transducers. • Replace right pressure transducer.
Code 103	<ul style="list-style-type: none"> • Flow obstruction in left intake valve • Faulty left pressure transducer 	<ul style="list-style-type: none"> • Perform a pump calibration test. If the pump does not calibrate properly, remove the left intake cartridge and perform pump maintenance to clear obstructions. • Perform a pump calibration test. If the pump calibrates properly, replace the left pressure transducer.
Code 104	<ul style="list-style-type: none"> • Flow obstruction in right intake valve • Faulty right pressure transducer 	<ul style="list-style-type: none"> • Perform a pump calibration test. If the pump does not calibrate properly, remove the right intake cartridge and perform pump maintenance to clear obstructions. • Perform a pump calibration test. If the pump calibrates properly, replace the right pressure transducer.
Code 105	<ul style="list-style-type: none"> • Flow obstruction in left exhaust valve • Faulty left pressure transducer 	<ul style="list-style-type: none"> • Perform a pump calibration test. If the pump does not calibrate properly, remove the left exhaust cartridge and perform pump maintenance to clear obstructions. • Perform a pump calibration test. If the pump calibrates properly, replace the left pressure transducer.
Code 106	<ul style="list-style-type: none"> • Flow obstruction in right exhaust cylinder • Faulty right pressure transducer 	<ul style="list-style-type: none"> • Perform a pump calibration test. If the pump does not calibrate properly, remove the right exhaust cartridge and perform pump maintenance to clear obstructions. • Perform a pump calibration test. If the pump calibrates properly, replace the right pressure transducer.
Code 107	<ul style="list-style-type: none"> • Clogged pump strainer • Tubing or plumbing size restriction • Chemical too thick 	<ul style="list-style-type: none"> • Clean pump strainer and check for obstructions in injection line between the pump inlet and chemical supply tank. • Verify the proper size of injection supply tubing is used between the chemical supply tank and pump inlet. • Dilute product in chemical supply tank. Some chemicals may not be applied using a direct injection system.
Code 108	<ul style="list-style-type: none"> • Clogged or restricted pump outlet supply lines • Tubing or plumbing size restriction • Faulty PSI transducer • Hand valve closed • Low injection pressure 	<ul style="list-style-type: none"> • Check for restrictions or blockages in outlet supply lines. Flush the injection system to clear clogs and residue buildup. • Verify the proper size of injection outlet tubing is used between the point of injection and pump outlet. • Check hand valves are open and allow flow from the injection pump outlet port.

Error Code	Possible Cause	Solution
Code 109	<ul style="list-style-type: none"> • Boom pressure transducer not connected • Faulty boom pressure transducer 	<ul style="list-style-type: none"> • If installed, check that the boom pressure transducer is installed and properly connected. • Replace boom pressure transducer.
Code 110	<ul style="list-style-type: none"> • No power to pump motor • Pump motor or encoder issue 	<ul style="list-style-type: none"> • Verify that the high current LED on the injection pump node is lit. • Check motor and encoder connections. Disconnect the injection pump node from the pump motor and check that the motor and encoder connections are seated properly. If these connections appear solid, return pump to a local Raven dealer for service.

TABLE 3. Sidekick Pro Error Codes for SCS 4000/5000 Series Consoles

Error Code	Possible Cause	Solution
PSI Error Code 101	<ul style="list-style-type: none"> • Transducer out of calibration • Faulty transducer 	<ul style="list-style-type: none"> • Recalibrate pressure transducer. • Replace pressure transducer.
Flow Error Code 102	<ul style="list-style-type: none"> • Flow obstruction in valve • Empty tank or faulty intake hose • Faulty flow switch 	<ul style="list-style-type: none"> • Perform a pump calibration test. If the pump does not calibrate properly, remove the pump cartridge and perform pump maintenance to clear obstructions. • Check chemical supply tank and plumbing. Fix leaks if necessary or fill product. • Ensure flow switch is shuttling properly. If not, check connections or replace flow switch. If the flow switch is functioning properly, return node to a local Raven dealer for service.
Max. Vac Code 103	<ul style="list-style-type: none"> • Clogged pump strainer • Faulty Vacuum Switch • Tubing or plumbing size restriction • Chemical too thick 	<ul style="list-style-type: none"> • Clean pump strainer and check for obstructions in injection line between the pump inlet and chemical supply tank. • Verify the proper size of injection supply tubing is used between the chemical supply tank and pump inlet. • Dilute product in chemical supply tank. Some chemicals may not be applied using a direct injection system.
Max PSI/Low PSI Code 104	<ul style="list-style-type: none"> • Clogged or restricted pump outlet supply lines • Low injection pressure • Tubing or plumbing size restriction • Hand valve closed • Faulty PSI transducer 	<ul style="list-style-type: none"> • Check for restrictions or blockages in outlet supply lines. Flush the injection system to clear clogs and residue buildup. • Verify the proper size of injection outlet tubing is used between the point of injection and pump outlet. • Check hand valves are open and allow flow from the injection pump outlet port. • Replace pressure transducer.

Error Code	Possible Cause	Solution
Motor/Encoder Code 105	• No power to pump motor	• Verify that the high current LED on the injection pump node is lit.
	• Pump motor or encoder issue	• Check motor and encoder connections. Disconnect the injection pump node from the pump motor and check that the motor and encoder connections are seated properly. If these connections appear solid, return pump to a local Raven dealer for service.

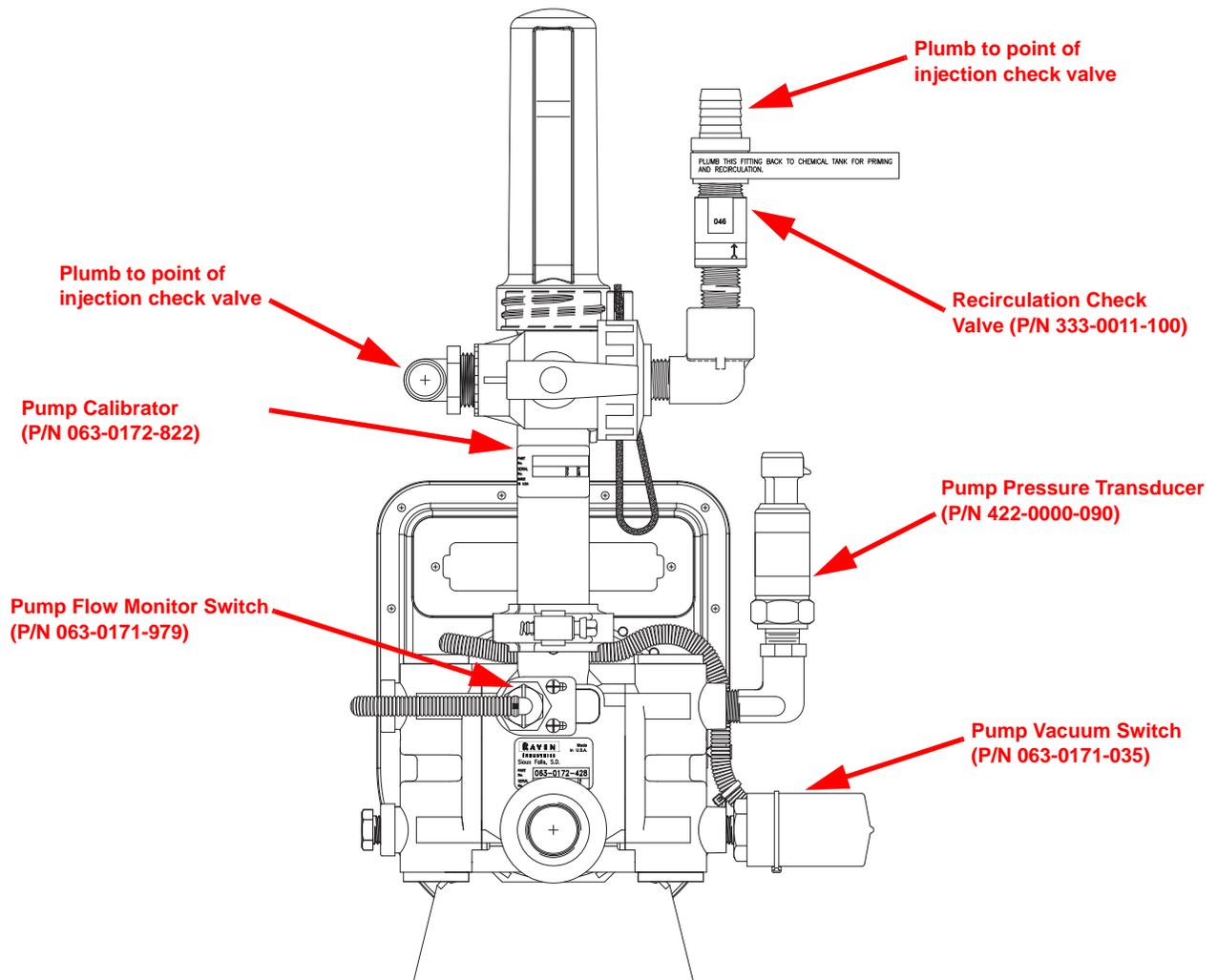
CHAPTER

8

Replacement Parts

Sidekick Pro Pump Replacement Parts

FIGURE 1. Injection Pump Components



Injection Pump Pressure Transducer

	WARNING Always use caution when performing maintenance or servicing an injection pump or system which has been previously pressurized. Wear appropriate protective equipment to prevent contact with hazardous chemicals and rinse the chemical system as instructed by the chemical manufacturer prior to performing maintenance.
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To replace the pressure transducer (P/N 422-0000-090):

1. Disable and shutdown any automatic product control features of the Sidekick Pro injection system and turn off the vehicle when replacing the pressure transducer assembly.

	WARNING Hazardous chemicals may be under pressure even if the pump has not been in service recently. Before replacing any components on the injection pump, thoroughly rinse the injection pump with clean water to remove excess chemical residue.
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2. Disconnect the pressure transducer connector on the top of the pressure transducer body. Be careful to keep dust, debris, or liquid chemicals which may seep from the injection pump head from contaminating the cable connection.
3. Loosen the pressure transducer while securing the connected fitting to prevent damage to the pump head.
4. Apply RectorSeal[®] or equivalent thread sealant to the new pressure transducer and thread into the pump head.
5. Tighten the pressure transducer body two or three quarter turns to secure the pressure transducer.

Note: *Do not over tighten the pressure transducer. Overtightening the pressure transducer may damage the pump head.*

Calibrating the Pump Transducer

Note: *The following process offers a general overview of calibrating or resetting the Sidekick Pro pump pressure transducer. Refer to the operation manual for the specific control console for detailed navigation and calibration of the pressure transducer or pressure display.*

1. Select or display the set up screens for the correct product.
2. Turn off the injection pump and product control system and ensure no product pressure in the injection lines.
3. Enter a value of zero for the pressure calibration value.

Injection Pump Vacuum Switch

	<p>WARNING</p> <p>Always use caution when performing maintenance or servicing an injection pump or system which has been previously pressurized. Wear appropriate protective equipment to prevent contact with hazardous chemicals and rinse the chemical system as instructed by the chemical manufacturer prior to performing maintenance.</p>
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To replace the vacuum switch (P/N 063-0171-035):

1. Disable and shutdown any automatic product control features of the Sidekick Pro injection system and turn off the vehicle when replacing the vacuum switch assembly.

	<p>WARNING</p> <p>Hazardous chemicals may be under pressure even if the pump has not been in service recently. Before replacing any components on the injection pump, thoroughly rinse the injection pump with clean water to remove excess chemical residue.</p>
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2. Disconnect the vacuum switch connector from the motor control cabling. Be careful to keep dust, debris, or liquid chemicals which may seep from the injection pump head from contaminating the cable connections.
3. Loosen the vacuum switch while securing the connected fitting to prevent damage to the pump head.
4. Apply RectorSeal® or equivalent thread sealant to the new vacuum switch and thread into the pump head.
5. If necessary, slide the protective covering on the vacuum switch back slightly to expose the hex surface for tightening the vacuum switch body.
6. Tighten the vacuum switch body two or three quarter turns to secure the vacuum switch.

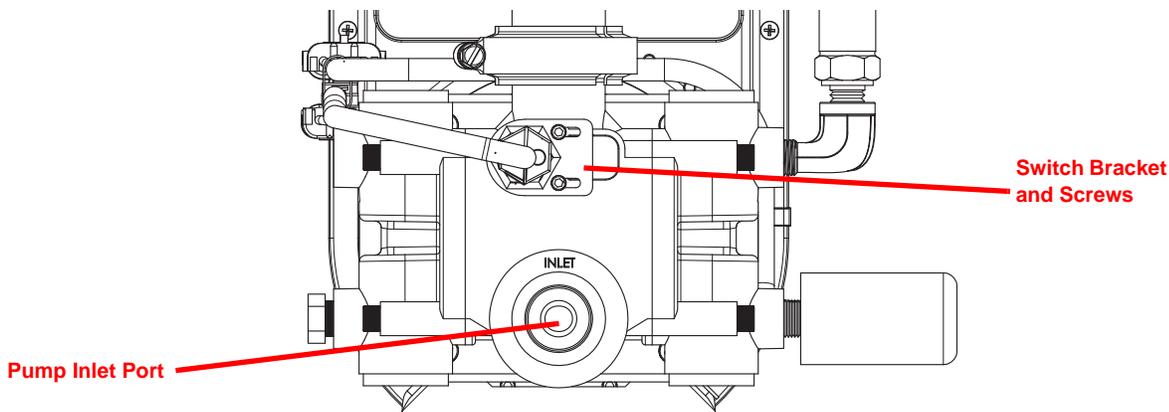
Note: *Do not over tighten the pressure transducer. Overtightening the pressure transducer may damage the pump head.*

7. Be sure to replace the protective cover over the flow switch before operating the pump.

Injection Pump Flow Switch

Perform the following procedure to replace the flow monitor switch (P/N 063-0171-979).

FIGURE 2. Pump Head and Flow Monitor Switch

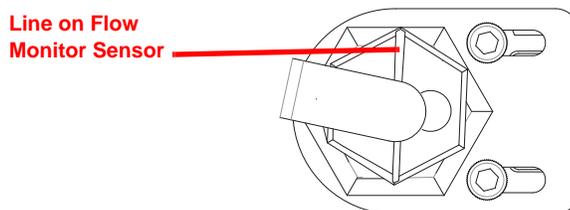


1. Disconnect the switch cable from the motor control cabling.
2. Loosen the locking nut on the switch assembly and remove the old switch assembly from the pump head.
3. Loosen the switch bracket mounting screws enough to allow the bracket to slide freely on the pump head.

Flow Monitor Switch Adjustment Procedure

4. Set the hand valves for the system to recirculate product to the chemical tank and prime and calibrate the pump.
5. Run the injection pump at the lowest injection rate within tolerance for the pump (i.e. 1 oz./min. for 1-40 oz./min. pumps or 5 oz. for 5-200 oz./min. pumps).
6. Thread the new flow monitor switch into the pump head until the switch body contacts the pump head.
7. Push the switch bracket to the left or right so that the switch body is as far from the center of the pump as possible.
8. Tighten the bracket mounting screws to set the switch bracket position.
9. Tighten the switch assembly a partial turn until the line on the flow monitor switch is near vertical. **Do not overtighten.**

FIGURE 3. Flow Monitor Sensor Assembly Detail



The LED indicator should be flashing while the pump is running. If the indicator light is not flashing, turn the switch body slightly until the LED flashes.

Note: *The line on the switch body should not be more than 45° off of vertical to ensure maximum sensitivity.*

Once the switch assembly is properly set and the LED indicator is flashing, tighten the lock nut on the switch assembly to secure the switch body to the bracket.

Injection Pump Encoder

Encoder Removal

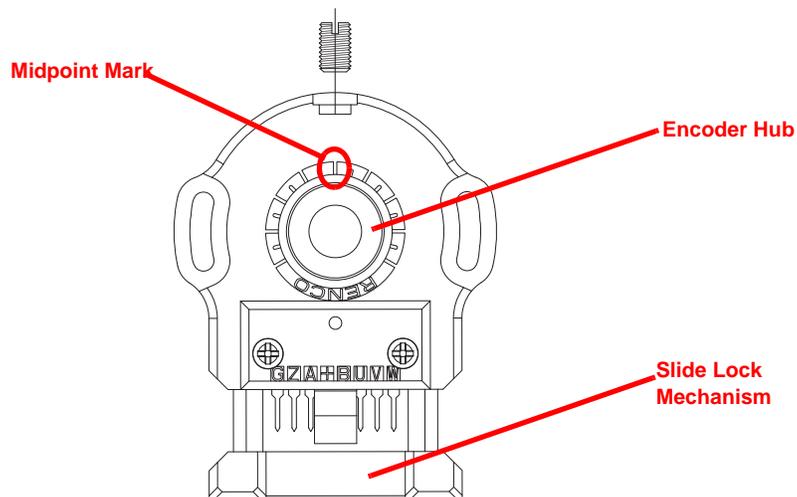
1. Loosen the set screw from the encoder hub.
2. Remove the mounting screws.
3. Carefully slide the encoder assembly off of the shaft.
4. Use a screwdriver to gently lift the locking tab and disconnect the encoder cable connector.

Encoder Installation

1. Gently pull the slide lock mechanism to ensure the lock is in the furthest out position.
2. Rotate the encoder hub until the set screw is aligned with the midpoint mark.
3. Loosen the hub set screw slightly to allow the hub to slide onto motor shaft.

Note: You may hear a click when the hub engages with the centering mechanism as the slide lock is pulled out.

FIGURE 4. Pump Encoder



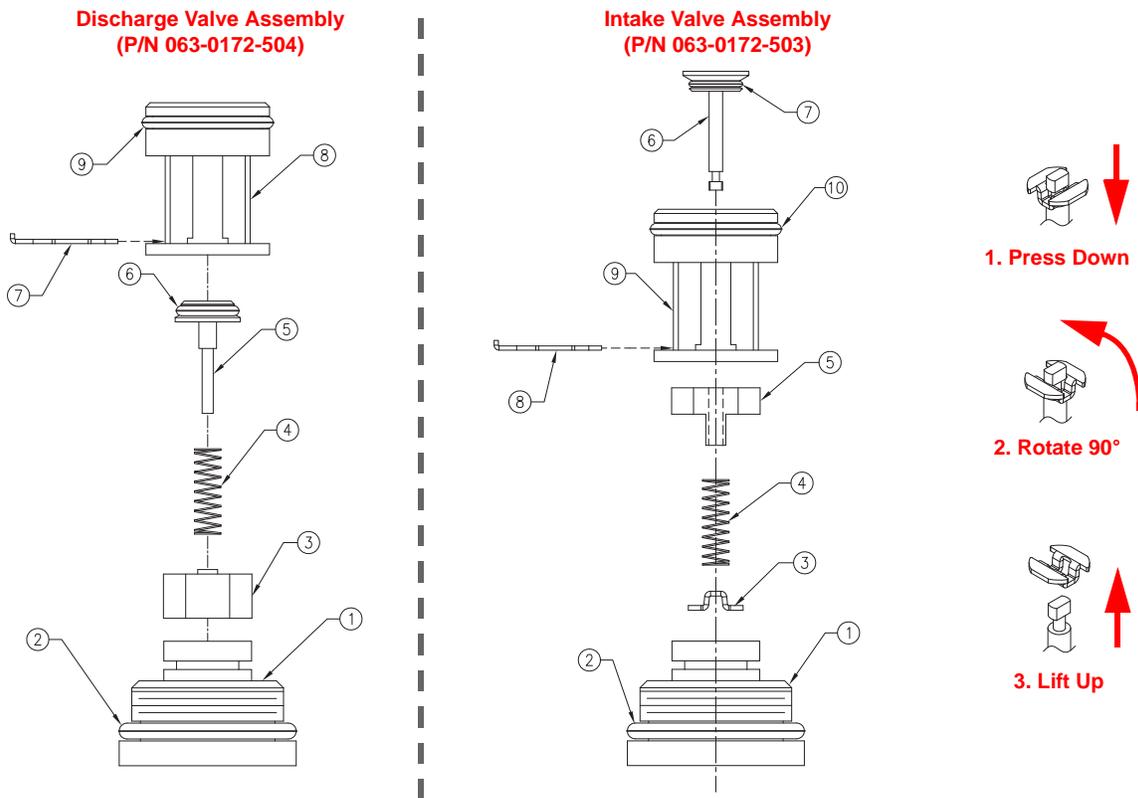
4. With the slide lock mechanism extended, align hub with motor shaft and firmly press down on hub to ensure the encoder is resting on the mounting surface. **Do not press on encoder body, press on the hub only.**
5. Hold the encoder assembly in place lightly to ensure the encoder remains in position.
6. Using the supplied wrench, tighten the hub set screw. Tighten the set screw by rotating approximately 60° with the supplied wrench. **Do not overtighten the set screw to prevent damaging the motor shaft.** If the hub set screw is overtightened, it may be difficult to remove the encoder in the future.
7. Rotate the body of the encoder if necessary to install the mounting screws in the center of each slot on the side of the encoder.
8. Install the mounting screws finger tight and press the slide lock mechanism toward the encoder body.
 - Insert the 8-pin connector on the encoder cable to the encoder body with the flat side toward the motor. Cable should lock in place.

Check Valve Assemblies

Item	Description	Raven P/N	Item	Description	Raven P/N
1	Fitting, Plug	107-0171-519	1	Fitting, Plug	107-0171-519
2	O-Ring	219-0002-912	2	O-Ring	219-0002-912
3	Guide, Poppet	107-0159-934	3	Retainer, Intake	107-0171-459
4	Spring	314-0000-006	4	Spring	314-0000-005
5	Poppet	107-0159-935	5	Guide, Poppet	107-0171-092
6	O-Ring (Viton)	219-0007-011 ^a	6	Stem, Poppet	107-0171-447
7	Clip, Retainer	107-0171-576	7	O-Ring (Viton)	219-0007-011 ^a
8	Valve Body, Discharge	106-0159-621	8	Clip, Retainer	107-0171-576
9	O-Ring (Viton)	219-0002-018 ^a	9	Valve, Body Intake	106-0159-622
			10	O-Ring (Viton)	219-0002-018 ^a

a. O-Rings included in Pump Seal Kit (P/N 117-0159-987)

FIGURE 5. Check Valve Spring Retainer Assemblies



CAN Integrated 1 to 40 oz./min. Pump

TABLE 1. Injection Pump (P/N 063-0173-103) Replacement Parts

Item	Description	Raven P/N	Item	Description	Raven P/N
1.	Housing, 3/4" Injection Pump	107-0171-523	27.	Bolt, 1/4"-20 x 1" Carriage	311-0069-004
2.	Bearing, Piston	325-0000-018	28.	Nut, Nylon Lock	312-4000-057
3.	Piston, 3/4" Pump	107-0171-531	29.	Washer, #6 Lock	313-3000-007
4.	Pump Head, 3/4"	107-0171-526	30.	Washer, Flat	313-2300-009
5.	Modified Pump Head, 3/4"	019-0159-569	31.	Washer, #10 Lock	313-3000-014
6.	Motor	416-0000-040	32.	Washer, 1/4" Lock	313-3000-017
7.	Encoder	422-0000-096	33.	Screw, #4-40 x 1/2" Socket Head	311-0068-007
8.	Magnet Assembly	063-0171-977	34.	Screw, 1/4" x 20 x 1/4" Hex Head	311-0068-060
9.	Bearing Assembly	063-0172-501	35.	Screw, 1/4" - 20 x 3/4" Socket Head	311-0073-066
10.	Node, Integrated Motor Control CAN	063-0173-082	36.	Screw, #6 - 32 x 1/2"	311-0004-013
11.	Cartridge, Intake	063-0172-503	37.	Screw, #10 - 24 x 1-1/2"	311-0068-191
12.	Cartridge, Discharge	063-0172-504	38.	Screw	311-0004-040
13.	Transducer, Pressure (0-250 PSI)	422-0000-090	39.	O-Ring	219-0001-153
14.	Switch, Injection Vacuum	063-0171-035	40.	O-Ring	219-0002-015
15.	Switch, Flow Monitor	063-0171-979	41.	O-Ring	219-0003-045
16.	Key	107-0171-588	42.	O-Ring	219-0007-117
17.	Ball	321-0000-313	43.	Seal, Slipper	219-0000-125
18.	Spring	314-0000-012	44.	Sealant, Loctite® #242 Thread	222-1001-029
19.	Bracket, Sensor	106-0159-539	45.	Grease, Lubricating	222-0000-002
20.	Bracket, Pump Motor Mounting	107-0171-599	46.	Grease	222-1001-114
21.	Plug, 1/4" (NPT) Hex Pipe	333-0009-061	47.	Compound, Nickel Anti-Seize	222-1001-079
22.	Strap	107-0171-600	48.	Sealant, RectorSeal®	222-1001-026
23.	Conduit, Convoluted	434-1001-016	49.	Label, Serial	041-0159-710
24.	Tie, Cable	435-1000-002	50.	Label, 1 to 40 oz./min Injection System	041-0159-806
25.	Tie, 8" Screw Mount	435-1000-030	51.	Tie, Cable	435-1000-005
26.	Elbow, Stainless Steel Street	333-0007-041	52.	Label, Node Number	041-0159-840

FIGURE 6. CAN Integrated Pump (P/N 063-0173-103) Housing and Encoder

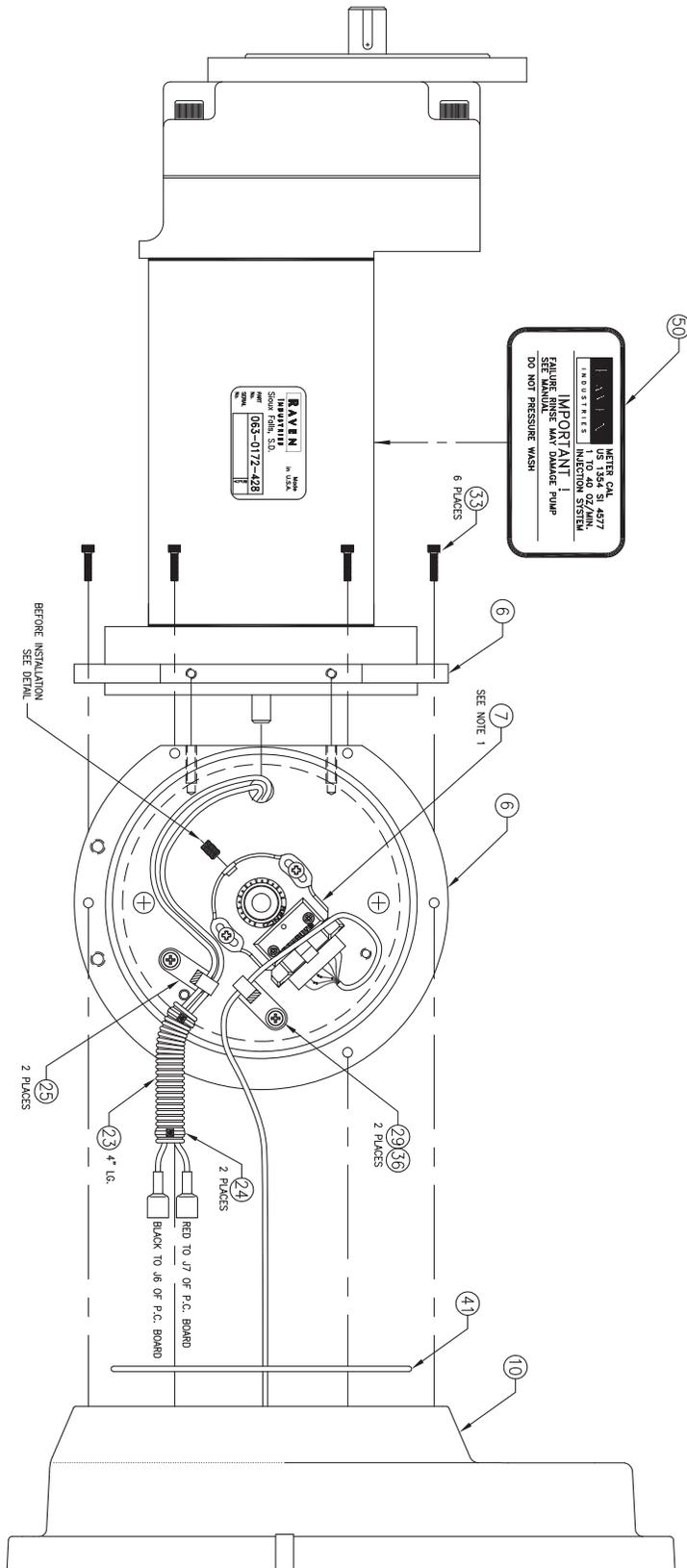
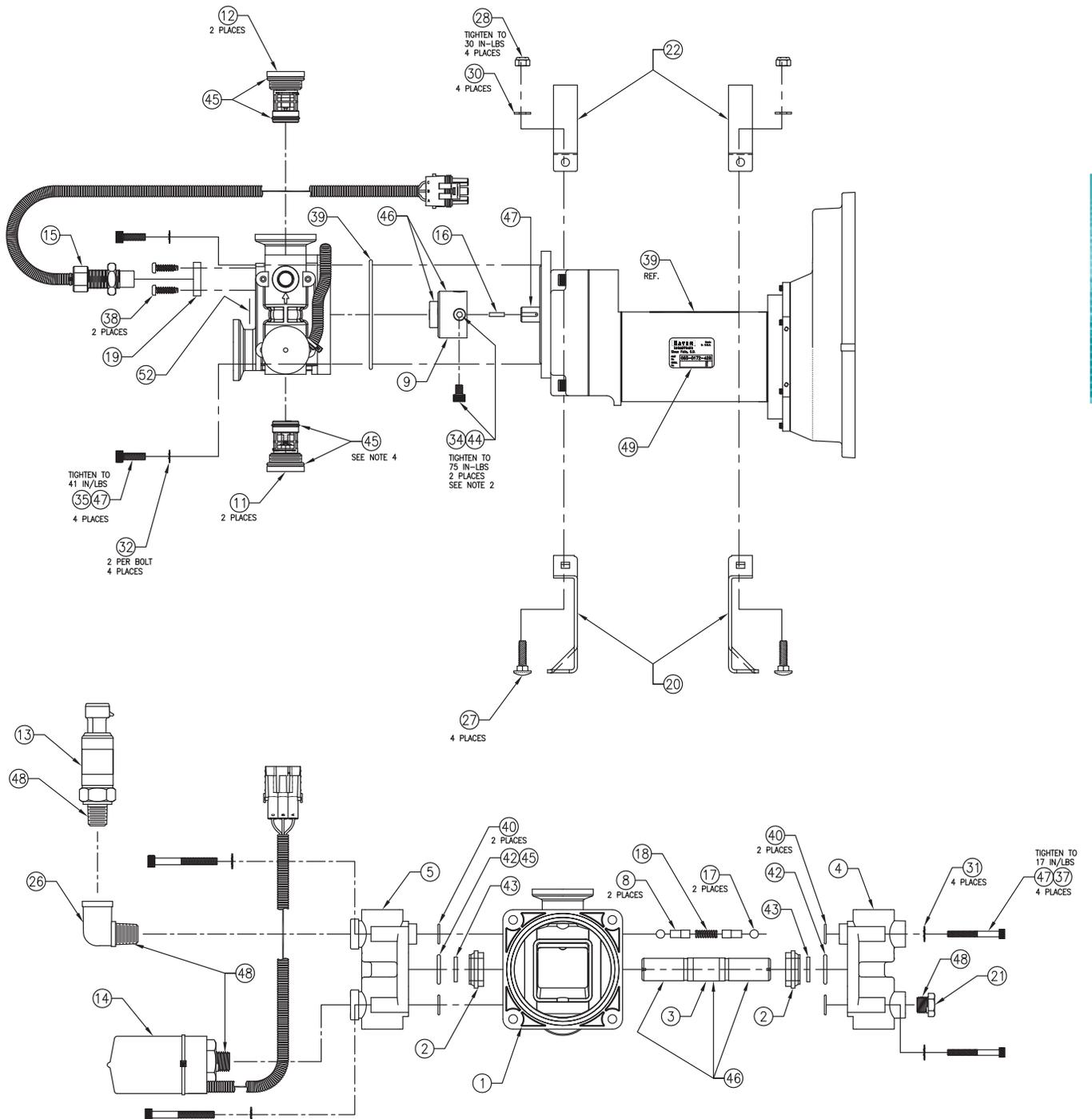


FIGURE 7. CAN Integrated Pump (P/N 063-0173-103) Pump Head and Mounting Bracket



Sidekick Pro 5 to 200 oz./min. Pump

TABLE 2. CAN Integrated Injection Pump (P/N 063-0173-081) Replacement Parts

Item	Description	Raven P/N	Item	Description	Raven P/N
1.	Housing, 3/4" Injection Pump	107-0171-523	28.	Washer, #6 Lock	313-3000-007
2.	Bearing, Piston	325-0000-018	29.	Washer	313-2300-009
3.	Piston, 3/4" Pump	107-0171-531	30.	Washer, #10 Lock	313-3000-014
4.	Head, 3/4" Pump	107-0171-526	31.	Washer, 1/4" Lock	313-3000-017
5.	Head, 3/4" Modified Pump	019-0159-569	32.	Screw, #4-40 x 1/2" Socket Head	311-0068-007
6.	Motor	416-0000-039	33.	Screw, 1/4" x 20 x 1/4" Socket Head	311-0068-060
7.	Encoder	422-0000-096	34.	Screw, 1/4"-20 x 3/4" Socket Head	311-0073-066
8.	Magnet Assembly	063-0171-977	35.	Screw, #6-32 x 1/2"	311-0004-013
9.	Bearing Assembly	063-0172-501	36.	Screw, 10-24 x 1-1/2"	311-0068-191
10.	Node, Integrated Motor Control CAN	063-0173-082	37.	Screw	311-0004-040
11.	Cartridge, Intake	063-0172-503	38.	Terminal, 10/12 GA.	405-2001-048
12.	Cartridge, Exhaust	063-0172-504	39.	O-Ring	219-0001-153
13.	Transducer, Pressure (0-250 PSI)	422-0000-090	40.	O-Ring	219-0002-015
14.	Switch, Injection Vacuum	063-0171-035	41.	O-Ring	219-0003-045
15.	Switch, Flow Monitor	063-0171-979	42.	O-Ring	219-0007-117
16.	Key	107-0171-588	43.	Seal, Slipper	219-0000-125
17.	Ball	321-0000-313	44.	Sealant, Loctite® #242 Thread	222-1001-029
18.	Spring	314-0000-012	45.	Grease, Versilube® Lubricating	222-0000-002
19.	Bracket, Sensor	106-0159-539	46.	Grease	222-1001-114
20.	Bracket, Pump/Motor Mounting	107-0171-589	47.	Compound, Nickel Anti-Seize	222-1001-079
21.	Plug, Pipe Hex	333-0009-061	48.	Sealant, Rectorseal®	222-1001-026
22.	Strap	107-0171-594	49.	Label Serial	041-0159-710
23.	Conduit, Convolute	434-1001-016	50.	Label, 5 to 200 oz./min. Injection System	041-0159-807
24.	Tie, 8" Screw Mount	435-1000-030	51.	Tie, Cable	435-1001-002
25.	Elbow, Stainless Steel Street	333-0007-041	52.	Tie, Cable	435-1000-005
26.	Bolt, 1/4"-20 x 1" Carriage	311-0069-004	53.	Label, Node Number	041-0159-840
27.	Nut	312-4000-057			

FIGURE 8. CAN Integrated Pump (P/N 063-0173-081) Housing and Encoder

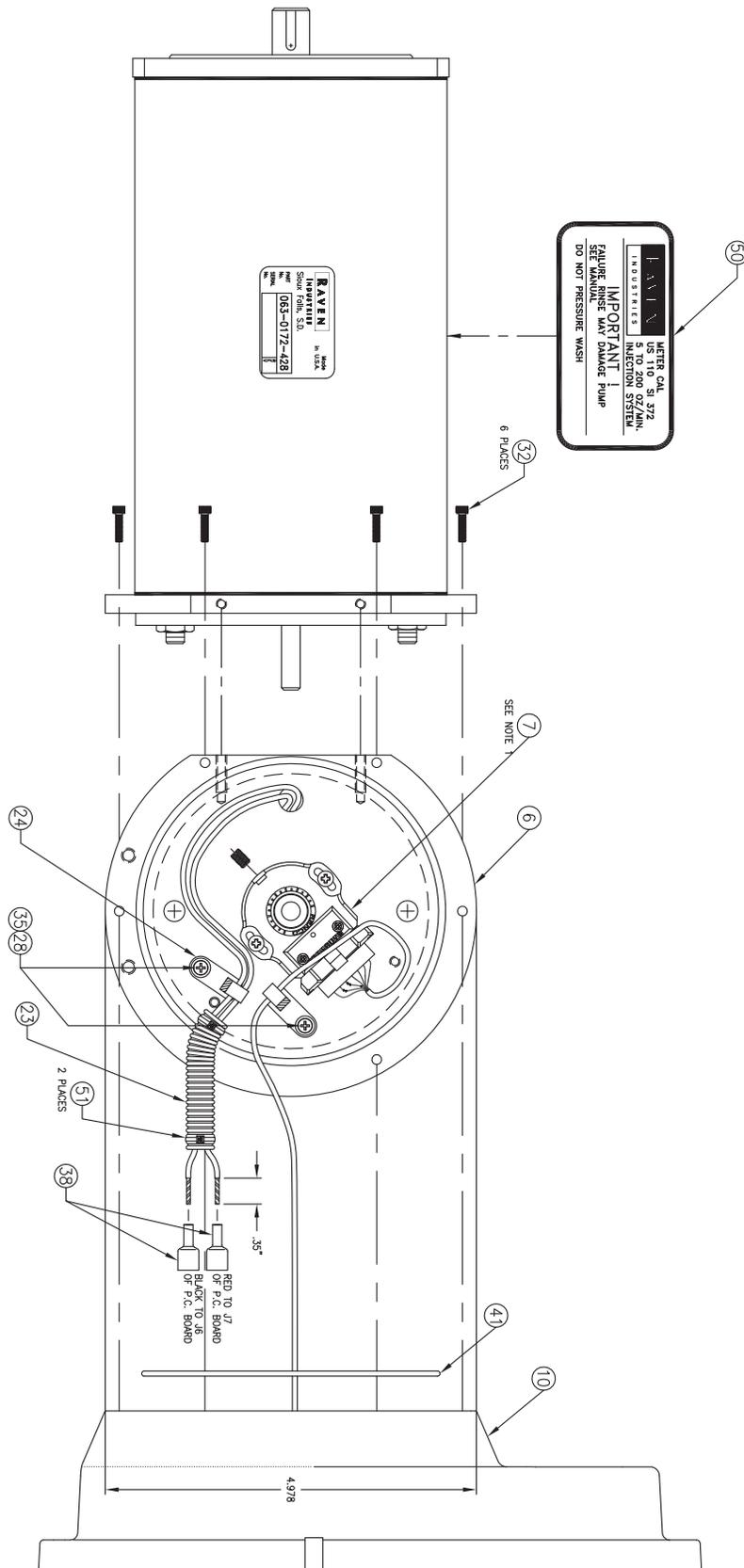
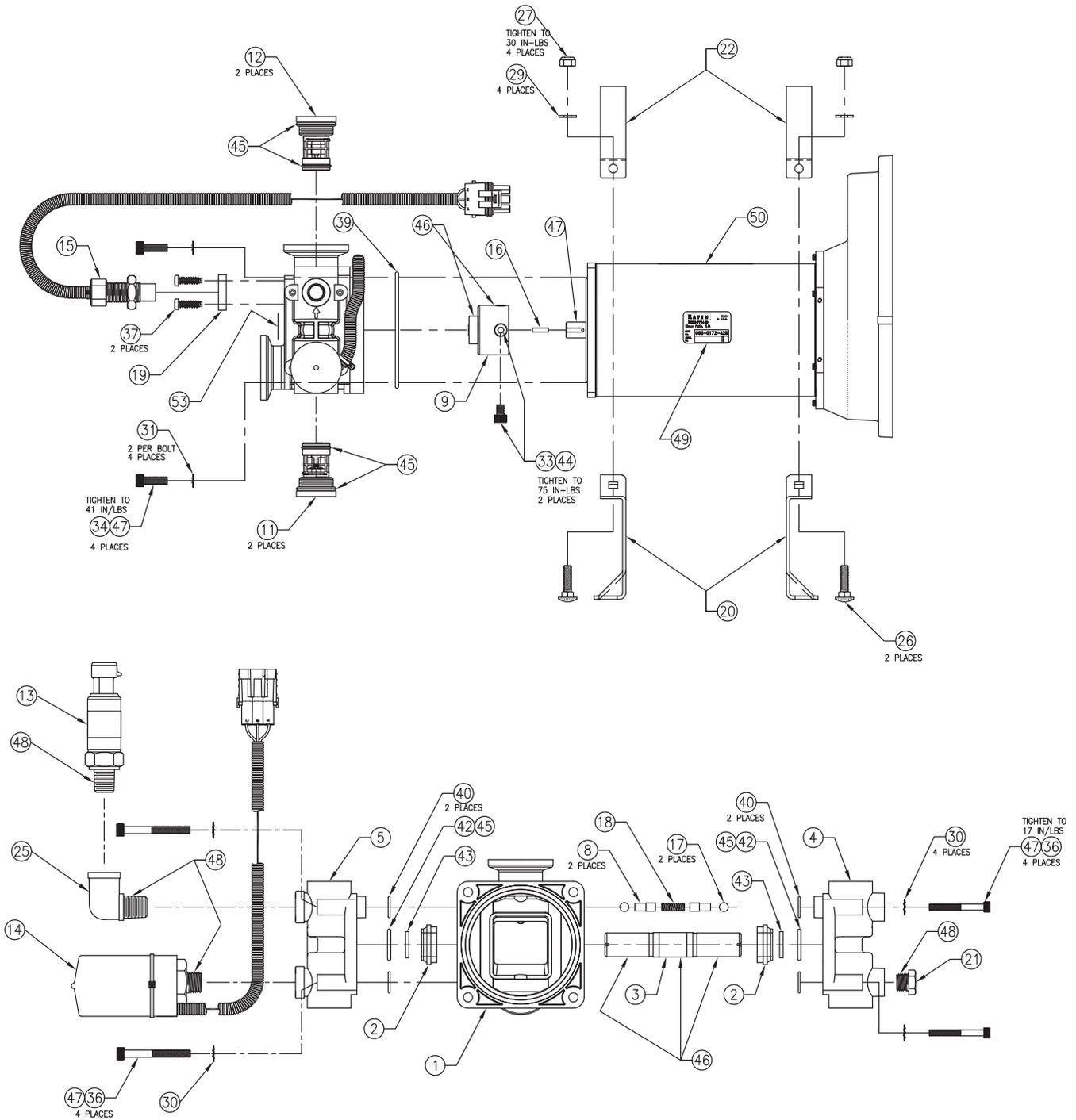


FIGURE 9. CAN Integrated Pump (P/N 063-0173-081) Pump Head and Mounting Bracket



Sidekick Pro Module Replacement Parts

Modules with 24 Gallon Tank and 1 to 40 oz./min. Pump

**TABLE 3. Injection Module (P/N 063-0173-212) Replacement Parts
(24 Gallon Chemical Tank, 1 to 40 oz./min. Pump)**

Item	Description	Raven P/N	Item	Description	Raven P/N
1.	Weldment, Platform	116-0159-484	23.	Nut, 5/16"-18 Nylon Hex Lock	312-4000-059
2.	Calibrator, Pump ^a	063-0172-822	24.	Washer	313-2300-012
3.	Pump, CAN Integrated Injection (1-40 oz./min.)	063-0173-103	25.	Washer, 0.390 x 1.63 x 0.06 Fender	313-2300-122
4.	Saddle, Molded	118-0159-007	26.	Washer, 1.5 O.D. x 0.25 I.D.	313-2300-124
5.	Tank, 24 GAL.	118-0159-016	27.	Washer, 0.625 O.D. x 0.281 I.D.	313-2301-810
6.	Cover, Fillwell	118-0159-043	28.	Washer, 1/4" Lock	313-1000-017
7.	Tube, Formed Upright	107-0171-374	29.	Fitting, 3/4" x 1/2" Elbow	333-0002-050
8.	Strap, Stainless Tank Mounting	107-0171-375	30.	Fitting, 1/2" Street Elbow	333-0007-031
9.	Check Valve, 1/2" with Bleed Hole (12 PSI)	333-0011-100	31.	Nut, 1/4-20	312-1001-031
10.	Valve, 3-Way	334-0001-037	32.	Fitting, 3/4" x 1/2" NPT Elbow	333-0002-048
11.	Valve, Continuous Flow 3-Way	334-0001-054	33.	Fitting, M-100 x 3/4" Flanged Elbow	333-0002-200
12.	Hose, 3/4" EVA (7")	214-0001-005	34.	Fitting, 1/2" x 1/2" Elbow	333-0002-047
13.	Hose, 1/2" Braided EVA (32")	214-0001-014	35.	Fitting, 1/2" Plug	333-0009-063
14.	Tie, Cable (11.5")	435-1000-010	36.	Fitting, 3/4" Plug	333-0009-064
15.	Clamp, Hose	435-3003-002	37.	Fitting, 1/2" x 1/2"	333-0002-108
16.	Clamp, Hose	435-3003-003	38.	Fitting, 1/4" NPT Close Nipple	333-0008-165
17.	Clamp, FC-100 V-Band	435-3003-044	39.	Fitting, 1/2" x 1/4" NPT Bushing	333-0003-069
18.	Bolt, J-Hook	321-0000-316	40.	Fitting, 1/2" x 4" Nipple	107-0159-907
19.	Bolt, 1/4"-20 x 1"	311-0050-105	41.	Fitting, 1/2" x 1/2" Nipple	333-0008-154
20.	Bolt, 5/16"-18 x 1-3/4" Zinc	311-0052-108	42.	Strainer, 1/2"	333-9000-008
21.	Bolt, 1/4"-20 x 5/8"	311-0050-202	43.	Gasket, M-100 Viton	219-0000-129
22.	Bolt, 1/4"-20 x 3.5" Carriage	311-0069-014	44.	Sealant, RectorSeal [®]	222-1001-016

a. To order the clear plastic calibrator cover separately, order part number 106-0159-637.

FIGURE 10. Injection Module (P/N 063-0173-212) Plumbing and Valves

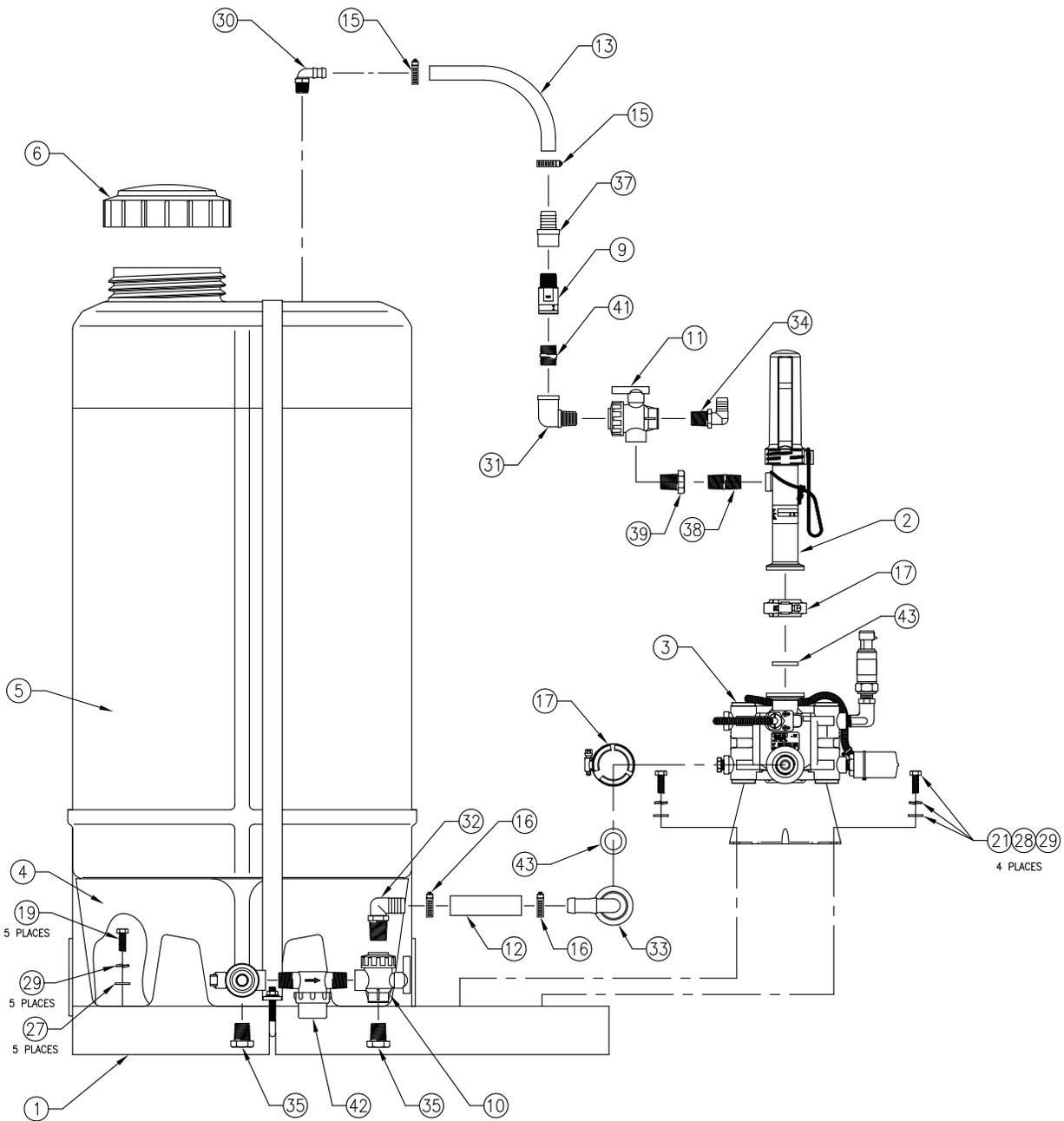
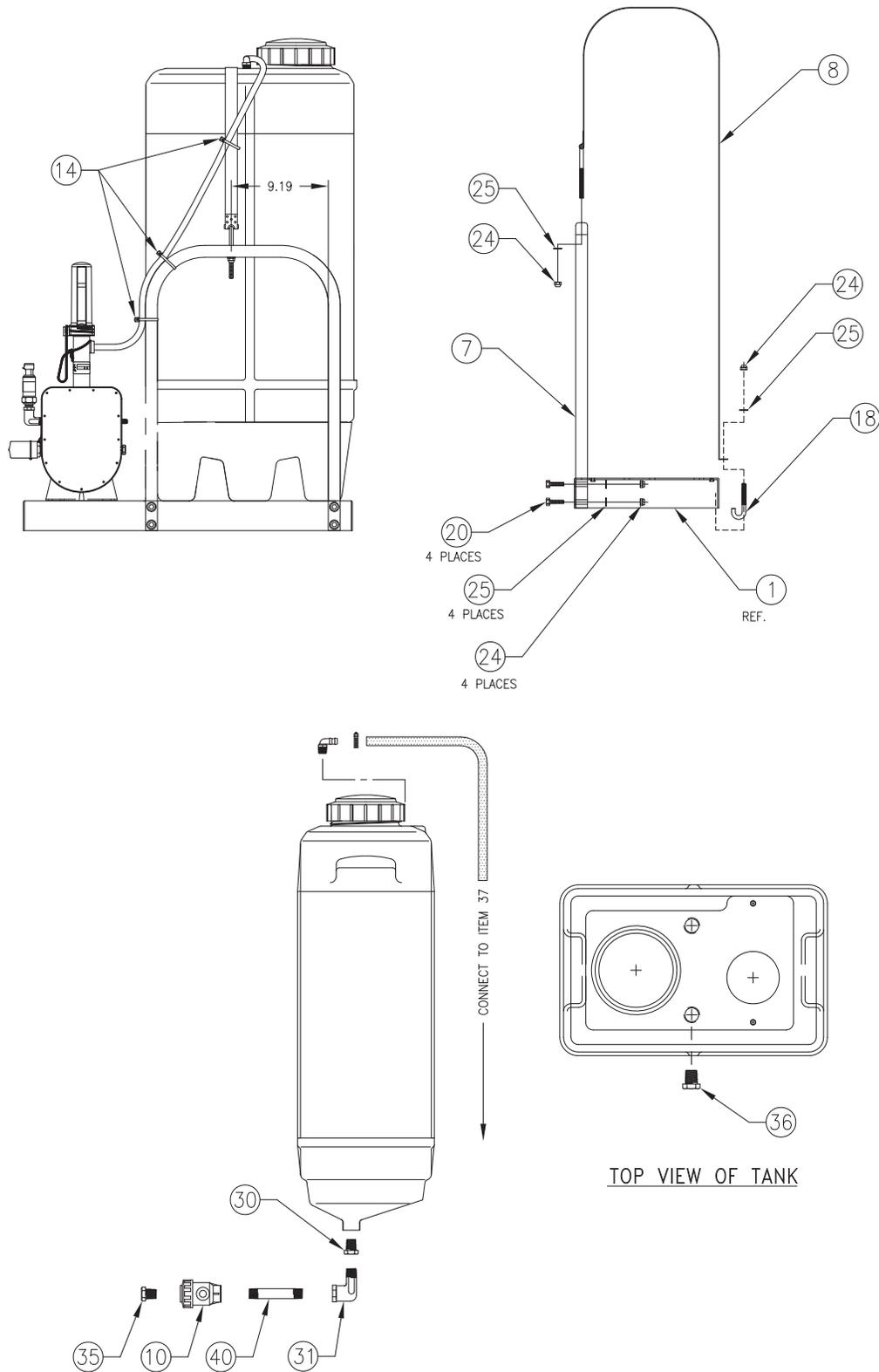


FIGURE 11. Injection Module (P/N 063-0173-212) Final Plumbing and Mounting



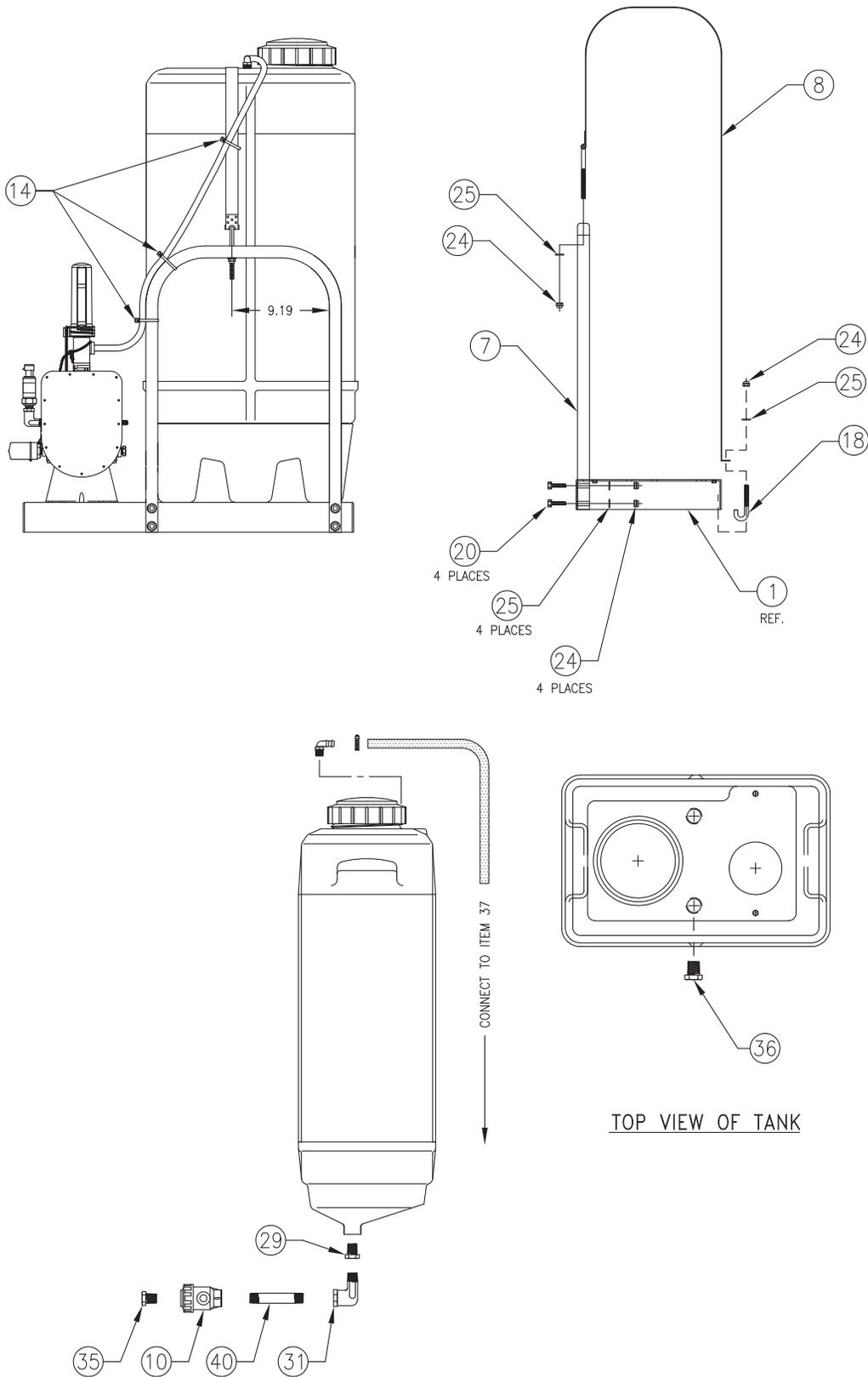
Modules with 24 Gallon Tank and 5 to 200 oz./min. Pump

**TABLE 4. Injection Module (P/N 063-0173-213) Replacement Parts
(24 Gallon Chemical Tank, 5 to 200 oz./min. Pump)**

Item	Description	Raven P/N	Item	Description	Raven P/N
1.	Platform, Weldment	116-0159-484	23.	Nut, 1/4-20	312-1001-031
2.	Calibrator, Pump ^a	063-0172-822	24.	Nut, 5/16-18 Nylon Hex Lock	312-4000-059
3.	Pump, CAN Integrated Injection (5-200 oz./min.)	063-0173-081	25.	Washer	313-2300-012
4.	Saddle, Molded	118-0159-007	26.	Washer, 0.39 x 1.63 Fender	313-2300-122
5.	Tank, 24 Gallon	118-0159-016	27.	Washer, 1.5 O.D. x 0.25 I.D. Fender	313-2300-124
6.	Cover, Fillwell	118-0159-043	28.	Washer, 0.625 O.D. x 0.281	313-2301-810
7.	Tube, Formed Upright	107-0171-374	29.	Washer, 1/4" Lock	313-1000-017
8.	Strap, Stainless Steel Tank Mounting	107-0171-375	30.	Fitting, 3/4" x 1/2" Elbow	333-0002-050
9.	Check Valve, 1/2" with Bleed Hole (12 PSI)	333-0011-100	31.	Fitting, 1/2" Street Elbow	333-0007-031
10.	Valve, 3-way	334-0001-037	32.	Fitting, 3/4" x 1/2" NPT Elbow	333-0002-048
11.	Valve, 3-way Continuous Flow	334-0001-054	33.	Fitting, M-100 x 3/4" Flanged Elbow	333-0002-200
12.	Hose, 3/4" EVA (7")	214-0001-005	34.	Fitting, 1/2" x 1/2" NPT Elbow	333-0002-047
13.	Hose, 1/2" Braided EVA (32")	214-0001-014	35.	Fitting, 1/2" Plug	333-0009-063
14.	Tie, Cable	435-1000-010	36.	Fitting, 3/4" Plug	333-0009-064
15.	Clamp, Hose	435-3003-002	37.	Fitting, 1/2" x 1/2"	333-0002-108
16.	Clamp, Hose	435-3003-003	38.	Fitting, 1/4" NPT Close Nipple	333-0008-165
17.	Clamp, FC-100 V-Band	435-3003-044	39.	Fitting, 1/2" x 1/4" NPT Bushing	333-0003-069
18.	Bolt, J-Hook	321-0000-316	40.	Fitting, 1/2" x 4" Nipple	107-0159-907
19.	Bolt, 1/4"-20 x 1"	311-0050-105	41.	Fitting, 1/2" x 1/2" Nipple	333-0008-154
20.	Bolt, 5/16"-18 x 1-3/4" Zinc	311-0052-108	42.	Strainer, 1/2"	333-9000-008
21.	Bolt, 1/4"-20 x 5/8"	311-0050-202	43.	Gasket, M-100 Viton	219-0000-129
22.	Bolt, 1/4-20 x 3.5" Carriage	311-0069-014	44.	Sealant, RectorSeal [®]	222-1001-016

a. To order the clear plastic calibrator cover separately, order part number 106-0159-637.

FIGURE 13. Injection Module (P/N 063-0173-213) Final Plumbing and Mounting



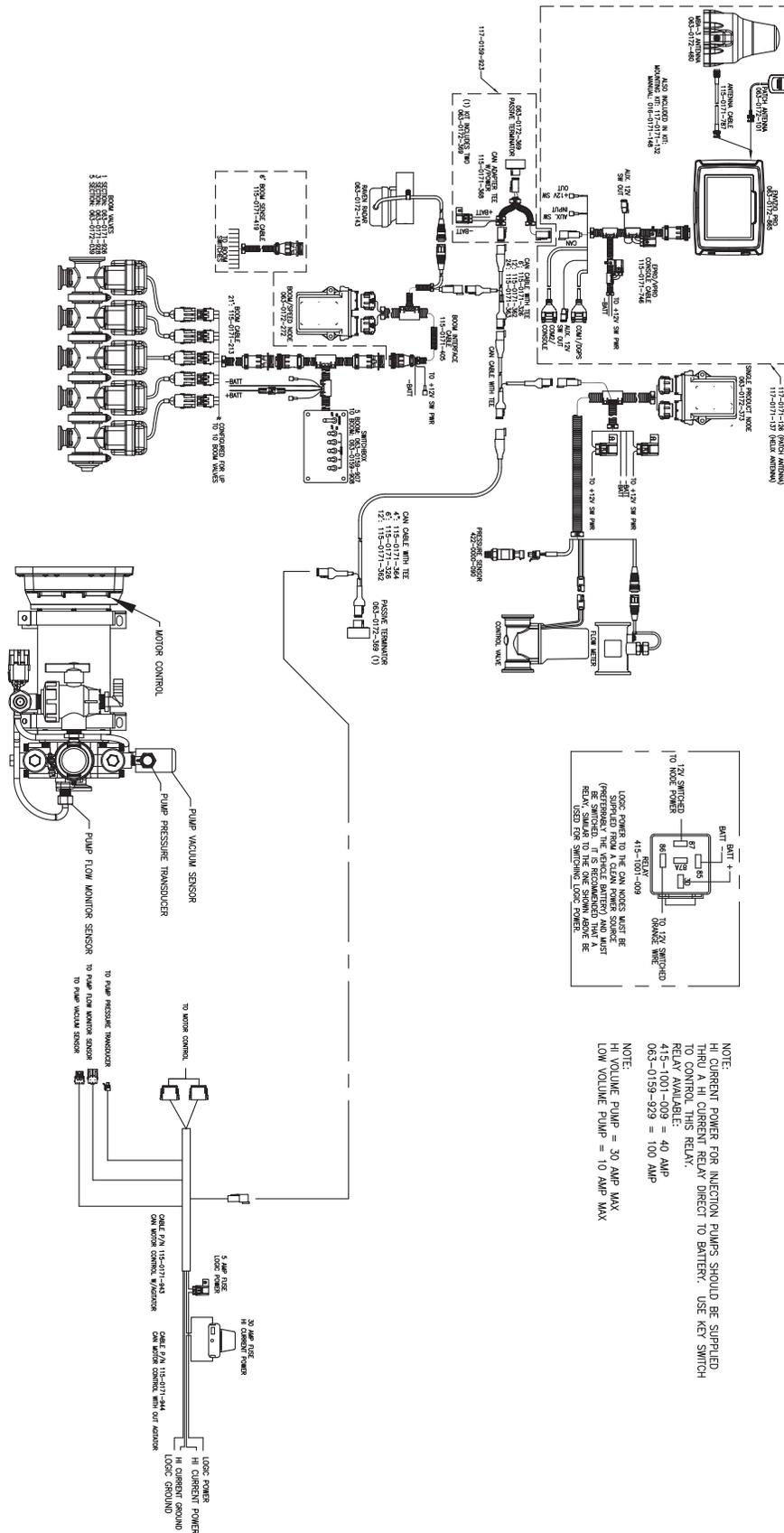
CHAPTER

9

System Diagrams

Refer to the following diagrams for connecting a Raven injection system to a new or existing CANbus product control system.

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Limited Warranty

What Does this Warranty Cover?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service.

How Long is the Coverage Period?

Raven Applied Technology Division products are covered by this warranty for 12 months after the date of purchase. This warranty coverage applies only to the original owner and is nontransferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If your dealer agrees with the warranty claim, the dealer will send the part and proof of purchase to their distributor or to Raven Industries for final approval.

What Will Raven Industries Do?

Upon confirmation of the warranty claim, Raven Industries will, at our discretion, repair or replace the defective part and pay for return freight.

What is not Covered by this Warranty?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit or other special damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.

R A V E N

Sidekick Pro™
1 to 40 oz./min. & 5 to 200 oz./min.
Installation & Operation Manual
(P/N 016-0171-391 Rev A 7/10 E16422)

Simply improving your position.™



Raven Industries
Applied Technology Division
P.O. Box 5107
Sioux Falls, SD 57117-5107

Toll Free (U.S. and Canada): (800)-243-5435
or Outside the U.S. :1 605-575-0722
Fax: 605-331-0426
www.ravenprecision.com

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